This invention relates to laundry centrifugal extraction machines such as, for instance, automatic washers and combination washer dryers. More particularly, it relates to an arrangement which improves the clothes distribution within the rotating container, and which also provides an improved liquid removal effect for a given rotational speed.

Centrifuging machines of the type generally set forth above incorporate the difficulty that, when a high rotational speed is provided and the clothes are not evenly distributed around the container, there may be very high unbalance forces acting on the machine. This is true in all kinds of laundry extraction machines, including those where the container rotates on a generally vertical axis; it is especially so in non-vertical axis type washing machines such as combination washer dryers.

It is, accordingly, a primary object of my invention to provide a new, simple, and improved container construction in a centrifugal extraction machine which improves the distribution of the clothes for proper balance, and also improves the liquid extraction performance for a given rotational speed.

A further object of my invention is to provide such a machine wherein the clothes receptacle has a symmetrical non-circular configuration in order to achieve the aforementioned goals.

According to my invention, I provide a laundry centrifugal extraction machine with a rotatable clothes receptacle. While, in the broadest aspect of my invention, this receptacle may be rotatable on any axis, including a vertical axis, my invention finds its optimal field of usefulness where the axis is substantially non-vertical. The outer wall of this receptacle is non-circular and symmetrical, with perforations in at least those areas which are the greatest distance from the axis. As is conventional with this type of machine, there is provided suitable means for rotating the receptacle at a speed sufficient to centrifuge liquid out of clothes in the receptacle.

Because of the formation, in effect, of pockets by virtue of the non-circular wall, the clothes will gravitate to areas where they will offset each other and tend to balance each other out so as to improve the balancing condition of the clothes receptacle. They will also, as a result of the non-circular configuration of the basket, form a thicker layer within the pockets than they would have if the basket had the usual circular configuration and the clothes were distributed all around it. It has been found that increasing the thickness of the clothes layer has a tendency to increase the amount of liquid extracted from the clothes for a given rotational rate.

The subject matter which constitutes my invention is particularly pointed out and distinctly claimed in the concluding portion of the specification. The invention itself, however, as to organization and method of operation together with further objects and advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawings.

In the drawings:

FIGURE 1 is a rear elevational view of a combination washer dryer with the rear panel removed to illustrate details;

FIGURE 2 is a side elevational view of the machine, partly in section and with certain surfaces broken away to show details; and

FIGURE 3 is a schematic side elevational view in cross section showing a second embodiment of my invention. Referring now to FIGURES 1 and 2 of the drawings, there is shown a combination clothes washing and drying machine as a machine typical of those in which my invention may be incorporated. The machine has its operating elements included within an outer cabinet structure having a central wrap-around section supported on a base and toe board assembly, and carries a separate top 3 on which is supported a splashback panel 4. Panel 4 may, as shown, be mounted on posts 5, and is conventionally provided with appropriate electrical control devices (not shown) for controlling various types of washing, liquid extracting, and drying sequences.

Access to the interior of the machine is provided by a door 6 formed in section 1, mounted on concealed hinges and opened by any suitable means such as, for instance, a knee operated latch control 7. As best shown in FIGURE 2, the machine is of the non-vertical axis type, in this particular case the axis being horizontal. The machine has a clothes basket, or container, 8 mounted for rotation on a generally horizontal axis within an outer enclosing tub structure 9. Basket 8 comprises an outer peripheral wall 10 which is closed at its rear end by means of a suitable wall or plate 11. The basket also includes a front wall 12 which is formed so as to define an access or loading opening 13 in registry with an opening 14 in wrap-around section 1 provided for door 6.

The basket is rotatably supported by a shaft 15 which is mounted in an elongated bearing 16 supported from rear wall 17 of tub 9. There is also provided an opening 18 aligned with opening 14 and opening 13 so that clothes may be placed into and removed from the basket when door 6 is opened. The door is sealed against a suitable gasket 19 during operation of the machine.

Referring now particularly to FIGURE 1, during operation of the machine the basket 8 is driven from an electric motor 20. The drive from the motor to the basket includes a pulley 21 which is secured to the motor shaft so as to rotate therewith and over which passes belt 22. Belt 22 drives an adjustable sheave assembly 23 of the type which is well known for use in selecting the output speeds from a constant input speed source. The adjustable sheave assembly in turn operates a belt 24 to cause rotation of pulleys 25 and 26. The rotation of pulley 26 is passed on through a belt 27 to a pulley 28 which is secured on the basket shaft 15.

In this manner, motor 20 may be driven at a constant speed, and, through the adjustable sheave assembly 23, the speed imparted to pulley 28 and basket 8 may be varied so as to provide an appropriate range of speeds for the basket. For instance, for tumbling purposes during the washing and rinsing operation, and also during the heat drying operation, a speed of approximately 47 r.p.m. may be provided to the basket 8, and, through the slow acceleration imparted by an adjustable sheave type transmission, a centrifuging speed of several hundred r.p.m. may be provided to the basket for effecting centrifugal extraction of liquid from the clothes either prior to a heat drying operation or to removal of clothes from the container.

The operation of the variable speed drive briefly described above does not form any part of the present invention and is merely set forth to provide a substantially complete description of an operative machine. A detailed description of such a drive is provided, for instance, in Patent 2,970,464 issued on February 7, 1961, to John W. Toma and assigned to the General Electric Company, assignee of the present invention.

To heat the clothes during the drying portion of the cycle there is provided within the machine a heater assembly 29 mounted within the upper portion of tub 9 so
that when energized it causes heating of the basket 8. When the heater assembly is energized during the drying cycle, the heat is transferred to the clothes basket 8 which then passes the heat on to the clothes to cause vaporization out of the clothes. In addition, the heater of basket 8 may be provided, as will be further discussed herebelow, with perforations 30 and thus some of the heat from heating elements 29 passes directly to the clothes by radiation.

The means whereby water is admitted to and discharged from tub 9 during operation of the machine are particularly shown in FIGURE 1. The water supply means includes connections 31 and 32 through which hot and cold water are supplied to the machine for the washing operation. A valve controlled by a solenoid 33 admits hot water to the machine and a valve controlled by an opposed solenoid 34 admits cold water to the machine. The hot and cold water valves under the control of solenoids 33 and 34 discharge through a common outlet conduit 35, through a suitable air gap, and then through a funnel 36 to a sump 37 formed at the bottom of tub 9. Connection of the funnel to the sump may be made through a suitable conduit 38, a portion of which is shown adjacent the sump in FIGURE 1. The air gap provided by funnel 36 makes it impossible for the water to be siphoned from the machine and thus to contaminate the incoming water supply line. A pressure actuated sensing device or water level control 39 controls both solenoids 33 and 34 to maintain the proper water level in the machine during the washing operation. Sensing device 39 is connected to the interior of tub 9 by a suitable line 40.

The illustrated machine is of the type which provides cold water during the heat drying cycle for condensing moisture condensed from the clothes. The condenser water is admitted to the machine through an additional solenoid operated valve 41 which is energized during a drying operation so that the valve passes water at a flow rate sufficient to condense from the air the moisture vaporized from the clothes. The condenser water valve discharges into a conduit 42 which leads through an appropriate air gap (not shown) into another conduit (not shown) to the inlet 43 of a vent trap 44. Trap 44 is of the type commonly provided in connection with machines of this type in order to seal off the tub and basket from atmosphere during heat drying of the clothes, while leaving the atmosphere of the machine. Any appropriate construction for vent trap 44 is, for instance, fully described and claimed in Patent 2,800,008 Raczyński issued on July 23, 1957, and assigned to the General Electric Company, owner of the present invention.

From vent trap 44, the condenser water flows into tub 9 through an opening 45, and then flows in a thin sheet down the lower left wall 46 so as to cool a substantial portion of the area of the side wall and provide a large cool surface for condensing moisture extracted from the clothes.

The wash and rinse water used during the washing portion of the operation, and the condenser water and the moisture extracted from the clothes during the drying operation, are discharged from the machine through the sump 37 mounted at the bottom of tub 9. A suitable discharge hose 47 leads from the sump to any suitable motor driven pump 48 which may, as shown, be driven directly from the motor 20 and which discharges through an outlet conduit 49 to a valve 50 controlled by a suitable solenoid (not shown). Since pump 48 is continually operated, the draining of water from sump 37 is controlled by the drain valve, draining occurring upon energization of the solenoid.

With the apparatus described, any suitable sequence derived from the basic sequence of washing, rinsing, and spinning may be utilized to effect the washing operation of the cycle and may be followed, where so desired by the operator, by suitable heating of the clothes as they are tumbled in basket 8. As stated above, in order to make the clothes dry as fast as possible in a heat drying operation, it is important that the last operation of the washing portion of the cycle, that is, the spin, be conducted at a relatively high centrifuging speed in order to extract as much moisture as possible from the clothes.

During this centrifuging of the clothes, there are substantial forces on the machine which result from the fact that a body having a relatively high moment of inertia is being rotated at high speed. These forces increase tremendously if the clothes in basket 8 divide themselves so that they create an unbalanced condition, that is, that one side of the basket weighs more than the other. In such a case, as the speed increases, the centrifugal force acting on the unbalance creates a great stress on the machine and may, in fact, if not properly controlled, cause damage to the machine. For this reason it is highly desirable to obtain proper distribution of the clothes in the basket 8 whenever a washing, spin or centrifugal extraction operation is to be provided.

A feature of my invention is that I cause this suitable distribution of the clothes to be provided by forming the basket 8 with a symmetrical, but non-circular, cross sectional configuration, in direct opposition to all high speed rotating laundry basket configurations known heretofore. Viewing FIGURE 1, it will be seen that basket 8 has its outer wall 10 formed to provide a pair of pockets 51 and 52 which are positioned opposite to each other so that the force shown of rotation in cross sectional configuration. The formation of these pockets causes the basket to have a wall portion 53 for pocket 51 and a portion 54 for pocket 52; these portions are the radially outermost part of the basket with respect to the axis of rotation.

Intermediate the pockets, and forming the separation between them, the basket is formed with wall portions 55 and 56 which are concave with respect to the exterior of the basket. As shown in FIGURE 1, the wall portions 55 and 56 extend over a substantial portion of wall 10. The portions 55 and 56 include relatively short sections, 55a and 56a respectively, of rapidly changing radius and relatively long sections, 55b and 56b respectively, of slowly changing radius. The sections 55a, 55b, 56a and 56b slope smoothly toward the pockets 51 and 52. Thus, there is provided a basket with a number of pockets formed to receive clothes at a relatively substantial distance from the clothes, but the pockets being separated by wall portions which are radially closer to the axis of rotation. The result of this is that, when a washing operation is finished and the speed of basket 8 starts to increase, the centrifugal force will cause clothes to be forced into the two pockets. There will, consequently, be a tendency for a dump of clothing to be positioned in such a location that it will cause an unbalance. Rather, the two main groups of clothes will tend to offset each other as to balance, and therefore to provide a balanced condition of the basket. It will be noticed that the concave nature of wall portions 55 and 56 guides the clothes into the pockets in such a case the clothes tend to move outwardly against such portions.

In addition to the advantage of distributing the clothes load so that the two masses of clothes in the pockets offset each other and provide a balanced condition, there is the additional advantage that the clothes are distributed in a thicker layer within the pockets than if they extended around the periphery of wall 10. This, in turn, has improved liquid extraction for the clothes as a whole by virtue of the fact that the clothes at the inner edge of the mass of clothes become heavier than is the case with a relatively thin layer of clothes.

Referring now to FIGURE 3, there is shown a second embodiment of my invention in which the tub 9 is formed as before but, instead of the basket 8 of FIGURES 1 and 2, there is provided a basket 57 which is in the shape of an ellipse in which the pockets 58 and 59 are formed at the ends of the long axis. Another point which is to be noticed is that a second modification in FIGURE 3
from the structure of FIGURE 1 lies in the provision of perforations only at the pockets, that is, at the radially outermost parts of the basket relative to the axis of rotation. While perforations may be provided over the entire surface of the basket, as particularly well shown in FIGURE 2 for the first embodiment, it is also possible to provide the perforations only in the areas of the pockets. This would tend to guide the clothes more swiftly into the pockets to effect a balanced condition as the basket comes up to speed.

Thus, with either of these embodiments, it can be seen that the desired goals of balancing clothes distribution and increasing the thickness of the clothes layer are achieved during high speed rotation. It is to be understood that modifications such as, for instance, the provision of more than two pockets may readily be made so long as cross-sectional symmetry is maintained. Thus, while equal numbers of pockets such as 2, 4, 6, etc., are preferred, 3, 5, 7, etc. equi-spaced pockets would also be deemed acceptable and within the scope of the invention. Also within the main concept of the invention is the provision of such a structure for a vertical axis type machine wherein the only perforations are provided adjacent the top or radially outermost part of an inverted frusto conical member, a shape very often conventionally provided for vertical axis washing machine baskets. Again, the same advantages of increased clothes layer thickness and improved balance are obtained by the provision of my structure.

Therefore, while I have shown and described two particular embodiments of my invention, I do not desire to be limited to the precise constructions disclosed, and I intend by the appended claims to cover all modifications, such as but not exclusively those set forth above, as full within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a laundry centrifugal extraction machine; a rotatable clothes container, a motor, means connecting said motor to said container for driving said container at a speed sufficient to cause centrifugal extraction of liquid from clothes in said container, said speed being sufficient that an unbalance of said container due to an unbalance of the clothes in said container may damage the machine, said container including an outer wall having a substantially smooth inner surface, said outer wall including spaced, outwardly convex portions forming pockets and outwardly concave portions between said pockets, said concave portions extending over a substantial portion of said outer wall, each of said concave portions including a relatively short section of rapidly changing radius and a relatively long section of slowly changing radius, said sections sloping smoothly toward said pockets, said slope causing clothes thrown against said outwardly concave portions during centrifugal extraction to move along said concave portions to form a substantially thicker than normal layer of clothes in said pockets.

2. In a laundry centrifugal extraction machine; a rotatable clothes container, a motor, means connecting said motor to said container for driving said container at a speed sufficient to cause centrifugal extraction of liquid from clothes in said container, said speed being sufficient that an unbalance of said container due to an unbalance of the clothes in said container may damage the machine, said container having a continuously convex outer wall of generally elliptical, non-circular configuration and being perforated in those areas of greatest distance from the axis of rotation of said container, said outer wall having a substantially smooth inner surface, the configuration of said outer wall causing balanced distribution of the clothes in said container during centrifugal extraction.

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