Nov. 17, 1942. J. B. KIRBY 2,302,634

WASHING MACHINE

Filed Feb. 16, 1939

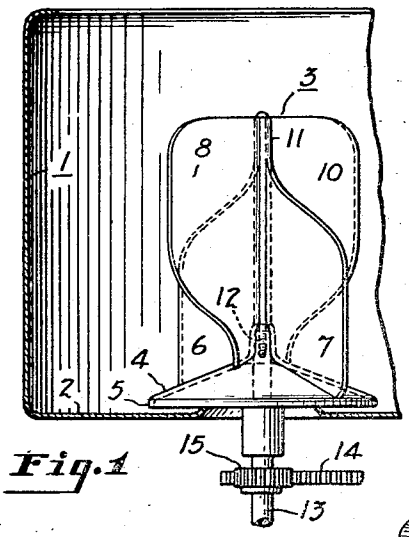


Fig. 1

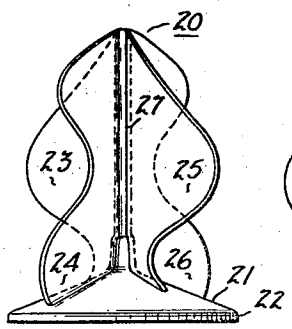


Fig. 3

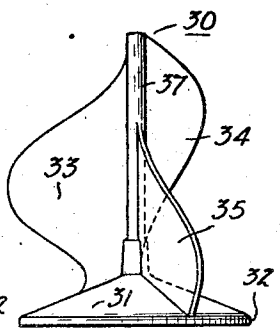


Fig. 4

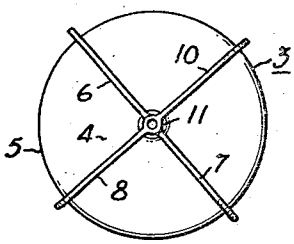


Fig. 2

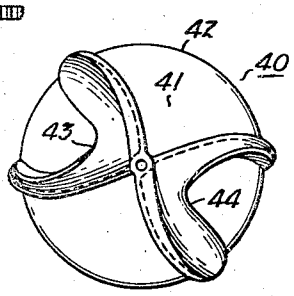


Fig. 5

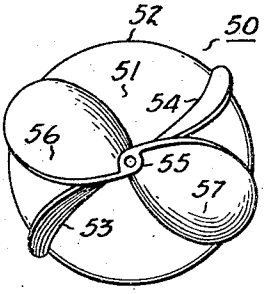


Fig. 7

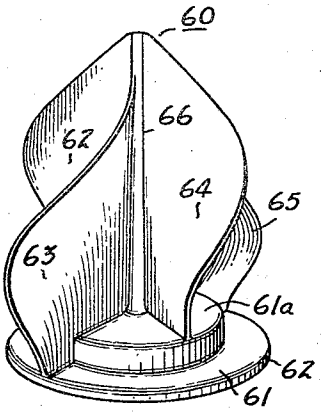


Fig. 9

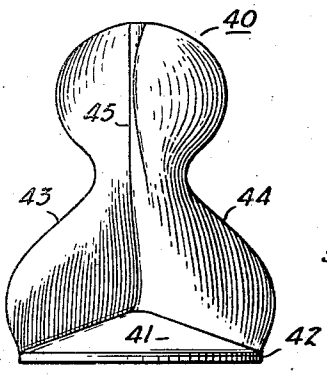


Fig. 6

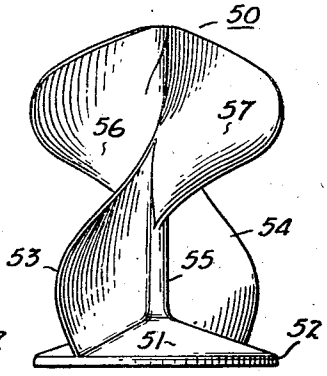


Fig. 8

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2,302,634

WASHING MACHINE

James B. Kirby, West Richfield, Ohio, assignor to The Apex Electrical Manufacturing Company, Cleveland, Ohio, a corporation of Ohio, as trustee

Application February 16, 1939, Serial No. 256,657

1 Claim. (Cl. 68—133)

This invention relates to a clothes washing machine and in particular to a dasher or agitator therefor.

The present invention is a continuation-in-part of my copending application Serial No. 68,273, filed March 11, 1936, for Laundry machine.

The invention has for its objects the provision of an improved form of washing machine agitator, which is simple and easy to make, which requires a minimum amount of metal, which is highly efficient in its operation, and which serves to effectively and simultaneously agitate the clothes and washing fluid in several distinct areas and zones in the washing machine tub with the result that substantially the entire contents of the tub are being worked upon and washed at one and the same time during the operation of the agitator.

These and other objects of the invention will become more apparent and better understood after consideration has been given to the following detailed description of the invention, taken in connection with the drawing which shows, merely by way of illustration, structure adapted for carrying out the objects of the invention.

In the drawing:

Figure 1 is a fragmentary side elevational view partly in section of a washing machine showing one form of agitator illustrative of the invention;

Figure 2 is a plan view of the agitator shown in Figure 1;

Figure 3 is a side elevational view of an agitator illustrating another species of the invention;

Figure 4 is a side elevational view of an agitator illustrating another species of the invention;

Figure 5 is a plan view and Figure 6 is a side elevational view of an agitator illustrating another species of the invention;

Figure 7 is a plan view and Figure 8 is a side elevational view of an agitator illustrating another species of the invention; and

Figure 9 is a perspective view of an agitator illustrating yet another species of the invention.

The six different species of agitators illustrated herein have the common feature of providing a plurality of impelling surfaces in which the impelling surfaces are circumferentially spaced about the axis of the agitator and located at different elevations relative to the bottom of the washer tub.

In the species of the invention illustrated in Figure 1, there is shown a washer tub 1, having a bottom 2, from which an agitator 3 extends to a level slightly above the normal fluid level in the tub. The agitator comprises a conical base 4 with a downturned flange 5 at its edge, vertical, upstanding lower blades 6 and 7, and vertical upstanding upper blades 8 and 10. These four blades project radially outwardly from a center post 11 and upwardly from the base 4. The side edges of the blades are generally vertical. The lower blades each exhibit a downwardly inclined upper edge whereas the upper blades each exhibit an upwardly inclined lower edge. The top edges of the upper blades are substantially horizontal and exhibit rounded corners where they merge with their vertical edge portions. An elongated screw 12 is used to secure the agitator to its driving shaft 13 and the shaft is adapted to be oscillated by means of a reciprocating rack bar 14 and a pinion 15 fixed to the said shaft in connection with suitable power means and associated mechanism (not shown) as is customary.

When the agitator is oscillated the advancing faces of the blades 6, 7, 8 and 10 impel the water radially outwardly and circumferentially around the tub in the direction of their movement. At the same time this takes place the trailing faces of the blades exert a suction effect and tend to draw the fluid and clothes toward the rear surfaces of the blades and inwardly toward the center of the agitator, while at the same time moving the fluid and clothes in the same circumferential direction as the blades are moving.

Upon clockwise movement of the agitator, the combined effect of these movements of fluid and clothes in the quadrant of the agitator toward the observer in Figure 1 is an inward movement at the upper portion of the agitator and an outward movement at the lower portion of the agitator, with the result that the fluid and clothes curve or spiral inwardly at the top, then downwardly and then outwardly at the bottom of the agitator while at the same time moving in a clockwise direction. The fluid and clothes in the adjoining quadrants curve or spiral inwardly at the bottom, then upwardly and then outwardly at the top of the agitator, while at the same time moving in a clockwise direction around the tub.

When the rotation of the agitator is reversed, the general circumferential direction of movement of the fluid and clothes is also reversed and the action previously described for the adjoining quadrants of the agitator now takes place in the quadrant of the agitator facing the observer in Figure 1 and the previously described action for

the quadrant facing the observer now takes place in the adjoining quadrant. The mode of operation just described depends in a large measure upon the relation of the areas of the upper and the lower blades which areas in the present instance are substantially the same. It should be evident that when either the upper or the lower blades are substantially relatively larger with respect to each other, the action of the agitator would be quite different and larger lower or upper blades would tend to overcome and minimize the action of the smaller upper or lower blades, respectively.

This action is radically different from the customary vortex action for gyrator-type clothes washers because the clothes instead of following a rather regular path of movement, sometimes referred to as roll-over, which by the way is objectionable because of the strong tendency it has to wind and wrap the articles being washed about each other, move both inwardly and outwardly in both the upper and lower portions of the tub while at the same time moving both upwardly and downwardly in the different quadrants of the agitator with the result that the clothes are flexed first in one direction and then in another as they are whipped about and spiral inwardly, downwardly and outwardly and then inwardly, upwardly and outwardly during the operation of the agitator while at the same time being rubbed and scrubbed by the surfaces of the agitator.

The agitator **20** illustrated in Figure 3 comprises a conical base **21** having a downwardly turned flange **22** at its edge and blades **23**, **24**, **25** and **26** which project outwardly from a center post **27** and which are joined at their lower edges to the base **21**. The blades **23** and **25** are generally triangular in shape while the outer edges of the blades **24** and **26** exhibit a sinusoidal curve with the narrowest portions of these blades being located on about the same elevation as that for the widest portions of the blades **23** and **25**.

In its action the agitator shown in Figure 3 has many of the characteristics of the agitator first described. Upon clockwise movement of the agitator in the quadrant of the agitator facing the observer in Figure 3, the fluid and clothes are drawn in at the top and in at the bottom of the trailing face of the blade **24** as the advancing face of the blade **25** propels the fluid and clothes outwardly at the intermediate portion of the agitator and the agitator as a whole moves the tub contents in a clockwise direction.

While the aforesaid action is taking place the fluid and clothes in the adjoining quadrants move inwardly at the intermediate portion of the agitator behind the trailing faces of the blades **23** and **25** and outwardly at the upper and lower portions of the advancing faces of the blades **24** and **26**. The blades **24**, **25** and **26** of the agitator exhibit successive maximum impelling areas at the top, middle and bottom and at the bottom, middle and top of the agitator.

The action of the agitator shown in Figure 3 is similar to the action of the agitator shown in Figure 1 in that the fluid and clothes curve or spiral inwardly, upwardly and outwardly in one quadrant and then inwardly, downwardly and outwardly in the next quadrant, the difference being that while the aforesaid movements are taking place in the lower half of the tub contents, the contents in the upper half thereof are moving inwardly, downwardly and outwardly in the first quadrant and then inwardly, upwardly and outwardly in the next quadrant.

The action of the agitator **20** in effect produces separate circulatory movements in the lower and upper halves of the tub contents which are similar to the effect produced by the agitator **3** on the tub contents as a whole. The action of the agitator **20** thus provides for greater flexing of the clothes and more rubbing and scrubbing of the clothes against each other and against the blades of the agitator with a correspondingly enhanced efficiency of operation.

In the species of the invention illustrated in Figure 4, the agitator **30** shown therein comprises a conical base **31** having a downwardly-turned flanged edge **32** and three vertically-disposed, equidistantly-spaced, laterally-extending blades **33**, **34** and **35**. The aforesaid blades extend outwardly from a center post **37** and the lower blade **35** and the intermediate blade **33** join the base **31** at their lower ends.

The agitator **30** is somewhat similar in its construction and operation to the agitator **20** just described, the principal difference being that the latter agitator employs three blades of comparable area, each having a portion of maximum width located on a different elevation, said elevations corresponding to the upper, intermediate and lower levels of the washing fluid. In its operation the advancing faces of the blades impel the fluid and clothes outwardly while the trailing faces of the blades draw the fluid and clothes inwardly at the three different elevations mentioned. At the same time this takes place there is also movement of the fluid and clothes in vertical directions after the manner previously described, such movements extending between the intermediate and the lower levels, the lower and the upper levels and the upper and the intermediate levels for the three respective sectors of the agitator.

The agitator **40** illustrated in Figures 5 and 6 comprises a conical base **41** having a downwardly turned flanged edge **42** and a pair of blades **43** and **44**. The blades extend radially outwardly from a center post **45** and at their lower ends they merge with the base **41**. Both blades are of similar construction and they are formed by winding a warped surface about the axis of the agitator, the edge of such surface extending sharply inwardly intermediate the height of the agitator as is clearly shown in Figure 6. Because of this the agitator exhibits four different impelling surfaces two of which are provided by the relatively wide lower portions of each of the blades and two of which are provided by the relatively wide upper portions of each of the blades.

The aforesaid lower portions of the blades are curved to form concave surfaces on one side of the blade and a convex surface on the opposite side of the same portion of the blade. The aforesaid concave surfaces of each blade, both face in the same direction around the tub. The upper portions of the blades are similarly formed to provide a concave surface at one side and a convex surface at the opposite side of the blade. The concave surfaces of the upper portions of the blades, however, face in an opposite direction to the concave surfaces of the lower portions of the blades.

The action of the agitator shown in Figures 5 and 6 is similar to the action of the agitators **3** and **30**, differing therefrom principally in that the concave-convex surfaces of the lower portions of the blades tend to impart a general, one-way circulation about the axis of the tub in a

clockwise direction, while the concave-convex surfaces of the upper portion of the blades tend to produce a revolution of the clothes in an opposite direction about the axis of the agitator. The radial component of the forces exerted by the concave-convex areas of the blades is somewhat less than it is for a flat, radially-disposed surface. The aforesaid circulation movements are compounded with the inwardly, downwardly and outwardly, and inwardly, upwardly and outwardly movements previously described in connection with the agitator **3**. The result of the compounding of the aforesaid movements is to provide a complete and thorough agitation of the clothes which in turn results in a rapid and efficient washing of the clothes. The agitator **40** differs structurally and functionally from the agitator shown in my United States Reissue Patent No. 20,313 because of the dividing of the two blades of the agitator into four different, separate and distinct impelling areas.

The agitator **50** illustrated in Figures 7 and 8 comprises a conical base part **51** having a downwardly-turned, flanged edge **52**, and a pair of lower blades **53** and **54** projecting upwardly from the base **51** and joined at their inner edges to a center post **55**. The upper portion of the center post carries a pair of radially-extending blades **56** and **57**. The surfaces of the four blades of the agitator as they extend upwardly from the bottom of the agitator are wound about the axis of the agitator in a counter-clockwise direction when the agitator is viewed from above and, as in the case of the agitator **40**, the blades of the present agitator exhibit concave-convex surfaces which face in the same direction as for the corresponding portions of the blades of the agitator **40**.

The action of the agitator illustrated in Figures 7 and 8 is substantially the same as for agitator **40** and some slight advantages in the way of increased washing efficiency are present in the agitator **50** over the agitator **40** as a result of the complete separation of the upper and lower impelling areas of the blades.

The agitator **60** which is illustrated in Figure 9 comprises a base part **61** of stepped construction terminating in a downwardly-turned, flanged edge **62**. This agitator is provided with four blades **62**, **63**, **64** and **65**. The blades **63** and **65** which are of similar contour extend across the entire radius of the base part **61** and project upwardly therefrom for a portion only of the height of the agitator. The inner edges of the blades **63** and **65** are joined to a center post **66**. The lower edges of the blades **62** and **64** extend radially outwardly at their bottom edges a distance equal to the radius of the upper ledge **61***a* of the base and they extend upwardly throughout the entire height of the agitator. The blades **62** and **64** are of similar contour and their inner edges, too, are joined to the center post **66**. The upper edges of all four blades extend in a direction downwardly and outwardly away from the axis of the agitator.

In its operation the agitator illustrated in Figure **9** includes most of the characteristics of the agitators **40** and **50**, differing therefrom in that the greater part of the agitation is largely confined to the lower two-thirds of the washing fluid, with the result that the action in the upper portion of the tub is somewhat less severe than it is in the case of the other species of this invention. By reducing the area of the topmost portions of the blades **62** and **64**, there is less tendency for this agitator to cause splashing than there is in the case of the agitator **3** shown in Figure 1. This same result is accomplished to a lesser extent in the agitators **20**, **30**, **40** and **50** which also exhibit upper blades, the edges of which extend downwardly and outwardly.

The operation of the various agitators and the circulation of the fluid and clothes previously described varies somewhat in the matter of degree for different loads and where large pieces of clothing are being washed, individual portions of the mass of fluid and clothing do not follow any very precise paths, because, while the impelling surfaces tend to cause the circulation described, portions of a large article of clothing will lie in different portions of the tub and the tendency to move such an article in one direction in one quadrant of the agitator may be neutralized or even reversed by the forces which are acting upon another portion of the same article in a different quadrant of the agitator, so that under ordinary operating conditions it is difficult to trace out the exact paths followed by the fluid and clothes and the previous description of the mode of operation of the agitators disclosed herein must be considered as the mode of operation which the agitator would tend to produce if the fluid and clothes were perfectly free to move in response to the various forces impressed upon them by the various surfaces of the blades of the agitator without interference by the actions that are taking place in other portions of the tub.

While the forces and fluid currents were described with particular reference to the operating zone of the agitator it should be noted that the sides and bottom of the tub also have some effect on the fluid circulation which takes place outside the operating zone of the agitator. The effect of the tub sides on the adjacent fluid and clothes is to cause them to move in paths parallel to the sides, while the tub bottom tends to divert or constrain the fluid and clothes adjacent thereto to move in horizontal paths. Thus if these is an outward movement of fluid and clothes away from the agitator at the bottom of the tub and an inward movement of the fluid and clothes thereabove there would be a resultant upward movement at the sides of the tub where the outwardly moving stream would tend to flow upwardly and join the inwardly moving stream in accordance with the well understood phenomena involving the flow of liquids. In a similar manner when the fluid movement is outward at the top and inward at the bottom there would be a resultant downward movement at the sides of the tub.

The agitators shown in Figures 3 to 8 inclusive are adapted to be interchanged with the agitator **3** in the tub **1** and they can be secured to the agitator shaft **13** by any suitable means such as the screw **12** referred to earlier herein.

Having thus described my invention, what is desired to be obtained by Letters Patent, is defined by the appended claims.

Having thus described my invention what I claim is:

In a washing machine, a tub, an agitator, comprising a circular base, an upright tubular post centrally mounted on said base, a pair of upper washing vanes connected to said post at 180 degrees from each other, said upper vanes varying in width and having their maximum width above the center of the center post and decreasing in width downwardly so that the minimum width of vane is disposed below the midpoint along the

vertical height of said center post, a pair of lower vanes secured to said circular base and to said center post having their maximum width near said base and decreasing in width upwardly thereof to a point above the midpoint of said center post, said lower vanes being connected to said center post at substantially 90 degrees from the upper vanes, said upper and lower vanes being curved along their edges in the area of maximum width to form concave washing surfaces and being proportioned vertically so that the curved edges overlap each other for at least a portion of their vertical extent, said base and blades being spaced from the side wall of the tub, and the base having a radial extent sufficient to guide the clothes and fluid outwardly beyond the blades and into the space between the agitation and tub wall.

JAMES B. KIRBY.