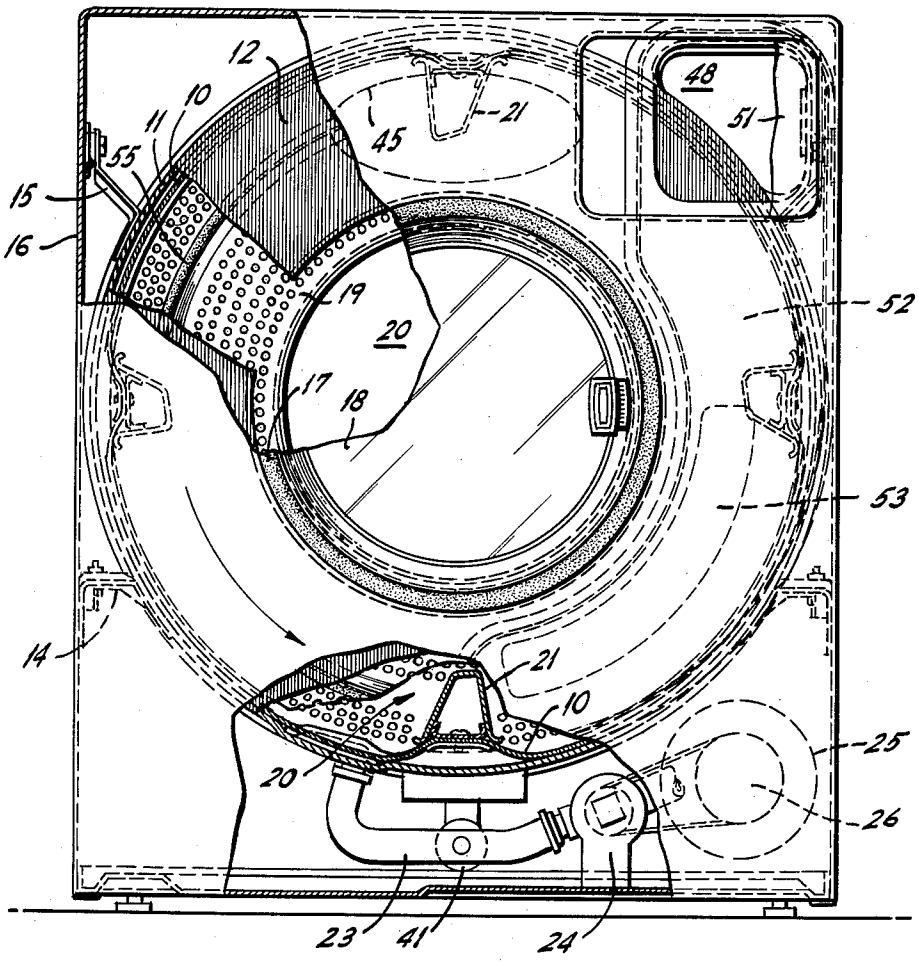
Jan. 23, 1962 J. J. HAVERSTOCK ET AL 3,017,758

LAUNDERING MACHINES

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FIG. 1.



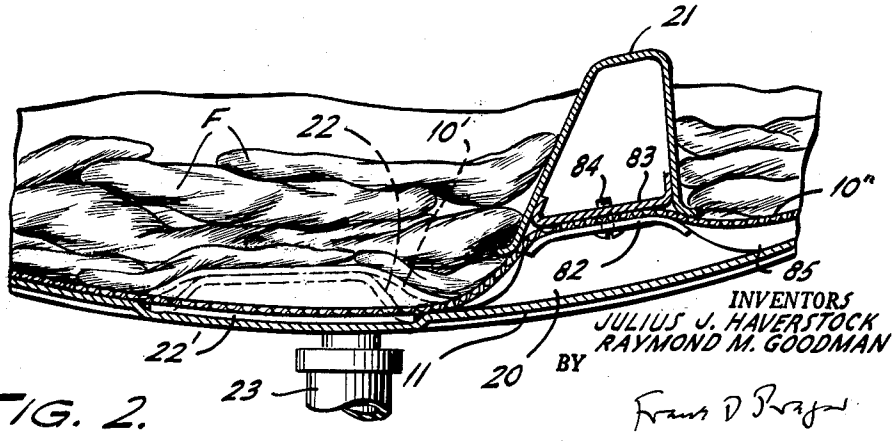


FIG. 2.

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FIG. 4.

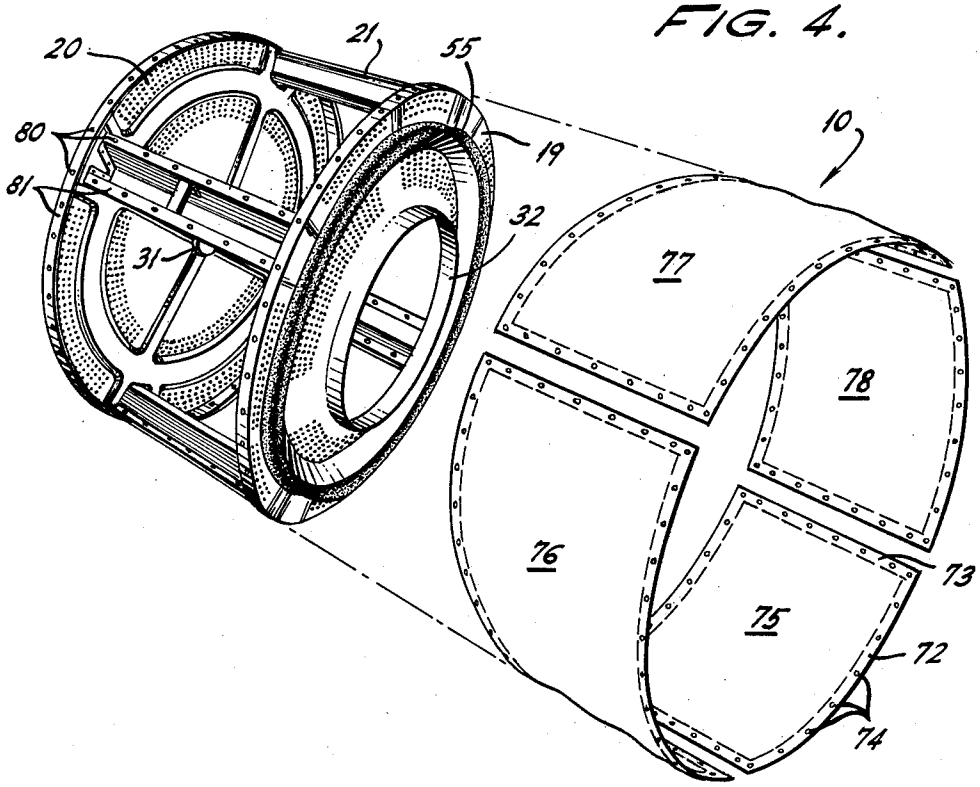
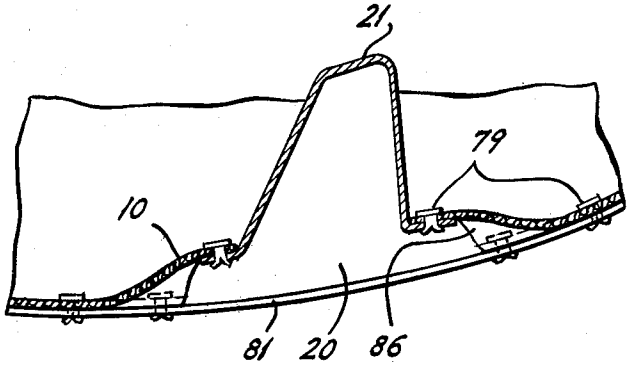


FIG. 3.



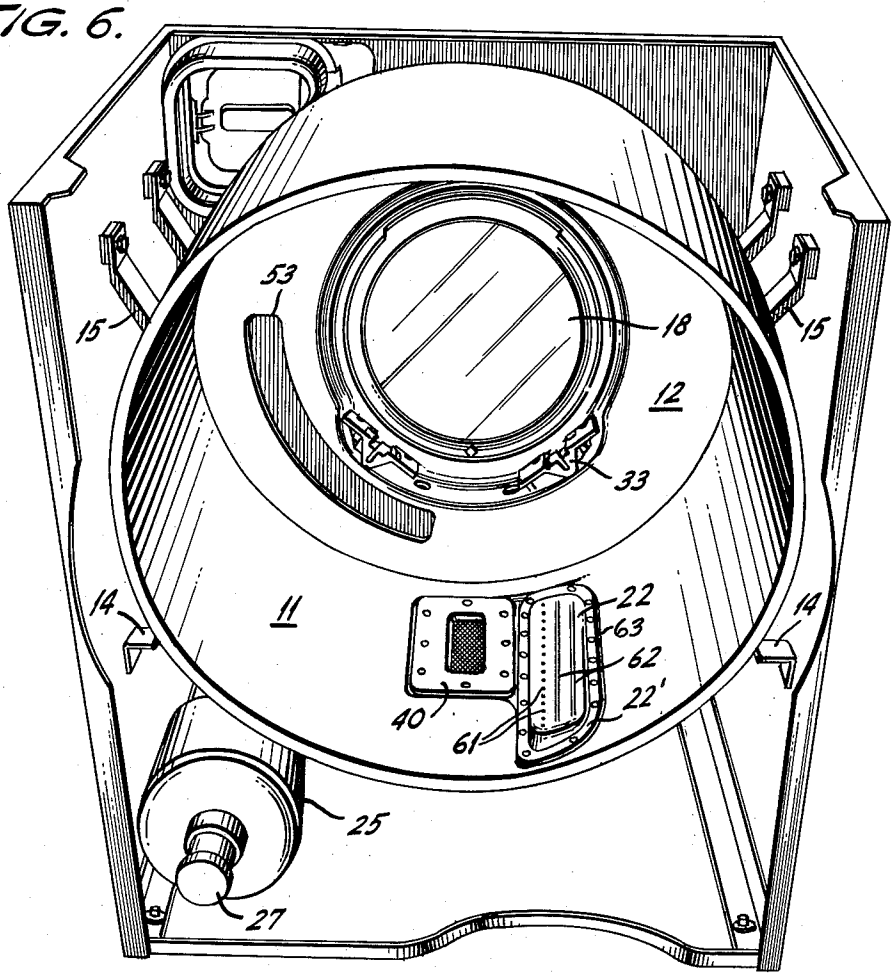
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LAUNDERING MACHINES

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FIG. 6.



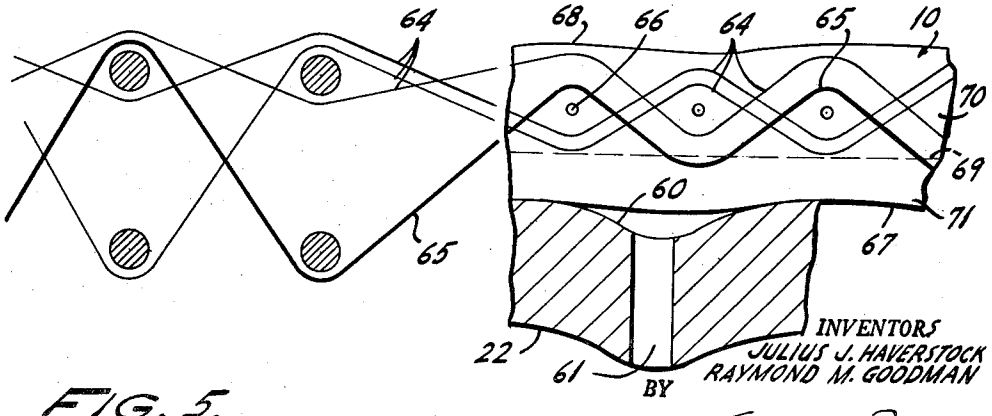


FIG. 5.

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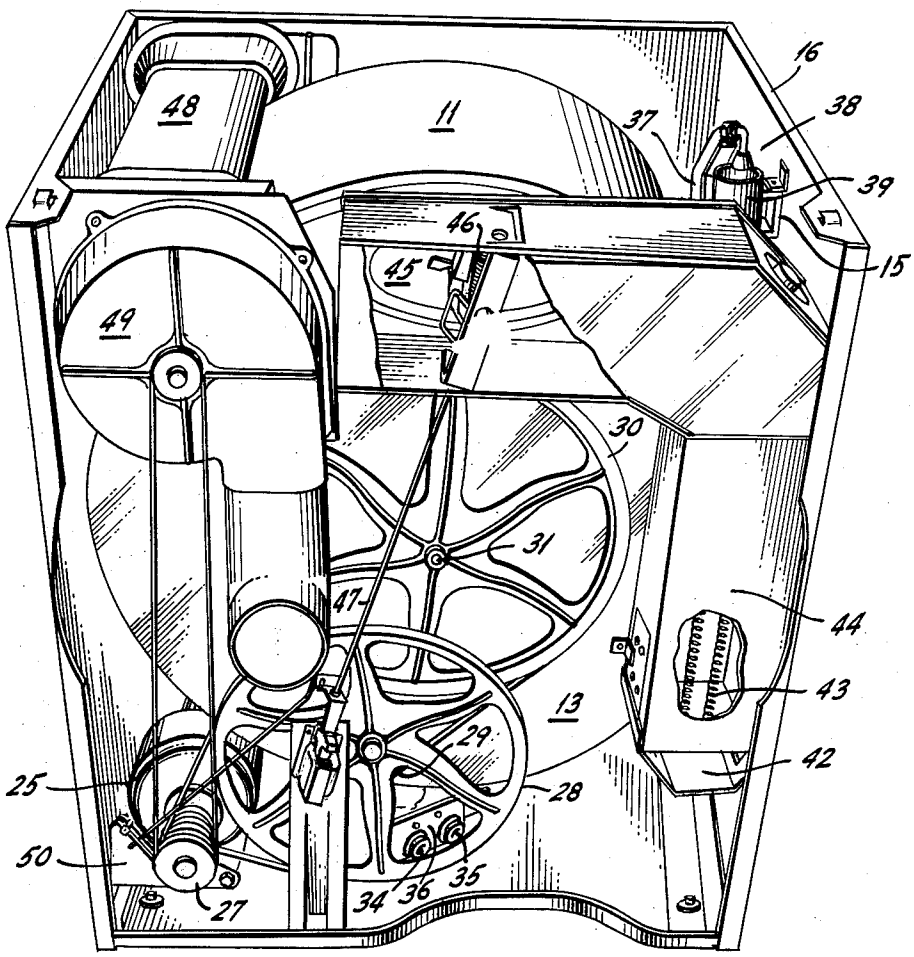


FIG. 7.

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3,017,758

LAUNDERING MACHINES

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Filed Aug. 12, 1957, Ser. No. 677,720
6 Claims. (Cl. 68—19)

This invention relates to laundering machines and has to do particularly with the extraction of liquid from wet or damp, laundered fabrics, by a liquid-carrying medium of the general type disclosed in Patent No. 2,758,461 to David Tann. The present invention is an improvement over that disclosed in said patent.

Heretofore it has been difficult to provide rapid extraction of liquid by a medium of the type indicated and yet to maintain satisfactory operation in other respects. Particular difficulties were encountered in providing a broad and freely extended span of the liquid-carrying medium, directly exposed to the fabrics, as is desirable for rapid picking up of the liquid, while yet protecting said medium from certain effects of the weight and/or the impact of the wet or damp fabrics which are kept in motion on and against the medium.

Accordingly, it is a primary object of this invention to construct and arrange a liquid-carrying medium in such a way as to make maximum use of the liquid-extracting capacity thereof, especially by forming the medium into a wall of or a band around a space for wet or damp fabrics, with broad and freely extended areas of said medium exposed to the laundered fabrics, and at the same time to protect the so-arranged or extended medium from difficulty and injury due to influences such as the weight and/or impact of tumbling fabrics.

We have found it possible to achieve this object by a construction of remarkable simplicity. This can briefly be described as employing an extended, flexible, liquid-carrying wall or belt or the like, together with a rigid structure defining a wall of a tub or the like, on the outside of the liquid-carrying member; said flexible wall or belt and said rigid structure being in engagement and particularly in sliding contact with one another. Such contact is desirably maintained at least in certain regions, where influences such as the pressure and/or the motion of wet or damp fabrics would otherwise tend to cause stretching or bulging of the freely extended, liquid-carrying material.

This engagement or sliding contact of the flexible medium with a surrounding rigid structure has introduced certain further problems, including those of wear and tear of the said medium. It is therefore a further object hereof to solve such further problems; and this has been achieved by further development of the structures referred to. Especially, use has been made of certain composite fabric sheet materials for said medium, providing material of high resistance to abrasion on one side of the medium and material of high capacity for carrying liquid on the other side thereof.

A further object is to provide a thoroughly practical machine of the general type described; and still other objects and advantages will become apparent from the consideration of a specific embodiment of the invention, which will hereinafter be described in detail.

Reference will be made to the drawing, wherein:

FIGURE 1 is a front elevation of a preferred embodiment with certain parts broken away to disclose others. FIGURE 2 is an enlarged detail from FIGURE 1.

FIGURE 3 shows a modification of the detail of FIGURE 2. FIGURE 4 is an exploded perspective view, on a scale smaller than FIGURE 1, of apparatus forming

part of this invention and particularly embodying the modification of FIGURE 3.

FIGURE 5 is an enlarged diagrammatic view of a small section of the liquid-carrying medium, together with certain parts in contact therewith and also with a schematic illustration of means employed in a method of making such a medium.

FIGURE 6 is a perspective back view of the machine of FIGURE 1 with certain portions removed to disclose those parts which normally are in engagement and contact with said medium.

FIGURE 7 is a view similar to FIGURE 6 but with those portions in place which have been removed in FIGURE 6.

Referring first to FIGURE 1: a body 10 of flexible, liquid-carrying sheeting, forming an extended boundary of a receptacle for fabrics to be laundered and shown particularly as a peripheral, cylindrical wall, belt or band, is surrounded by a slightly larger, substantially rigid and imperforate wall structure 11. The latter structure forms part of a tub which also has a vertical, annular front wall 12 and (FIGURE 7) a vertical circular back wall 13. The tub 11, 12, 13 is mounted by brackets 14, 15, in a cabinet 16. Desirably this cabinet 16 has a front access opening, and suitable provision is made by gasket means 17 and door 18 to close this opening.

A support structure for the flexible, liquid-carrying member 10 is shown in FIGURE 1 and in the left part of FIGURE 4, which part may be considered as a portion of the device of FIGURE 1. The support structure as shown comprises a rigid, annular, front member or hoop structure 19, a circular back member or hoop structure 20 and a few rib-like members, rod structures, or bracing elements 21 interconnecting the elements 19 and 20, these ribs 21 being spaced around and slightly inwardly of the peripheries of the annular or circular members 19, 20, so as to form a structural system 19, 20, 21 coaxial with the tub 11, 12, 13. The flexible liquid-carrying material 10 is secured to and extended between flanges, at the outer edges of the structure 19, 20, 21, thereby forming a drum 10, 19, 20 which largely consists of material 10. The axis of the drum is substantially horizontal.

Between the outer edges of the structure 19, 20, 21, the flexible liquid-carrying medium 10 is free to be stretched and otherwise deformed; and, as best indicated in FIGURE 2, a tendency to cause outward bulging of this medium is encountered in the lower part of the illustrated matchine, where said medium is loaded by the weight and impact of wet or damp fabrics F, tumbling within the receptacle 10, 19, 20. However, an inner surface of the rigid wall structure 11 is disposed closely adjacent the outer surface of the flexible liquid-carrying medium 10, and said surfaces are in sliding contact with one another. Thus the flexible medium is supported against excessive stretching, bulging, distortion and the like. Only minor and narrow parts 10′ of the area of the flexible wall 10, in the lower part of the tub, are not so supported and protected; among the unsupported parts being those which pass over certain corners and apertures and similar portions of a device 22 (see FIGURES 2 and 6) incorporated in structure 11 and engaging the medium 10 for removing liquid therefrom. This device is illustrated (FIGURES 1 and 2) as a suction nozzle secured to the rigid tub 11 by a flange 22′ and connected by a pipe 23 to a suction pump 24, the pump being driven by a motor 25 and clutch means 26 being interposed between the motor and the pump. Narrow sections 10′ of the flexible medium 10, spanning the nozzle apertures etc., are self-supporting, but it will be noted that the material 10, being flexible, tends to conform to an irregularity 22 in the surface of the wall of the tub wall 11,

although said material, being peripherally extended, is not entirely able to conform to relatively small irregularities, thereby causing the existence of the small sections 10' freely spanning certain spaces where the material is unsupported. So long as the irregularities of tub wall 11 are minor, this local lack of support causes no failure and no difficulty, since even a highly flexible, interstitial material is self-supporting to at least some extent.

It will further be understood that during the use of the machine, successive portions of material 10 are flexed by nozzle areas or irregularities 22 or the like, as the portion of material 10 in contact with nozzle 22 continually changes, the drum structure 10, 19, 20 being continually rotated, as will be described presently. As fabrics F are present in the rotating drum, on the flexible and flexing drum wall 10, these fabrics are slightly shifted relative to one another, during their passage over an irregularity such as nozzle 22, and this shifting contributes to the dewatering of the fabrics, as it tends to bring the fabric surfaces into closer contact with one another, and some of them with the medium 10, in a manner somewhat similar to that in which the shaking of a screen tends to concentrate the "fines" adjacent to the wire mesh and to accelerate their passage through the same. This shifting of the fabrics is one of the characteristic advantages of this invention.

The various fabric movements are produced by a simple mechanism. As shown in FIGURE 7, the motor 25 may be adapted, by a clutch 27 and a pulley transmission 28, 29, 30, to drive a shaft 31 arranged coaxially with the tub 11, 12, 13; and this shaft, as indicated in FIGURE 4, is centrally secured to the receptacle back wall member 20, whereby it is adapted to rotate the receptacle structure 19, 20, 21 within the stationary tub 11, 12, 13. The shaft 31 runs in a suitable bearing, not shown, in the back wall 13 of the tub. The front wall member 19 of the receptacle structure may be supported on suitable rollers, not shown, by means of an annular flange 32 on said front wall of the receptacle and a pair of roller bearing assemblies 33 (FIGURE 6) on the front wall 12 of the tub. Both sets of bearings, for shaft 31 and for flange 32, can be relatively light and simple, since a considerable part of the static and dynamic load, incident to the rotation of the drum, is absorbed by the sliding of medium 10 on tub wall 11.

The direction of rotation of the receptacle 10, 19, 20 is shown by the arrow in FIGURE 1. The speed of this rotation is such that the forces created thereby, aided by the impelling effect of the ribs 21, causes a tumbling motion of fabrics laundered within the receptacle, in addition to the motions described up to this point. In other words, the fabrics cling to and rise with the flexible medium 10 in that part of the machine which appears at the right hand in FIGURE 1; thereafter they drop away from this medium, either directly upon an underlying section of said medium 10, in the vicinity of the suction nozzle 22, or into a body of liquid retained in the tub.

The machine is shown as being useable either for washing or rinsing, or for damp drying, or for complete drying of fabrics, or for any desired combination and sequence of such and similar operations. Accordingly the machine, as shown in FIGURE 7, has inlets 34, 35 for hot and cold water; a mixing valve 36; a tube 37 connected to said valve and a vacuum breaker structure 38 at the end of tube 37, discharging into a duct 39 and thereby into the tub 11, 12, 13. In the bottom of this tub, as best shown in FIGURE 6, there is provided a sump 40 for the rapid draining of free water, and this sump, as indicated in FIGURE 1, may be connected to the suction pipe 23 of the pump 24, with a suitable valve 41 interposed between the sump and the pipe, in order to allow the suction of the pump to be applied selectively to the suction nozzle 22 alone or to said nozzle and the sump 40.

There is also provided an air blowing and heating system which as shown in FIGURE 7 has an intake structure 42 and air heating elements 43 in a suitable duct 48, which leads from the front to the back of the aperture of tub 11, 12, 13. A spring 46 is provided for normally holding the closure 45 closed, and a solenoid mechanism 47 is adapted to open it. Air is removed from the tub 11, 12, 13 by passage means 48 having one end connected with the tub and another connected with the suction inlet of a blower 49 which can be driven by the motor 25 when a suitable control is applied to the clutch 27 by a linkage 50 connected with the solenoid mechanism 47.

The way in which the heated air circulates in the interior of the tub 11, 12, 13 can best be described by reference to FIGURE 1. It will here be noted that the duct 48, which leads from the front to the back of the cabinet 16, is normally closed in front by the cabinet structure, including a door 51, behind which a front portion 52 of this duct extends downwardly along the front wall 12 of the tub. In a lower portion of the duct 52 the wall 12 has an aperture 53 (FIGURE 6). Thus the suction of the blower 49 (FIGURE 7) is applied by the duct 48, 52 (FIGURE 1) to the inside of the tub 11, 12, 13 through the opening 53 (FIGURE 6), thereby allowing the creation of a partial vacuum within this tub. At the time when the solenoid structure 47, by clutch linkage 50, causes the blower 49 to be driven and to apply this vacuum, the solenoid structure 47 also opens the closure 45 (FIGURE 7), thereby allowing the partial vacuum within the tub to draw air through the duct 44 and heater 43, from the air inlet 42. Thus it will be seen that the blower tends to circulate air through the interior of the tub in a generally forward, downward and laterally inclined direction from the aperture 45 to the opening 53 (FIGURE 1), so that the air stream crosses the approximate path of the dropping and tumbling fabrics. This circulation is not significantly deflected by the receptacle 10, 19, 20, since the flexible medium 10 has substantial permeability for air and the supporting wall members 19 and 20 are of perforated or foraminous construction.

Preferably the suction of the blower 49 is applied so as not to interfere with the upwardly and outwardly directed forces created by the rotation of the receptacle 10, 19, 20, said forces being useful as they tend to hold the fabrics against the rising, liquid-carrying medium 10 and to drive liquid through the fabrics to be dried and into the medium 10. Accordingly the front wall member 19, as shown in FIGURES 1 and 4, may have annular partition means, such as a felt ring 55, coaxially secured to the outside thereof, between outer and inner portions of this wall member, in sliding contact with the inside of the front wall 12 of the tub; the connection 53 between the tub and the air duct 48 being disposed on the inside of said felt ring. Thus the above-described circulation of heated air (FIGURE 1) passes into the receptacle 10, 19, 20 through the perforated back wall 20 and the periphery 10, particularly in the vicinity of the inlet 45 in the upper portion of the machine, and thereafter passes in an oblique downward and forward direction across the path of the tumbling fabrics to the outlet 53; the latter being disposed inside the felt ring 55 and inwardly spaced from the flexible wall 10.

In order to operate the machine in a complete washing, rinsing, damp-drying and hot-air drying cycle, the operator first opens the front door 18 and introduces the fabrics to be laundered, usually together with a detergent such as soap powder or the like, in the receptacle 10, 19, 20. Thereafter the door 18 as well as the air duct access door 51 is closed, suitable circuitry, not shown, is actuated either manually or automatically by suitable, well known cycle controls, not shown; and the following cycle of operations is thereby initiated.

The mixing valve 36 admits water of suitably selected temperature through the vacuum breaker 38 to the tub 11, 12, 13; this water entering the receptacle 10, 19, 20 through the perforations in the walls 19, 20 and the interstices of the liquid-carrying medium 10, soaking the fabrics and, in some cases, dissolving the detergent. When the water has reached a predetermined level, a mechanism such as a float switch or pressure switch, not shown, closes a circuit for motor 25. This causes rotation of the pulley system 28, 29, 30 and, by means of the shaft 31, rotation of the receptacle 10, 19, 20 and of the fabrics therein, at a predetermined velocity, in the direction of the arrow in FIGURE 1, thereby tumbling the fabrics into and through the body of water retained in the tub. This in turn causes formation of suds, and washing of the fabrics.

When this washing has been applied for a predetermined period of time, suitable circuitry, not shown, causes the sump outlet valve 41 to be opened and the pump clutch 26 to be actuated, while the motor continues to operate, so that the pump 24 now drains the body of water from the tub 11, 12, 13, largely through the sump 40 and to some extent through the nozzle 22. The tumbling of the fabrics continues in the same direction and at the same speed. While such tumbling continues, the pump clutch 26 is reversed when the water has been drained; the sump valve 41 is closed, and the mixing valve 36 is now caused to admit rinsing water to the machine in suitable amount or amounts. Such rinsing water is thereafter drained from the machine by substantially the same successive operations of the pump clutch 26 and sump valve 41 as have been described.

Thereafter the sump valve 41 is closed again, while the pump 24 continues to operate and the receptacle 10, 19, 20 continues further to rotate as before, so that from then on residual washing and/or rinsing liquid is withdrawn from the medium 10 by the suction nozzle 22 while the fabrics continue to shift and tumble. This leads to a relative, progressive drying of the medium 10, which in turn leads to a transfer of liquid and/or dampness from the fabrics to that medium. As the wet or damp tumbling fabrics repeatedly drop and slap onto the freely extended and exposed rotating medium 10, adjacent the nozzle 22, liquid is expelled from the fabrics by forces of impact and centrifugal action as well as by a very effective application of the forces of capillary adhesion, causing the liquid particles to leave the fabrics and enter the liquid-carrying medium readily. They are in turn withdrawn from medium 10 by the suction nozzle 22.

This drying of the fabrics and of the liquid-carrying medium can be continued, with intensified action as is required for removing the last remaining dampness within a reasonable time, by starting the air-drying operation. This may start by energizing the solenoid mechanism 47, which opens the closure 45 and causes the clutch mechanism 50 to start the blower 49, while suitable switch means, not shown, energize the heating element 43. The shifting and tumbling of the fabrics by rotation of the receptacle, and the removal of humidity by operation of the suction pump may continue unchanged, although it is also possible to stop the suction operation at or suitably after the inception of the air-blowing.

It will thus be seen that in the operation of the machine, surface portions of flexible wall 10 and of tub wall 11 are in engagement and sliding contact with one another, mainly in the vicinity of the suction nozzle 22. This engagement and sliding contact involves considerable wear and tear of the flexible wall and even of the tub wall, particularly in view of the fact that foreign matter, including abrasive particles such as sand grains and the like, are frequently present as a result of the washing of soiled fabrics. It is therefore important that the tub wall 11 should be non-abrasive and should particularly have no sharp edges or corners or points in contact with the medium 10. Accordingly, wherever sections of the tub wall 11 extend into or out of engagement with the flexible wall 10, the transitional portions of the tub wall are rounded, see for instance (FIGURE 5) the portions 60 adjacent the orifices 61 in the suction nozzle 22 and likewise (FIGURE 6) the ribs 62 which may have to be incorporated in this nozzle in order to reinforce it, and the edge portions 63 forming part of the sump structure 40 where this structure is secured to the tub structure proper.

It is equally important to minimize wear and tear by the construction of the flexible medium 10. A preferred construction of this medium (FIGURE 5) utilizes threads 64, 65 of suitable material extending in one direction, for instance peripherally, while threads 66 of one of these materials, or of still other type, extend in the other direction. Substantially all threads 64, 65, 66 are preferably made of fibers which facilitate picking up as well as releasing moisture. Thus the fibers should not be "absorptive" in the narrow sense of picking up moisture and retaining it rather than releasing it; they should be "absorptive" in the broad sense of tending to pick up and carry moisture by capillarity, adsorption and other processes, subject to ready and easy release of the moisture. The terms "absorbing" and "absorptive" are herein employed in this broad sense. In order to ensure such easy picking up and releasing of moisture, all threads are preferably made of inorganic, synthetic, plastic fibers such as Dacron, Orlon, nylon and the like, not of organic materials such as wool, cotton, linen, hemp and the like.

However, different fibers and weaves are useful in different parts of the medium. At the outer or wearing surface 67, it is best to employ fibers 65 of highly abrasion-resistant material, such as Dacron, preferably in a relatively coarse or "large denier" weave, which seems to add to the abrasion resistance of the material, but which must still be fine enough to provide good, broad contact with the nozzle surfaces 60. Within the body and at the inner surface 68 of the medium 10 it is best to use fibers 64 of Orlon or the like, preferably in a finer or "smaller denier" weave. The relative sizes of the yarns used for the inner and outer parts of the material 10 can be approximately proportional to the respective deniers. These differences in weave characteristic or denier count are schematically indicated by the feature that the Dacron fibers 65 are shown as exposed beyond the boundary 69 between inner and outer parts 70, 71 of the body 10 and that at least two turns of Orlon 64 are exposed at and adjacent the inner surface 68 for every one turn of Dacron 65 exposed at or near the outer surface 67.

The surface yarns and turns, forming part of the said strands 64, 65, or at least the outer Dacron yarns 65, should extend in the direction in which the drum rotates, while the warp or fill 66 may extend crosswise thereto. All strands should be twisted or spun, it being found that a mere filament or "rover" provides inferior liquid transfer and, at 65, inferior wear resistance. The preferred materials, a mixture of Orlon and Dacron, have been found to furnish best results when woven to an overall thickness such that the finished fabric, when dry, weighs about 1 to 1¼ lbs. per square yard; and such fabric has been found to be able to carry an approximately similar weight of water.

It is further preferred that edge portions 72, 73 of the medium 10 (FIGURE 4) should be constructed or treated so as to provide such portions with added resistance against concentrated stresses, so that the material can be fastened to the supporting receptacle structure 19, 20, 21 by a limited number of spaced fasteners, engaging holes 74 in said edges 72, 73. This can be achieved for instance by dipping the edge portions in a plastic and then curing this plastic.

As shown in FIGURE 4 this method of fastening may

be employed along the peripheral edges of the wall members **19** and **20** and also along the straight edges of the ribs **21**; and in this case it is preferred that the liquid-carrying member **10** be formed of individual sections **75**, **76**, **77**, **78**, desirably in the form of rectangular panels, one of which can be installed between each pair of ribs **21**. This construction allows removal and replacement of some or all of these sections, without disassembly of the machine or of any major parts thereof. For such removal the user opens the door **18** (FIGURE 1) and reaches into the front opening surrounded by the collar **32** (FIGURE 4), takes hold of one portion of an edge **72** or **73** and pulls the fabric inwardly, overcoming the resistance of fasteners **79** (FIGURE 3) which are inserted in the holes **74** and the corresponding holes **80** (FIGURE 4), formed in flanges **81** of the structure **19**, **20**, **21**.

A modified form of a liquid-carrying member **10''** and of fastening structures for the same is shown in FIGURE 2 wherein the flexible material forms a one-piece ring around the structure **19**, **20**, **21**; this ring being secured to each rib **21** by clamping means **82**, **83**, interengaged by suitable bolts **84**.

Attention may be drawn to the fact that it is unnecessary to form a very tight seal between the liquid-carrying material **10**, **10''** and the supporting structure and that accordingly the spacing between the fasteners **79** may be fairly wide; also corner portions of the flexible material, shown at **85** in FIGURE 2 and at **86** in FIGURE 3, can be suitably deformed without any attempt to form an air-tight or water-tight seal, so long as the contact between the rigid and flexible materials is close enough to prevent the fabrics to be laundered from working their way out of the rotating receptacle **10**, **19**, **20**.

While only a single embodiment of the invention, with two forms of fabric attachment, has been described, it should be understood that the details thereof are not to be construed as limitative of the invention, except insofar as is consistent with the scope of the following claims.

We claim:

1. In a laundering machine: a rotary drum of the type wherein fabrics tumble onto the inside of a peripheral wall which substantially consists of substantially freely extending sheeting, held by the sides of the drum in a substantially cylindrical but generally loose and flexible form and made of fabric adapted to absorb and carry liquid; means to rotate the drum; and a tub surrounding said drum and having an inner bottom surface area substantially consisting of rigid metal, curved in general accordance with said substantially cylindrical form, extending gradually into contact with said drum, and disposed in slidingly supporting contact with substantial outer surface area of said sheeting.

2. A laundering machine comprising: a flexible, liquid pervious medium adapted to carry liquid; means for holding said medium in such a way as to loosely define an approximately cylindrical, receptacle of the type used for the tumbling of fabrics onto the walls whereof; a container, including rigid structure which gradually extends into and is disposed in slidingly supporting contact with outer, lower surface portions of the medium; and means for maintaining rotary motion of the medium, in sliding relation with said structure, for tumbling fabrics in said receptacle.

3. A laundering machine comprising: a rigid, rotatable drum structure having a pair of rigid hoop elements, one axially spaced from the other; flexible sheeting disposed about the drum structure, substantially composed of interstitial material, having narrow marginal portions in direct contact with said hoop elements, and having wide portions which are not in any direct contact with said drum structure; means for moving the drum structure and the sheeting so as to tumble fabrics therein and thus to transfer liquid from the fabrics to interstices of the sheeting; a stationary tub structure substantially surrounding the drum structure and having inner surfaces at least in bottom portions of the tub structure gradually engaging outer surfaces of the sheeting to slidingly but rigidly support said outer surfaces and thereby to prevent distortion of said flexible sheeting; and means for removing liquid from said interstices.

4. A machine as described in claim 3 wherein the drum structure has rigid flange elements extending between said hoop elements and wherein said sheeting comprises a plurality of panels individually secured to said hoop and flange elements.

5. A washing machine of the tumbling basket type, comprising: a pair of rigid hoop elements; means axially spacing and supporting said hoop elements and leaving major peripheral areas therebetween unoccupied; a liquid-absorptive sheeting medium marginally contacted and supported by said hoop elements and spanning said major peripheral areas so as to form an approximately cylindrical but slack enclosure of the tumbling basket; a tub surrounding said hoop elements, spacing means and sheeting medium and having at least a bottom wall of rigid construction extending gradually toward and disposed in slidingly supporting contact with outer surface portions of said sheeting medium; means for passing fluids into and out of the tub; and means for removing liquid from said sheeting medium.

6. A machine as described in claim 5 wherein said sheeting medium is a woven fabric formed of at least two fibrous materials, a first such material predominating on the outer side of the medium, being remote from contact with any fabrics in the tumbling basket and being substantially composed of highly abrasion-resistant fibres, and a second such material predominating on the inner side of the medium and being substantially composed of fibrous material having a high liquid-carrying capacity, whereas individual fibers of both materials are of types not tending to retain liquid in such fibers.

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