Feb. 27, 1962 R. C. ABERLE 3,022,654

LINT FILTER FOR CLOTHES LAUNDERING MACHINE

Filed June 20, 1960 2 Sheets-Sheet 1

FIG. 1

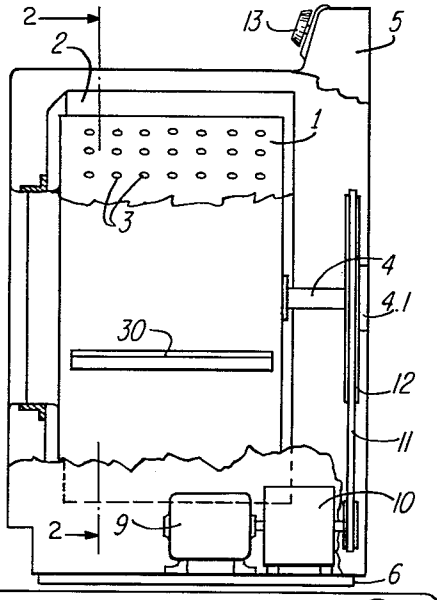
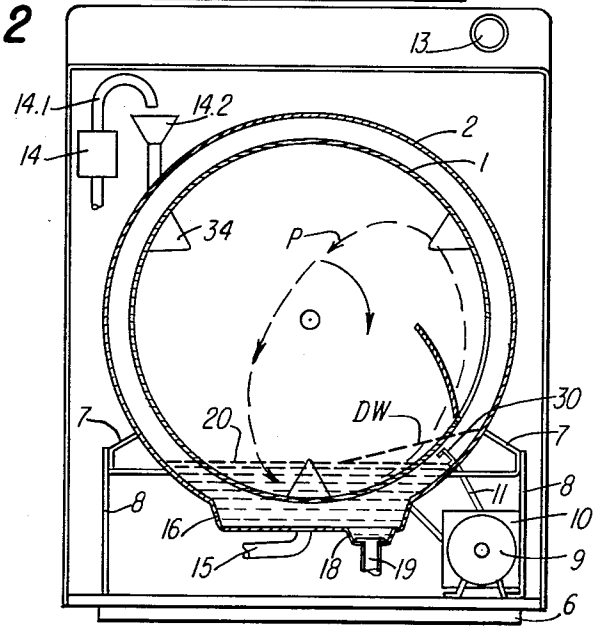



FIG. 2




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FIG. 3

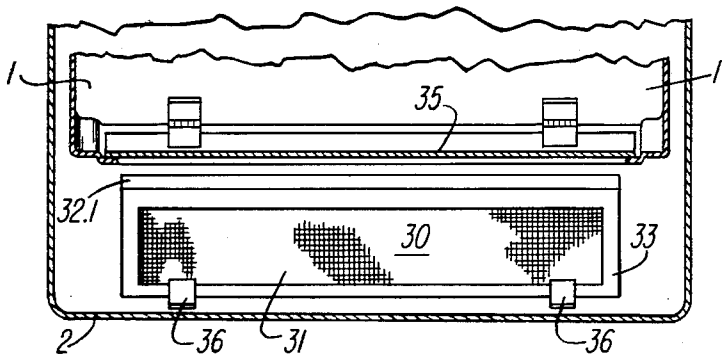
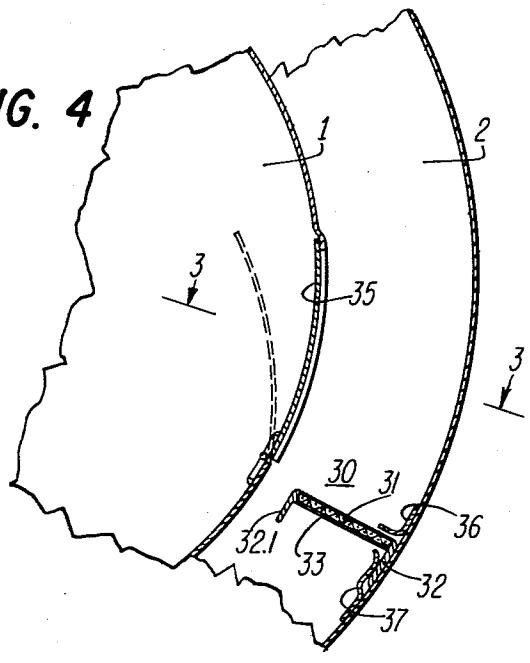



FIG. 4




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3,022,654

# LINT FILTER FOR CLOTHES LAUNDERING MACHINE

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The present invention relates to clothes washing machines of the tumble action type and more particularly to filtering mechanisms for the same.

Clothes washing machines of any type, whether they be vertical axis or horizontal axis machines require that some means be provided for arresting dirt and lint removed from the soiled clothes being washed. The lint, particularly, should be prevented from redeposition on the clothes being washed, by virtue of either a provision for flushing this waste material down the drain for example, or for retaining it in a filter mechanism for removal thereafter. In the usual washing machine, a filter is placed either in a recirculatory system of the machine whereby the lint accumulates on the filter during the washing action or in the drainage system. In either of these instances, the filter must be cleaned periodically; this generally requires manual removal of the filter from the machine.

It is therefore a primary object of my invention to provide in a clothes washing machine, a filter which is active throughout the washing process and is automatically cleaned by water movement during a final stage of the washing action.

It is a further object of the invention to provide a filter positioned in the path of liquid flow during the washing and rinsing cycles which will hold the lint during each of these processes and which will be cleaned automatically by the final draining of liquid to flush its accumulated matter down the drain.

It is a still further object of the invention to provide a lint filtering device which will not affect the operation of the machine in the event of its failure.

To produce these objects my invention provides a channel-shaped filter having a screen web on the tub wall of a perforate basket tumble washer. The mouth of the channel faces downwardly and the filter is positioned preferably above the static liquid level in the tub but definitely below the dynamic level of the liquid. In this way, lint, dirt and scum will be impelled by the upward dynamic force of the liquid in its direction of rotation and will agglomerate in the screen web of channel. The continuing dynamic water pressure tends to keep this waste matter clotted against the filter. All lint thus entrapped will be retained against the filter by virtue of the dynamic water pressure and will be kept out of contact with the clothes being washed. When the tumbling of the drum is being brought to a halt at the final stages of the washing action, the dynamic liquid pressure will decrease and the tub will begin to drain at which time a final charge of liquid from the dynamic head will stream in an upward and then a downward direction through the filter screen unclotting the lint from the filter for transmission down the drain. In this way the final force of the draining dynamic head releases the entrained lint from the filter at a time when there is no chance of this lint returning to the clothes being cleaned.

Further objects, features and advantages of the present invention will become apparent from the following detailed description of the presently preferred embodiment thereof, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a side elevational view of a combination clothes washing and drying machine embodying the present invention, the view being partially broken away to illustrate the details of the machine.



FIG. 2 is a front sectional view taken along the lines 2—2 of FIG. 1, and is a composite view to illustrate the water and mechanical conditions of the machine while it is at rest, and water conditions while the basket is rotating counterclockwise during washing and rinsing operations.

FIG. 3 is a partial sectional view of lower right-hand tub portion taken along the lines 3—3 of FIG. 4.

FIG. 4 is a partial sectional view of the lint filter section of FIG. 2.

Referring now to the FIGS. 1 and 2, we have shown therein a domestic laundry machine comprising a combination washer and dryer. The machine is of the horizontal axis type. That is, it includes a clothes basket **1** which is rotatable about a generally horizontal axis. The drum or basket **1** is mounted within an outer imperforate tub **2**, and the cylindrical side wall of the basket is provided with a plurality of perforations or holes **3** in order to allow communication between the basket and the tub. The basket is rotatably supported from the tub **2** by a horizontally extending shaft **4** which is mounted in an elongated bearing **4.1** hung from the rear wall of the tub structure. The shaft **4**, as well as supporting the basket **2**, also serves to drive it during the operation of the machine. The basket is loaded and unloaded in the usual manner through the conventional access opening in the front wall thereof which is aligned respectively with openings in the tub and the outer appearance cabinet **5** of the machine. A hinged door (not shown) mounted on the appearance cabinet **5** seals around the tub opening so as to close off the tub **2** during the operation of the machine.

The tub **2** and the appearance cabinet **5** are both mounted on a suitable base structure **6** at the bottom of the machine. The tub, specifically, is mounted thereon by means of a plurality of brackets or arms **7** which are mounted on upstanding plates **8** fixedly attached to the base. In addition to the tub and the appearance cabinet, the base **6** also mounts the basket drive means. The drive means comprises a motor **9** connected to a multi-speed transmission **10** which drives the basket through a belt **11**. The belt **11** turns a basket drive pulley **12** which is mounted on the outer end of the basket drive shaft **4**. The transmission assembly is shiftable between different gear ratios so that the basket **1** may be driven at one speed for tumbling clothes and at a second higher speed for centrifugally extracting water from the clothes.

As mentioned above, the machine illustrated is a combination washer-dryer. That is, it proceeds through a cycle of operations, first washing and damp-drying the clothes and then, if desired, completely or fluff-drying the clothes. The clothes basket **1** is driven at a slower speed both for washing the clothes and for tumbling them during the drying operation and is driven at its higher speed for extracting both wash and rinse water from them by centrifugal extraction. The machine during its sequence of operations is under the control of a suitable timer motor operated sequence control **13** which energizes and deenergizes the various electrical components of the machine in a predetermined sequence.

In order to supply water to the tub **2** for washing and rinsing purposes, the machine is provided with suitable solenoid-controlled hot and cold water supply valves, schematically shown at **14**, FIG. 2. These valves have a common discharge **14.1** which terminates in spaced relation above a funnelled entrance **14.2** to a hose or conduit **15** which leads to a sump **16** mounted underneath the bottom of the tub, as can be seen in FIG. 2. The inlet water entering the sump **16** first fills the sump and then rises into the tub through the openings in the bot-

tom of the tub **2**. The bottom wall of the sump is provided with a depressed portion **18** accommodating a drainage conduit **19**. The sump **16** therefore is an avenue through which the tub is supplied with washing and rinsing liquid, and from which the liquid is drained from the tub at the conclusion of the washing and rinsing operations. The water is discharged from the sump by means of a drain pump (not shown) into which the hose **19** discharges. From the drain pump the water is passed out of the machine through a suitable waste line. It will be understood, of course, that the drain pump like the other electrical elements of the machine is under the control of the sequence control **13**.

The water level in the tub during the washing operation may be controlled by timing the opening of the water inlet valves, or by a pressure sensing device (not shown) of the type well known in the art, which deenergizes the respective solenoid operated water valves when a predetermined water level is reached in the tub. It will be understood, of course, that essentially the water valve solenoids and water level sensing device are controlled by the establishment of suitable circuits by the timer operated sequence control **13**. The water level in the tub during the washing operation is such that the lower portion of the perforated basket **1** is submerged whereby the basket dips continually into the water as it rotates. For example, in a machine the size of the illustrated machine suitable for domestic use having a clothes basket twenty-six inches in diameter, the static water level **20** in the tub at the commencement of the washing operation is about five inches above the bottom of the basket.

In FIGS. 3 and 4, there is shown the lint filter **30** embodying the present invention. The filter, as shown, is channel-shaped, in which the web portion **31** is of fine mesh screen, and the flanges **32**, **32.1**, comprise elements of a rigid rectangular frame member **33**. In the illustrated arrangement, the frame member is affixed to the inner wall of the tub at a level above the static water level **20** which has been described as being approximately five inches above the bottom surface of the tub. The filter mounting places the screened portion **31** below the rotative axis of the wash basket and on the tub sidewall where it will be in the path of water movement as the longitudinal baffles **34** and the clothes (not shown) lift the water in a rightward direction as the basket is rotated in the counterclockwise direction. The clothes follow the tumbling path approximately by the broken line "P," whereby it is obvious that the clothes leave the water briefly and drop into it again. The combination of continuous tub rotation and clothes movement produces a continuous dynamic counterclockwise circulation of water, approximated by the line "DW" in FIG. 2.

The lint filter shown has a length of approximately three-fourths of the length dimension of the clothes basket. This dimensional factor allows the filter **30** to be removed for replacement or cleaning if necessary through the access door **35**. The drum access door **35** is a section of the clothes basket cylindrical sidewall which is secured to the remainder of the drum wall by means of hinges along its lower edge as shown in FIG. 4 or by means of any other suitable method. Self-tapping screws (not shown) fitted to suitable holes in the basket sidewall may be used to mount the upper edge of door **35** in place against the basket sidewall. By removing these screws, this wall section can be manipulated as shown dotted in FIG. 4 to afford access to the tub walls for cleaning and/or maintenance. In FIG. 2, the door is shown in an open position with one edge thereof against the drum in its normal location.

Also detachment of the basket access door allows access to the lint filter. The lint filter frame is secured to the tub wall by means of L-shaped spring clip members **36** and nesting clips **37** all of which are permanently affixed to the tub sidewall. Clips **36** are hung in cantilever fashion from their points of affixation and are



fabricated from suitable metal having spring-like qualities. The spring clips **36** fit snugly against the frame nominally holding the frame and filter tightly against the tub within the nest clips **37**. By exerting a force on the cantilevered ends of the clips **36**, the lint filter frame may be freed of its mounting and removed through the access hole. This removal should not be required more than once every month or two due to the self-cleaning nature of the filter as will be described.

The functioning of the filter only occurs after the tub has been filled with water to the predetermined level and the clothes basket is rotated in its normal counterclockwise direction. This rotation periodically submerges the clothes within the basket in the pool of water in the tub. By virtue of the drum rotation, the drum sidewall by means of skin friction or water surface tension raises a head of water along the tub sidewall. As mentioned previously, the filter as shown is positioned vertically above the static water level but within the space filled by this dynamic water level or dynamic head of water. It has been found that this positioning provides the maximum filtering and self-cleaning effect. It is conceivable that the filter could be placed below the static water level along the wall shown to provide the filtering and self-cleaning result. In such an instance, the filter would have to be sufficiently near the static water level to allow a suitably large counter surge on drainage to flush out the filter.

During the washing operation, the wash water frees a quantity of lint from the clothes and carries this lint about in its agitated motion. As water is formed into the pressure head, a quantity of lint entrained in the water will be borne against the filter screen with sufficient force to plaster the lint against the filter. Throughout the entire rotation period this dynamic water pressure will be maintained encompassing the lint filter screen. Thus, throughout the rotational period, additional lint will be picked up by the dynamic head of water, forced against the filter screen and maintained against the screen by the constant force exerted by the dynamic head of water resulting. In this way, all lint trapped by the filter will remain compressed against the underside of the lint filter channel for the duration of the rotational period. All lint thus entrapped will be removed from the possibility of contact with the clothes being washed for the entire length of the basket rotative period.

When the wash period is ended as indicated by the time controller **13**, the basket begins to decelerate. At this time the drain **19** is opened and the drain pump is activated to remove water from the tub. Water rapidly leaves the tub lowering the water level below the level of contact with the basket. At this period in the deceleration, the pressure wave or dynamic head is being dissipated and as a result a final rush of downflowing water is drained through the filter. As this down-rush of water passes through the filter, the entrapped lint is carried with the water into the diminishing pool within the sump and is washed down the drain. In this manner, the collapsing of the dynamic water head on cessation of basket rotation provides a wave for cleaning the filter of all lint entrapped there during the preceding washing operation.

The lint filter functions in the same manner for all periods in the cycle in which the basket is rotated through a pool of water. The filter thus provided has no moving parts, functions during all rotative periods including the wash, rinse and water extraction periods and cleans itself during the final phase of the cyclic period. Further, if for some reason the filter becomes clogged and fails to act, the washing operation can continue unimpeded in the normal manner.

While there has been described what is at present considered to be a preferred embodiment of the invention, it will be understood that various modifications may be made therein, and it is intended to cover in the appended

claims all such modifications as fall within the true spirit and scope of the invention.

What is claimed is:

1. In a washing machine of the tumble action type having a perforate rotatable drum disposed within an imperforate stationary tub, a channel-shaped perforate lint filter, means for introducing liquid into said tub to a predetermined static liquid level, means for rotating said drum through said liquid in said tub to produce an upflow of liquid in the direction of rotation of said drum, said liquid assuming a dynamic liquid level at a substantially higher elevation than said static level, and means for securing said filter to said tub wall with the length of the channel web parallel to the axis of said drum but below said dynamic level, the web of said channel being positioned substantially normal to liquid being impelled upwardly along the surface of said tub facing said basket for arresting lint entrained in the liquid against the underside of said filter web, said upwardly directed flow of liquid maintaining said arrested lint against said filter web.

2. In a machine as claimed in claim 1, said filter including an enclosing frame structure, and said securing means comprising members resiliently gripping said frame structure to allow ready demounting of said filter for cleaning.

3. In a clothes washing machine adapted to tumble wash clothes throughout a washing operation, an imperforate liquid retaining tub, means for filling said tub to a desired liquid level, a perforate drum journalled for rotation within said tub and including a cylindrical sidewall portion submerged in said liquid and rotatable into and out of the liquid retained in said tub to periodically submerge clothes carried within said drum, in said liquid, means for rotating said drum, said drum on rotation forming a continuous dynamic liquid pressure front upwardly directed in the direction of rotation of said drum, a stationary lint filtering means secured to said tub in the path of said directed pressure front, said filtering means comprising a channel normal to said directed front, said channel being of perforated construction to allow the liquid in said pressure front to pass upwardly through said channel while arresting lint entrained therein on the underside of said filtering means and confining said lint thereon throughout said washing operation, and drain means operable at the end of said washing operation for dissipating said pressure front in said liquid in a counterflow direction whereby said entrained lint is flushed off the underside of said filtering means and conveyed to the drain.

4. In a clothes washing machine adapted to tumble clothes to be washed during a washing operation, a perforate drum journalled for rotation about a non-vertical axis, said drum having an access opening through which clothes may be placed in the drum, an imperforate liquid retentive outer casing spaced outwardly of said drum and encircling said drum, means for filling said casing with liquid to a desired level submerging the lower portion of said drum, means for rotating said drum to tumble the clothes in said liquid, said drum on rotation generative of an upwardly directed wave of liquid within the space between said drum and said casing, a filter extending longitudinally of said drum, means for securing said filter stationarily in the space between said drum and said casing whereby said filter will be submerged by said directed wave, a mesh screen within said filter positioned substantially radially of the axis of rotation of said drum to allow liquid to pass upwardly through said screen while entrapping lint borne by said liquid against the underside of said screen, the hydraulic force of said wave maintaining trapped lint against the underside of said screen, means on said drum affording access to said filter to permit the removal thereof through said drum, and drain means operative at the conclusion of a washing operation for removing liquid from said casing whereby said directed wave collapses through said screen and lint on said screen is washed thereby from the underside of said screen for passage through said drain.

5. In a clothes washing machine adapted to tumble clothes to be washed during a washing operation, a perforate drum journalled for rotation about a non-vertical axis, said drum having an access opening through which clothes may be placed in the drum, an imperforate liquid retentive outer casing spaced outwardly of said drum and encircling said drum, means for admitting liquid into said casing to submerge a lower portion of said drum, means for rotating said drum to tumble the clothes in said liquid, said drum on rotation generative of an upwardly directed circulating wave of liquid within the space between said drum and said casing, a filter, means for removably securing said filter in the space between said drum and said casing whereby said filter will be submerged by said directed wave, a mesh screen within said filter positioned substantially normal to the direction of said directed wave to allow liquid to pass upwardly through said screen while entrapping lint borne by said liquid against the underside of said screen, said directed wave generative of a force maintaining trapped lint against the underside of said screen, means including a removable access panel in the peripheral wall of said drum to facilitate removal of said filter, and drain means operative at the conclusion of a washing operation for removing liquid from said casing for dissipating said directed wave through said screen whereby lint on said screen is freed for gravity fall from the underside of said screen for passage through said drain, the radially innermost edge of said filter being in spaced relation to the adjacent side of said drum to maintain a free liquid path between said filter and said casing to insure circulation of liquid at all times during rotation of said drum.

6. In a clothes washing machine adapted to tumble clothes to be washed during a washing operation, a cylindrical drum journalled for rotation about a non-vertical axis, said drum having a foraminated sidewall, an imperforate liquid retentive outer casing spaced outwardly of said drum and encircling said drum, means for admitting liquid into said casing to submerge a lower portion of said drum, means for rotating said drum to tumble the clothes in said liquid, said drum on rotation circulative of liquid in an upwardly directed wave of liquid within the space between said drum and said casing, a filter, means for securing said filter in the space between said drum and said casing whereby said filter will be submerged by said directed wave, said filter extending longitudinally of said drum substantially radially relative to the axis of rotation thereof, a mesh screen within said filter positioned substantially in the path of said directed wave to allow liquid to pass through said screen while entrapping lint borne by said liquid against said screen, said directed wave generative of a force maintaining trapped lint against the said screen, drain means operative at the conclusion of a washing operation for removing liquid from said casing for dissipating said directed wave through said screen whereby lint on said screen is freed for passage through said drain, said securing means maintaining said filter spaced from said drum to provide an open liquid path between said filter and said drum to insure circulation of liquid from said space through the side wall of said drum regardless of the accumulation of lint on said screen.

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