

[54] **LIQUID SUPPLY AND RECIRCULATION
MEANS FOR PARTITIONED CLOTHES
DRUM**

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68/145, 208, 207

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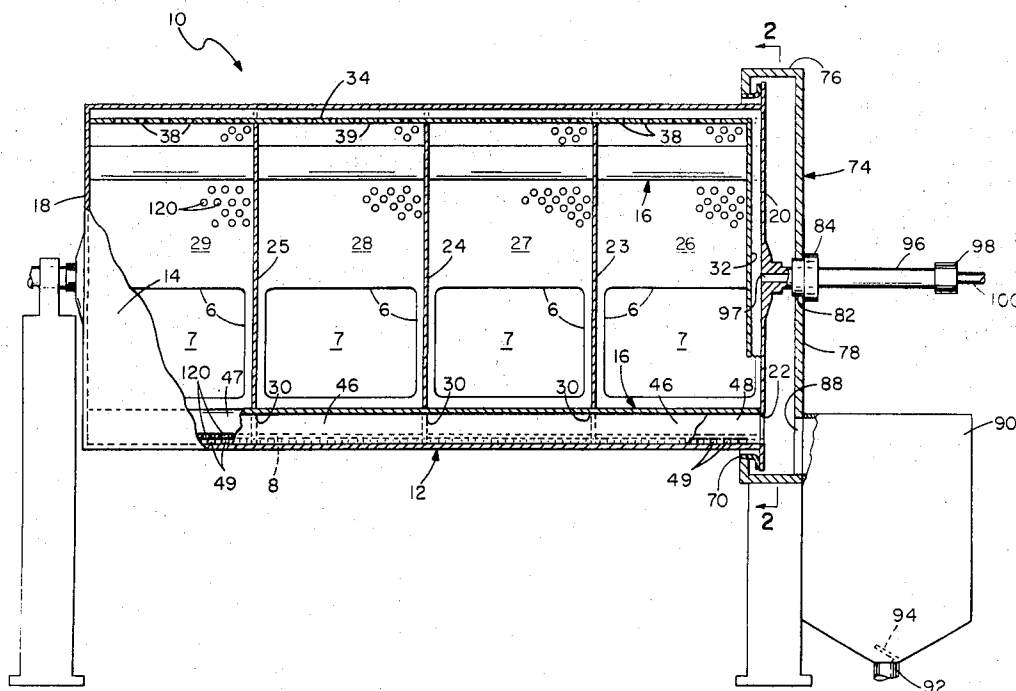
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[57] **ABSTRACT**

A washing machine of the type including a cylindrical drum rotatable in at least one direction about a horizontal axis, a pair of circumferentially spaced inlet conduits extending generally axially along the peripheral wall of the drum and including spaced therealong radially inwardly directed spray jets, a plurality of radially spaced, hollow in transverse cross-section ribs extending generally axially of and projecting radially inwardly from the wall, each rib being divided into two longitudinally-extending passages by a flexible and extensible interior partition extending the height and width of the rib, and a rib extension extending outwardly and generally circumferentially of the drum peripheral wall from intermediate the height of each side of each rib.

20 Claims, 3 Drawing Figures



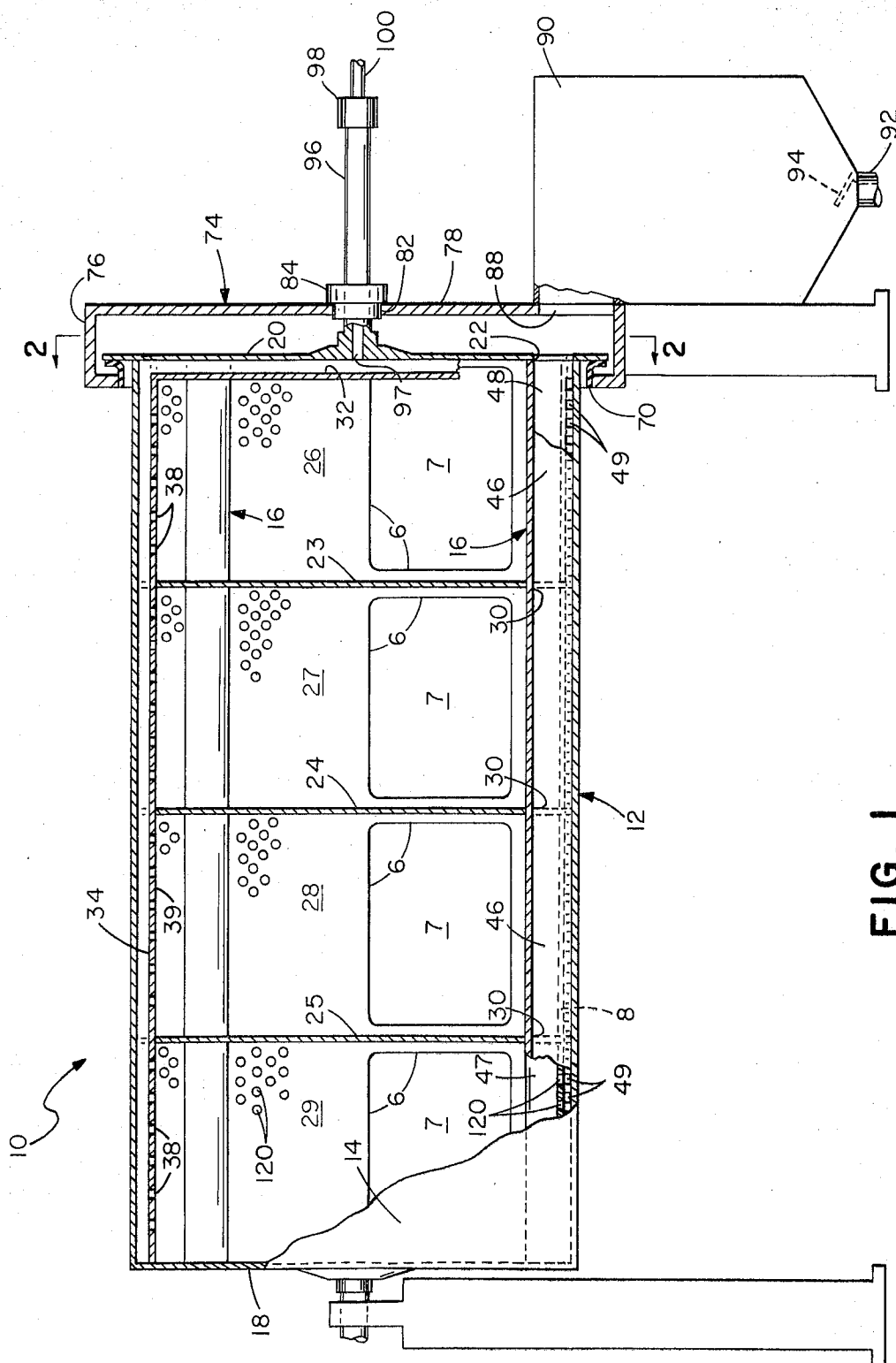


FIG. 1

LIQUID SUPPLY AND RECIRCULATION MEANS FOR PARTITIONED CLOTHES DRUM

This invention relates to washing machines and, more particularly, to machines of the type including a substantially cylindrical drum mounted for horizontal rotation about its axis.

It is a principal object of one aspect of the present invention to increase the recirculation of water within a commercial tumbler washing machine. A principal object of a second aspect is to prevent wash from clogging the recirculation system. A third aspect has as its principal object providing for spraying the wash within the cylinder. A fourth aspect has as its principal object enabling the water within the washing machine to be drained at a much greater speed than heretofore and to concomitantly enhance the machine's rinsing capability. Other objects, which may include more than one aspect, include eliminating the need for expensive and complex liquid injection and recirculation systems.

The first aspect of the invention features, in a machine having at least one longitudinally extending, hollow in transverse cross-section rib projecting radially inward from the cylindrical wall of the drum, a flexible partition extending the height and length of the rib and dividing it into two longitudinally-extending passages, portions of the rib defining openings to permit flow of liquid to and from each of the passages. The second aspect features, in such a machine, a perforate rib extension extending generally circumferentially of the drum, outwardly from each side of each rib intermediate the height thereof, the rib and rib extension cooperating to permit flow of liquid into and from the rib. In the third aspect there is featured, in a machine including a pair of circumferentially spaced inlet conduits extending generally axially along the drum peripheral wall, a perforated extension extending circumferentially outwardly from each conduit generally circumferentially of the drum and from adjacent the inner surface of the conduit and a plurality of inlet spray jets spaced along each conduit arranged for spraying liquid radially inwardly of the drum. Machines embodying the fourth aspect feature at least one hollow rib projecting radially inwardly from the drum cylindrical wall end extending longitudinally of the drum, air opening in a drum end wall coinciding with the rib, a perforate, longitudinally-extending rib extension projecting outwardly from each side of the rib intermediate the height thereof, and circumferentially-spaced openings in the drum end wall intermediate the rib extension and the drum cylindrical wall. Preferred embodiments combine all four aspects and feature a plurality of circumferentially-spaced ribs each extending from adjacent the drum wall to a point radially inward of the drum perforate extension extending between each rib and the next adjacent, as the case may be, rib or conduit, and ribs having outer walls that are perforate intermediate the extensions and drum wall imperforate interior of the liner and have an overall height not less than twice the radial distance between the drum wall and extensions, and axially-spaced drum interior walls dividing the drum into compartments and having flow openings therethrough intermediate the rib extensions and drum cylindrical wall.

Other objects, features, and advantages will appear from the following detailed description of a preferred embodiment of the invention, taken together with the attached drawings in which:

FIG. 1 is a side elevation, partially in section taken at line 1—1 of FIG. 2, of a washing machine embodying the invention;

FIG. 2 is an end sectional view of the machine of FIG. 1, taken at line 2—2 of FIG. 1; and,

FIG. 3 is a perspective view, partially in section, of portions of the machine of FIG. 1.

Referring to the drawings there is shown an industrial washing machine, generally designated 10, comprising a water-tight, substantially cylindrical drum 12 mounted so that it may be rotated in either direction about its horizontal axis. Three partitions, designated 23, 24 and 25, respectively, divide drum 12 into four, substantially equal in size, wash compartments, designated 26, 27, 28 and 29. Four openings 6, each closed by a rolling door 7, are provided in the cylindrical wall 14 of the drum, one overlying each wash compartment, to permit laundry to be put into and removed therefrom. Three ribs 16, circumferentially spaced at 90° intervals from each other around the portion of the drum not including openings 6, extend the full length of drum 12 and project radially inwardly from wall 14. As shown, one end 18 of the drum is sealed to be water-tight. The other end 20 is sealed except for openings 22, coincident with the location of each rib 16, and circumferential-spaced slotted openings 21 extending a short distance radially inwardly from drum wall 14. Each partition similarly includes openings 30 through which the respective ribs 16 extend and the periphery of which engage the outer wall of the respective rib 16 passing therethrough, and slotted openings 31 spaced around the outer edge of the respective partition and extending inwardly a short distance from wall 14.

Machine 10 also includes a liquid inlet assembly including a rectangular duct 32 extending diametrically of drum end wall 20 and a pair of substantially rectangular ducts, designated 34, 36 respectively, extending longitudinally along drum cylindrical wall 14 from a respective end of duct 32. As shown, each duct 34, 36 is spaced angularly 45° from the most adjacent respective rib 16, and extends from end wall 20 through partitions 23, 24, and 25, to drum end wall 18. Spray openings 38 are regularly spaced along the length of the radially inner surface 39 of each duct, arranged to direct liquid from ducts 34, 36 generally toward the axis of drum 12. Within each compartment 26—29, a pair of rectangular dividers 37, spaced 180° from each other and 90° from ducts 34, 36, extend longitudinally the length of the respective compartment. The respective dividers 37 in the different compartments are aligned with each other.

As shown most clearly in FIGS. 2 and 3, each rib 16 is generally U-shaped in transverse cross section. The rib base is secured to drum wall 14; its apex projects generally radially inwardly into drum 12. The sides of each rib 16 are formed by a pair of longitudinally extending diverging walls, designated 47, 48, respectively. An imperforate, flexible, neoprene divider 46 is provided within each rib 16, extending the full length of the rib and also from the rib apex to base. Beads at the inner 50 and outer 51 longitudinal edges of divider 46 are removably mounted in channels 56, 58 secured, respectively, to the rib apex and to drum wall 14 midway between rib side walls 47, 48.

Within each of compartments 26, 27, 28, 29 are six perforate arcuate rib extensions, designated 121—126. Each rib extension extends generally axially the full

length of the compartment and circumferentially through an arc of about 45° from a side of one of ribs 16 to the adjacent (as the case may be) a divider 37 or inlet 34, 36. Except for the spaces occupied by the ribs and inlets and the approximately 90° arc adjacent door openings 6, the six extensions form a cylinder, generally designated 8, coaxial with drum wall 14. The radial distance from each rib extension to drum wall 14 is approximately equal to 15 percent of the overall height (base to apex) of ribs 16, and is equal to the height of inlets 34, 36 so that surfaces 39 are flush with the inner surface of the adjacent extensions. The adjacent edges of extensions 121, 126 are secured to the inner surface of one of ducts 37, an edge of extension 124 is secured to the inner surface of the other duct 37. Inclined fillet strips 41 extend from cylinder 8 to drum cylindrical wall 14 along the side duct 37 and inlet duct 36 on opposite sides of drum wall openings 6. As shown, openings 21 in drum end 20 and openings 31 in partitions 31 in partitions 23-25 are located intermediate perforated cylinder 8 and drum cylindrical wall 14.

Referring particularly to FIG. 3, the portions of rib walls 47, 48 lying radially inward of liner 8 are imperforate. The longitudinally-extending portion 60 of each wall section 47, 48 between liner 8 and drum wall 14 defines a plurality of regularly spaced, radially-extending slots 49. Each slot 49 extends substantially from wall 14 to the perforated cylinder 8 defined by rib extensions 121-126.

Referring again to FIG. 1, a conventional wet box assembly, generally designated 74, and shown in a simplified form, is provided at drum end 20. As shown, the cylindrical portion of drum 14 adjacent end 20 is fitted within the cylindrical mouth 70 of wet box 74, which includes a cylindrical side wall 76 and a substantially flat end wall 78. Two openings extend through end wall 78—central opening 82, which is defined in part by an annular projection 84, and drain opening 88, leading to weir 90. A drain line 92, controlled by a valve 94, extends from the bottom of weir 90.

A hollow trunnion 96 extends axially of machine from an opening 97 in drum end wall 20, communicating with duct 32 of the inlet assembly, through opening 82. A rotary joint assembly 98 is provided to attach trunnion 96 to a fixed water supply pipe 100.

In operation the articles to be washed are placed in each drum compartment and the drum rotated. During the fill, rinse, and supply injection portions of the wash cycle, liquid is then sprayed onto articles in the compartments through spray jets 39 of ducts 34 and 36 of the inlet assembly. During the fill and supply injector cycle portions, spraying continues until each of the drum compartments 26, 27, 28, 29 has been filled to the desired level. During rinsing, when fresh water is introduced through ducts 34, 36, the exhaust rate from drum 14 through drain 94 is balanced to the rate of water input. Ribs 16 and openings 31 provide for communication between the compartments inter se (keeping the same liquid level in each) and the ribs and openings 21 permit flow between the compartments and wet box 74 (so that the wet box and weir 90 are also filled). Drum 12 is rotated during washing, and the circumferential spacing of the ribs insures that at least one rib or rib extension will always be submerged in the liquid.

As the drum rotates (for example in a clockwise direction as viewed in FIG. 2), each rib 16 is rotated through and is by rotation raised out of the liquid. This

movement, together with the weight of the water in the rib, flexes and bows partition 46 (see FIG. 2) toward the rib trailing wall, here the wall 48. As shown, the trailing passage of the rib (between partition 46 and wall 48) is much smaller than the leading passage (between partition 46 and wall 47). As the rib is raised out of the liquid, most of the liquid in the larger upper passage in the rib is captured in that passage and, rather than being discharged back into drum 12, flows from the end of the rib into wet box 74. Although this discharge tends to cause the level of liquid in wet box 74 to rise, liquid is free to flow back into drum 12 through the submerged ones of ribs 16 and the water level in the drum compartments and wet box remains constant. Thus, during drum rotation, there is continuing circulation of liquid from the wash compartments of drum 12 and into the wet box through an elevated rib 16, and back into the drum through a submerged rib. Recirculation of water within the drum is enhanced further by flow from the trailing lower passage (between partition 46 and wall 48) into the area between the adjacent rib extension and drum peripheral wall, and thence through the perforations 120 in the rib extension back into the drum compartments.

When a washing cycle is complete, or during the rinse cycle when fresh water is introduced into the cylinder, dump valve 94 is opened, emptying weir 90 and causing liquid to drain from drum 12 into wet box 74 through ribs 22, and thence to drain line 92 through pipe 89 and weir 90. Rotation of the drum is continued during draining so that substantial amounts of the liquid in the drum is discharged into wet box 94 by flow through an elevated rib, rather than all the liquid being withdrawn through the submerged ribs and clothing at the bottom of the drum. The ribs 16, rib extensions 121-126, and openings 21, 31 in partitions 23-5 and drum end 20 cooperate to greatly increase the speed at which water may be drained from drum 14.

The symmetrical (about partition 46) design of each rib 16 permits drum 12 to be rotated in either direction during washing. When the drum is rotated in a counter-clockwise direction (as seen in FIG. 2) partition 46 flexes in the other direction; the liquid captured in the now-lower passage defined by partition 46 and wall 47 drains back into the drum compartments through the slots 49 in rib 47 and perforations 120 in the rib extensions; and liquid in the now larger passage defined by partition 46 and wall 48 is captured thereon and flows from the end of the rib into wet box 74, causing the desired continuous circulation.

Other embodiments within the scope of the following claims will occur to those skilled in the art.

What is claimed is:

1. In a washing machine of the type comprising a horizontal cylindrical drum mounted for rotation in at least one direction about its axis, and at least one hollow in transverse cross-section rib projecting radially inwardly from the cylindrical wall of said drum, said rib including a partition interior thereof extending generally radially and longitudinally of said drum and dividing said rib into two longitudinally-extending passages, that improvement wherein:

said interior partition is flexible and spaced longitudinally extending edge portions thereof are secured in position within said rib; and portions of said rib define openings permitting flow of liquid to and from each of said passages.

2. The machine of claim 1 wherein said openings are located in longitudinally-extending portions of said rib adjacent said drum wall, and the portions of said rib radially-inwardly of said longitudinally-extending portion are imperforate.

3. The machine of claim 1 including a perforate rib extension projecting outwardly from each side of said rib, substantially circumferentially of said drum and intermediate the height of said rib.

4. The machine of claim 3 wherein the portions of said rib radially inward of said extensions are imperforate.

5. The machine of claim 4 wherein rib includes a pair of spaced side walls, each said side wall defining in conjunction with said partition one of said passages, a rib extension projecting outwardly from each of said walls, and the portion of each of said walls intermediate said drum wall and a respective one of said extensions defining a plurality of openings spaced therealong.

6. The machine of claim 1 wherein said rib is substantially U-shaped in transverse cross-section and said partition is secured along one longitudinally-extending edge to said wall and along its other longitudinally-extending edge to the apex of said rib.

7. In a washing machine of the type comprising a horizontal cylindrical drum mounted for rotation in at least one direction about its axis, and at least one hollow in transverse cross-section rib having a pair of longitudinally-extending side walls and projecting generally inwardly of said drum, that improvement comprising a perforate rib extension extending outwardly from each of said side walls in a direction generally circumferentially of said drum, the portion of each extension adjacent a respective said side wall being spaced radially inwardly of the peripheral surface of said drum, and said rib and said extensions cooperating to permit flow of liquid into and from said rib.

8. The machine of claim 7 wherein said rib includes an interior, longitudinally-extending imperforate wall dividing the interior of said rib into a pair of longitudinally-extending passages, the portions of said rib side walls radially inward of said extensions are imperforate, and said rib and extensions permitting flow of liquid between the area intermediate said extensions and said drum wall and each of said passages.

9. The machine of claim 7 including within said drum an inlet conduit extending generally axially along the peripheral wall thereof, said conduit having an inner surface along which is provided a plurality of spaced spray inlets arranged for injecting liquid from said conduit generally radially inwardly to the interior of said drum.

10. The machine of claim 9 wherein one of said rib extensions extends from said rib to said inlet conduit flush with the inner surface thereof.

11. The machine of claim 10 including a pair of substantially identical conduits spaced circumferentially of

said drum, and a plurality of substantially identical ribs spaced circumferentially of said drum, and a plurality of perforate rib extensions, each of said extensions extending generally circumferentially of said drum from a side wall of one of said ribs to a side wall of the adjacent one of said ribs and said conduits.

12. A washing machine including a horizontal cylindrical drum mounted for rotation about its axis, a pair of circumferentially spaced inlet conduits extending generally axially along the inner surface of the peripheral wall of said drum, each of inlet conduits having a radially inner surface including a plurality of inlet spray jets spaced therealong and directed generally radially-inwardly of said drum, and a perforate arcuate sheet projecting outwardly from each side of each of said conduits flush with the inner surface thereof in a direction generally circumferentially of said drum.

13. The machine of claim 12 including a plurality of circumferentially spaced, hollow in transverse cross-section ribs, each of said ribs being secured to the peripheral wall of said drum and projecting from said peripheral wall generally radially inwardly of said drum.

14. The machine of claim 13 including a perforate sheet spaced radially inwardly of the peripheral wall of said drum extending between each of said ribs and the adjacent one of a said rib and said inlet conduit.

15. The machine of claim 14 wherein each of said ribs includes an interior imperforate partition extending longitudinally thereof and dividing the interior of said each rib into a pair of longitudinally extending passages.

16. The machine of claim 15 wherein the outer longitudinal edge portion of each of said partitions is secured to the peripheral wall of said drum, and each outer wall of each of said ribs includes a perforate portion intermediate the adjacent said extension and said peripheral wall and an imperforate portion radially inward of said adjacent extensions.

17. The machine of claim 16 wherein each of said partitions is flexible.

18. The machine of claim 17 wherein each of said partitions is extensible.

19. The machine of claim 7 wherein said drum includes an end wall defining a first opening aligned with said rib for permitting flow of fluid from said rib through said end wall and a plurality of secured openings disposed intermediate said rib extensions and the cylindrical wall of said drum, said second openings being circumferentially spaced.

20. The machine of claim 7 including a partition dividing said drum into axially-spaced compartments, said partition defining an opening through which said rib extends and a plurality of circumferentially spaced openings disposed intermediate said rib extensions and said drum cylindrical wall.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,760,613 Dated September 25, 1973

Inventor(s) Raymond G. Henderson

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the Claims:

Claim 12, line 5, after "of", add --said--, and,
line 9, change "from each" to --from
at least one--.

Signed and sealed this 2nd day of April 1974.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents