United States Patent [19]

Fox

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[54] **LAUNDRY DRYER WITH OBLIQUE TUMBLING VANES**

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[73] Assignee: **Westinghouse Electric Corporation,** Pittsburgh, Pa.

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[52] **U.S. Cl.**.....**34/139,** 34/133

[51] **Int. Cl.**.....**F26b 11/02**

[58] **Field of Search**.....34/133, 139; 263/33 B

[56] **References Cited**

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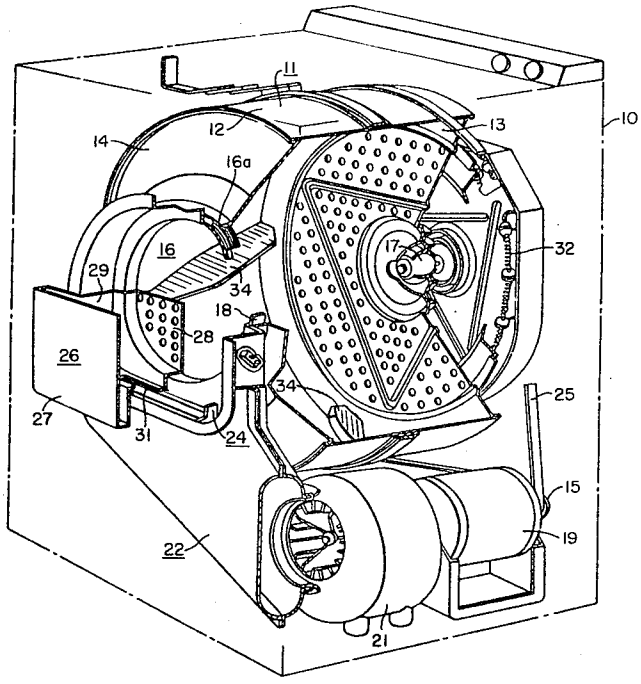
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[57] **ABSTRACT**

A laundry dryer is provided having three tumbling vanes generally equidistantly disposed on the internal cylindrical wall of the dryer drum. The vanes are oriented such that they intersect a straight line generatrix of the cylindrical surface of the drum at an angle of approximately 30°, with one of the vanes pivoted about its point of intersection in a direction opposite the two remaining vanes. The vanes in cross-section are generally V-shaped with each leg of the V lying adjacent the internal cylindrical wall of the drum, while the apex of the V is generally rounded and forms an upper surface along the length of the blade. The height of the upper surface is tapered from a maximum at generally the mid-point to a minimum at the trailing end of the vane determined with respect to the direction of rotation of the drum.

7 Claims, 4 Drawing Figures



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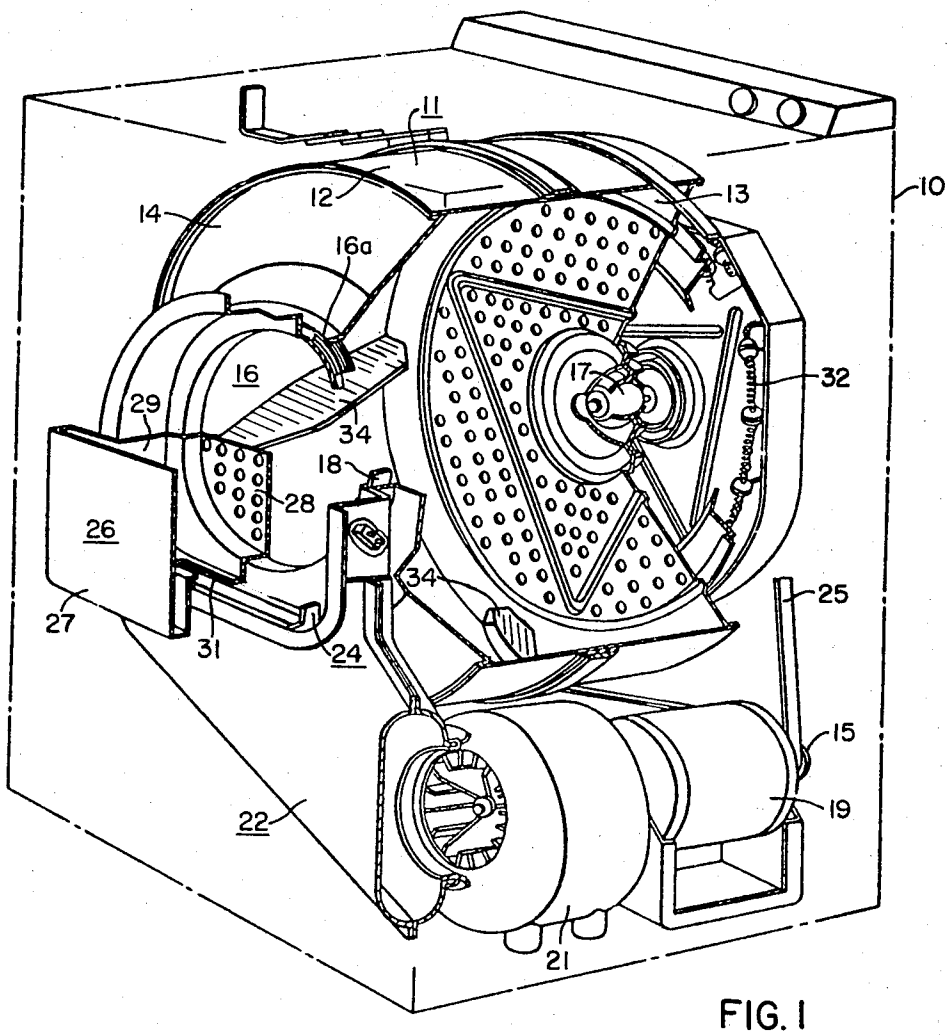


FIG. 1

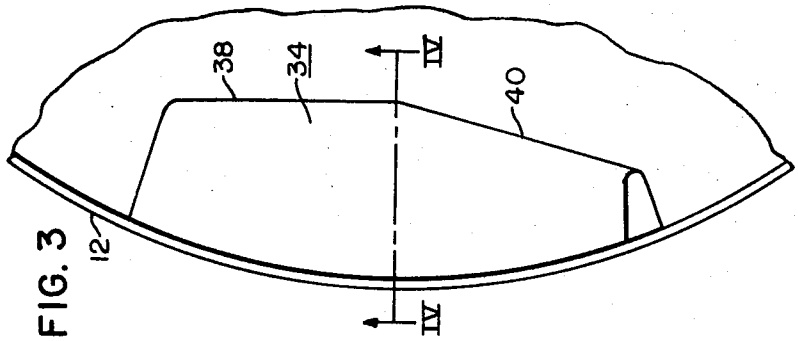


FIG. 3

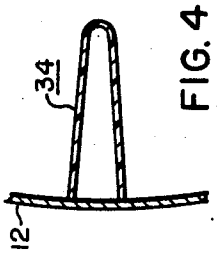


FIG. 4

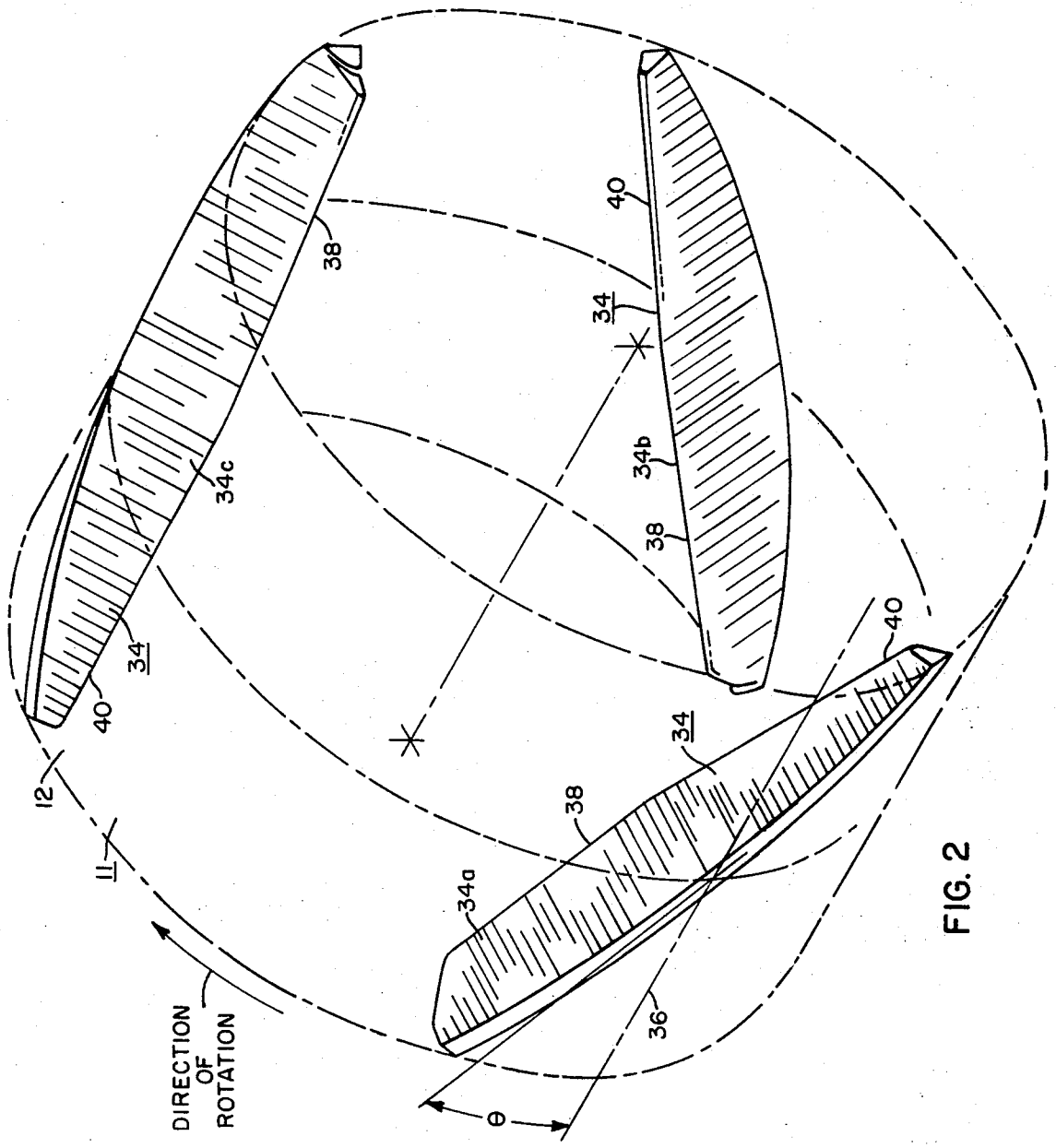


FIG. 2

LAUNDRY DRYER WITH OBLIQUE TUMBLING VANES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to clothes drying apparatus and more specifically to tumbling vanes within the clothes dryer to impart a tumbling motion to the clothes which in turn provides a greater exposure of the clothes to the warm air circulating within the dryer and therefore reduces the necessary drying time.

2. Description of the Prior Art

Generally, clothes dryers include a rotatable clothes receiving drum through which relatively dry warm air is circulated as the drum rotates. The front wall of the drum has an opening through which the clothes are inserted, and its rear wall contains a plurality of apertures through which the warm air enters the drum. In order to dry the clothes, the drum is rotated at a speed providing sufficient centrifugal force to maintain the clothes against the cylindrical wall of the drum until the clothes have reached some elevated position, whereupon, the centrifugal force is overcome by the gravitational force and the clothes drop to the bottom of the drum and the process is repeated. Such motion of the clothes is generally referred to as tumbling and is necessary to the drying process to thoroughly expose the clothes to the air passing through the drum. In order to facilitate this desirable tumbling motion, it is well known to place vanes on the wall within the drum. These vanes act much as a conveyor in that they assist in lifting the clothes to the desired elevated position. This permits a slower rotative speed than would be possible if just centrifugal force were relied upon to lift the clothes, which in turn reduces the tendency of the clothes to become bunched or compacted. The vanes serve yet another, more subtle purpose and that is to generally release the clothes at a uniform elevation (the preferred point being in the vicinity of 11:00 o'clock as the drum rotates in a clockwise direction) regardless of the amount of clothes being dried therein. It is evident that without the vanes, a small load would tend to generally evenly distribute itself in a relatively thin layer along the inner surface whereas a large load would tend to be distributed in a much thicker layer. In machines having a single rotative speed the centrifugal force on the small load would thus be greater, (because of the greater effective radius) and if the speed were preset to permit tumbling of such a load it would be too slow to provide sufficient force to lift the large load. Thus as a practical matter, the rotative speed is predetermined to provide a tumbling motion of an average to large load and in instances when only a small load is being dried, the vanes cause the portions of the load lying thereon to have a generally smaller effective radius such that at these points the clothes then begin to tumble also at generally the preferred elevation, dragging the clothes lying on the wall of the drum therealong.

Heretofore, such vanes had been disposed within the drum generally parallel to the horizontal axis of rotation or, in other words, parallel to the straight line generatrix of the cylindrical wall of the drum. The force imparted to the clothes by such rotating vanes, directed the clothes in a path generally normal to the axis of rotation as the clothes fell from their elevated position.

In an attempt to increase the distance the clothes traveled from their point of release on the cylinder wall to where they fell on the bottom of the drum, thereby increasing their exposure to the circulating air and in turn decreasing the drying time, vanes were utilized which had the general configuration of the right triangle. (See U.S. Pat. No. 2,611,976). The edge forming the hypotenuse provided a surface which, when contacted by the clothes, imparted a small force parallel to the axis of rotation. This force, plus the normal force imparted to the clothes by the front face of the vane directing them in a direction normal to the axis of rotation, resulted in a tumbling path that was angled other than normal to the axis. Further, the hypotenuse edge provided a surface of varying radii which, for the reasons previously discussed, should enhance the ability of a drum rotating at a single speed to produce a tumbling motion to loads of various sizes. However, as these vanes did not extend across the drum wall, and as the hypotenuse edge had limited effect on directing the clothes path, the triangular vanes alone did not produce the desired tumbling motion and generally other vanes had to be used in conjunction with them to provide adequate tumbling.

In the present invention, the clothes are caused to travel in a path other than normal to the axis of rotation by skewing the vanes such that they are obliquely disposed in the drum with respect to the straight line generatrix defining the cylindrical wall of the drum, and extend substantially from the front wall to the back. The upper or radially innermost surface of the vanes are contoured so as to provide a generally straight surface on the leading half of each vane (as considered in its direction of rotation) and a tapered surface providing an ever decreasing height for each vane from generally its midpoint to a minimum height at the trailing end. The vanes are also generally V-shaped in cross-section so that the face thereof which lifts the clothes to their elevated position is slanted rearwardly so the vane more easily releases the clothes and further reduces their tendency to bunch. In this manner, the oblique angle of the vanes directs the clothes in a path other than perpendicular and therefore longer, the tapered innermost surface of the trailing portion permits a gradual unloading of the clothes as they slide along the lifting face to eliminate bunching of the clothes at the juncture of the adjacent front or rear wall and the vane, and the slanted lifting face prevents the clothes from bunching at the juncture of the vane and the cylindrical wall so that all in all the clothes are maintained in generally a loose relationship so that more surface is exposed to the dry circulating air for a longer period of time during each tumbling motion thus generally reducing the drying time required in the prior art dryers.

SUMMARY OF THE INVENTION

The invention provides a plurality of generally V-shaped tumbling vanes on the internal cylindrical wall of the rotatable drum of a clothes dryer which are skewed at an oblique angle with respect to a straight line generatrix defining the cylindrical wall of the dryer. The top surface of each vane is contoured to provide a taper from about the midpoint of the vane to its trailing end. As the drum rotates, the path the

clothes take as they fall from the vanes is other than normal to the axis of rotation, thus resulting in a somewhat longer path permitting greater exposure of the clothes to the dry air circulating through the drum.

DRAWING DESCRIPTION

FIG. 1 is a perspective view, partly broken away of a dryer embodying the present invention;

FIG. 2 is a perspective view of the vanes in spaced relationship on the inside of a cylindrical drum shown in phantom;

FIG. 3 is a top plan view of FIG. 2; and

FIG. 4 is a cross-sectional view of the vane taken along the line IV—IV of FIG. 2.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The invention is embodied in a conventional clothes dryer which, as shown in FIG. 1, generally comprises an outer cabinet 10, housing a clothes basket or drum 11 having an imperforate cylindrical wall 12 and a perforated rear wall 13 and a front wall 14. Front wall 14 has an opening 16 bounded by shoulder 16*a* providing access to the interior of drum 11 for insertion and removal of clothes.

A bearing structure 17 carried by the rear wall 13 and an extended annular flange 18 framing the opening 16 serve to support the drum 11 within the housing 10 for rotation about a substantially horizontal axis.

The drum 11 is rotatively driven in one direction by means of a conventional motor 19 through a flat drive belt 25 encircling the cylindrical wall 12 and a pulley 15 fixed to one end of the output shaft of the motor. The other end of the shaft is connected to a fan means 21 for circulating air through the dryer. In this respect, the inlet side of the fan means 21 is connected to an air duct assembly 22 which generally includes a filter means 24 at the duct inlet adjacent the opening 16 in the front of the drum.

A hinged door structure 26, only a fragment of which is shown, is generally comprised of an imperforate front wall 27 for covering the access opening in the cabinet 10 and an inset perforated rear wall 28 spaced from the front wall by an annular wall 29 so as to generally fill the opening 16 to the drum 11. The lowermost portion of the annular wall 29 is provided with an elongated rectangular aperture 31 in registration with the filter means 24 when the door structure 26 is closed and provides air flow communication from the drum 11 through and around the perforate wall 28 to the inlet of air duct assembly 22.

An electrical resistance heating structure 32 over which air entering the drum through its perforate rear wall 13 must flow is mounted on the back of cabinet 10 and serves to heat the incoming air to accelerate the removal of moisture from the clothes. Thus, warm dry air is drawn into the drum 11, thence through the clothes where it picks up moisture and lint, and exits through the filter 24 to the fan to be either recirculated or exhausted from the machine.

The dryer controls are not shown as they form no part of this invention; however, it is understood that the motor 19 for rotating the drum 11 and driving the fan means 21 and the heater structure 32 are electrically connected through the proper controls to provide a desired drying cycle as is well known in the art.

In accordance with the present invention, three vanes 34 are mounted within the drum 11 on the cylindrical wall 12 by any well known means such as screws (not shown).

Referring now to FIG. 2, it is seen that the vanes 34 are mounted in a spaced relationship that can best be described with reference to a straight line generatrix 36 rotating about the axis of rotation of the drum 11 which, as rotated, describes the inner cylindrical surface of the drum. In this respect, each vane is skewed so that its general plane intersects the generatrix line 36 at an angle θ. Further, it is seen in FIG. 2 that two of the three vanes 34a and 34b are skewed such that the end of the vane adjacent the back wall precedes the end adjacent the front wall in the direction of rotation. The resultant motion imparted to the clothes by such vanes would have a forward component, i.e., towards the front wall, whereas the remaining vanes 34*c* is oppositely skewed at a similar angle θ to impart a rearward component to the path of the clothes travel. This provides a generally alternating forwardly and rearwardly directed tumble across the width of the drum which will be referred to as "cross" tumbling to distinguish it from a tumbling direction normal to the axis of rotation. Also with the ratio of the vanes being two to one, the clothes are contacted and released more frequently by the forwardly directing vanes 34*a* and 34*b* than the rearwardly directing vane 34*c* with the resultant effect being to generally maintain the clothes in the front portion of the dryer drum, away from the rear wall, which is adjacent the heater structure and therefore relatively warm, so there is generally an unobstructed air flow through the apertures therein. This also tends to position the clothes forwardly in the drum for unloading the machine without having to reach to the back of the drum to retrieve the dried clothes. It has been found that the angle θ should be in the order of 30° for best results.

Referring now to FIG. 4, it is seen that the vanes 34 are generally V-shaped in cross-section with the open end of the V being generally adjacent the cylindrical wall of the drum 11 and forming the base of the vane and contoured so as to conform to the surface of the cylindrical wall. The V-shaped vanes provide a leading face i.e., that face which generally provides the lift for the clothes, having a rearward slant which facilitates the release of the clothes from the cylindrical wall and vanes.

Further, it is seen in FIGS. 2 and 3 that the radially innermost surface of the vanes i.e., the apex of the V, is generally straight as at 38 over about half of the vane and generally extending between the leading end of the vane (as viewed in the direction of rotation of the drum) and its midpoint whereas the remaining trailing portion of that surface is generally tapered as at 40 from the midpoint to a minimum height at the trailing end of the vane adjacent either the front or rear wall of the drum. Thus, as the lifting face picks-up the clothes they have a tendency to slide therealong towards the trailing end. It has been found that if the blade were straight across its full length, the force of the sliding clothes compacts those clothes ahead of it against either the rear or front wall of the drum. However, the tapered surface reduces the thickness of the lifting face so as clothes slide along it in the above manner, they generally continue to a point where there is insufficient

surface to support them and thus drop therefrom. This maintains the clothes in a generally loose relationship and aids the tumbling motion.

It is apparent that it will not be necessary for all three vanes **34***a*, **34***b* and **34***c* to contact all the clothes during each revolution of the drum; however, the general tendency will be for the clothes to be contacted more often by the forwardly facing vanes **34***a* and **34***b* than the single rearward facing vane **34***c* and therefore maintaining the clothes generally in the forward portion of the drum. Further it is seen that the oblique path of travel of the clothes is longer than if the general plane of the vanes was parallel to the axis of rotation of the drum whereby the clothes are directed in a relatively shorter path generally normal thereto, thereby providing greater exposure of the clothes to the circulating air of the dryer.

I claim as my invention:

1. In a clothes dryer having a rotatable drum defined by a front and back portion joined by a cylindrical wall and means on said cylindrical wall to impart a tumbling motion to clothes placed within said drum, said means comprising a plurality of vanes projecting inwardly from said wall and extending substantially from adjacent said front portion to adjacent said back portion, and said vanes oriented on said wall such that the general plane of each of said vanes intersects a straight line generatrix of said cylindrical wall at an oblique angle, providing a leading and trailing end on each of said vanes when considered in the direction of rotation of said cylinder, wherein the improvement comprises:

each of said vanes having a contoured top edge tapering downwardly toward said cylindrical wall in the direction of said trailing end.

2. Structure according to claim **1** wherein said tapering top edge initiates at a point intermediate of said leading and trailing end of said vanes.

3. Structure according to claim **2** wherein said point is generally the midpoint between said leading and trailing end.

4. Structure according to claim **1** wherein at least two of said plurality of vanes are oppositely angled about said straight line generatrix, whereby the leading face of one of said vanes has a component facing said front portion and the leading face of the other of said vanes has a component facing said back portion of said cylinder.

5. Structure according to claim **4** wherein said plurality of vanes include, in numbers, at least one more of said one vane than said other vane whereby there are more vanes having a forwardly facing component than vanes having a rearwardly facing component.

6. Structure according to claim **5** wherein there are two of said one vanes and one of said other vanes.

7. Structure according to claim **4** wherein said oblique angle is approximately equal for each of said vanes and on the order of 30°, and the vanes are equidistantly disposed at their midpoints on said cylindrical wall.

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