Jan. 7, 1941. J. B. KIRBY 2,228,057

WASHING MACHINE

Filed May 18, 1936 2 Sheets-Sheet 1

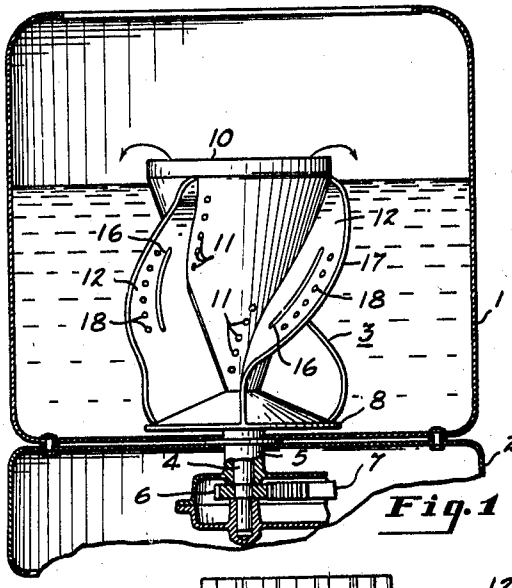


Fig. 1

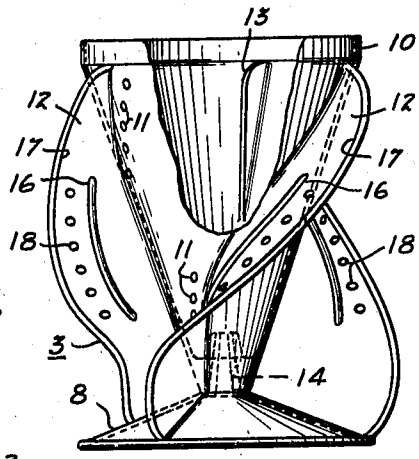


Fig. 2

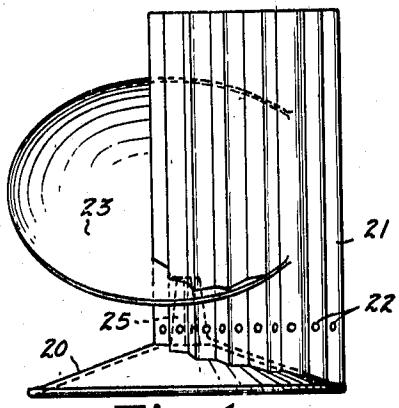


Fig. 4

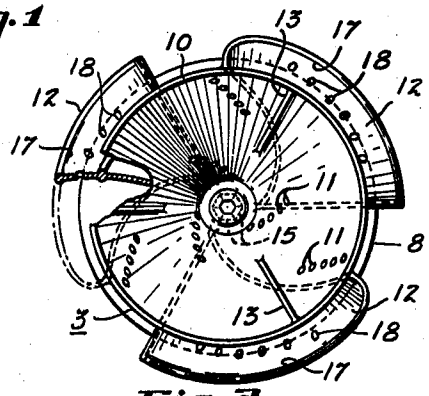


Fig. 3

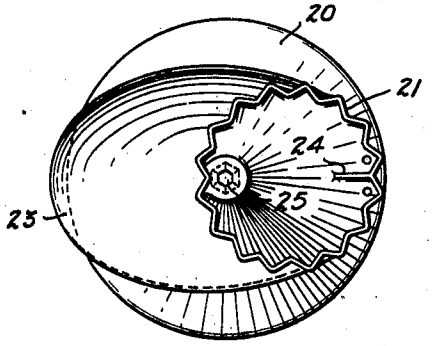


Fig. 5

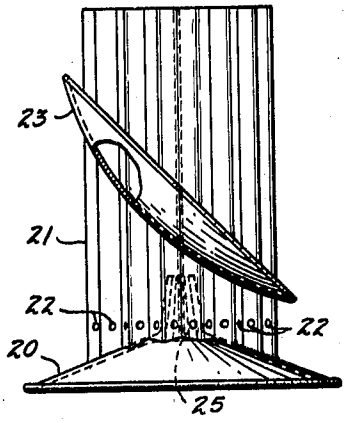


Fig. 6

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Jan. 7, 1941. J. B. KIRBY 2,228,057

WASHING MACHINE

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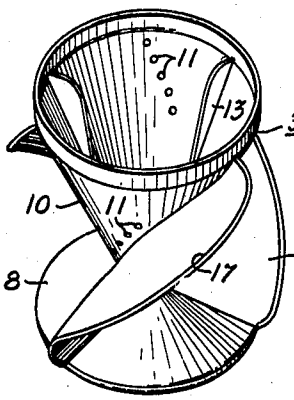


Fig. 7

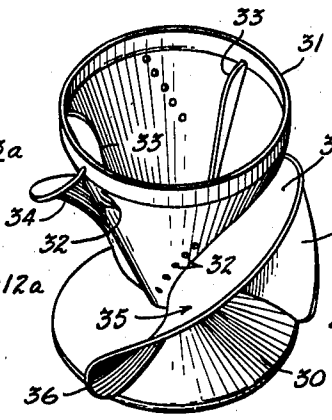


Fig. 8

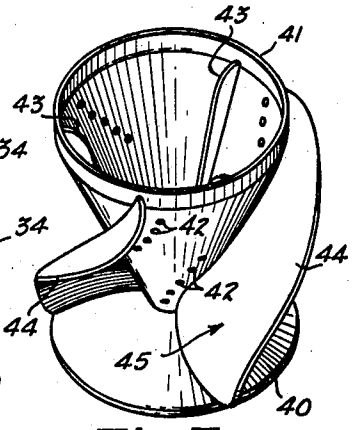


Fig. 9

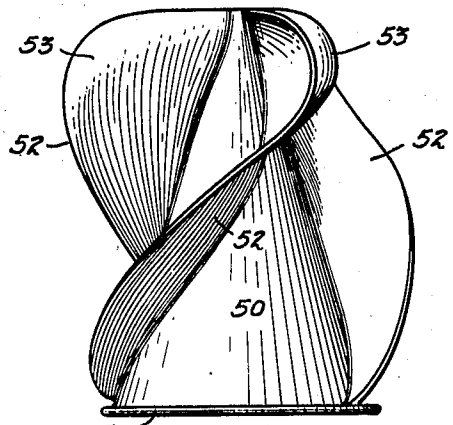


Fig. 10

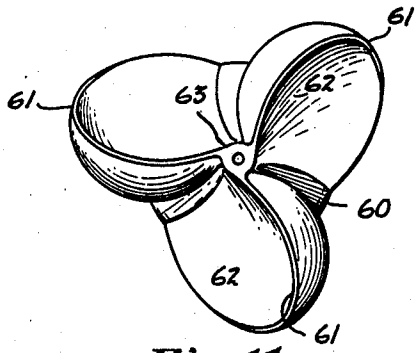


Fig. 11

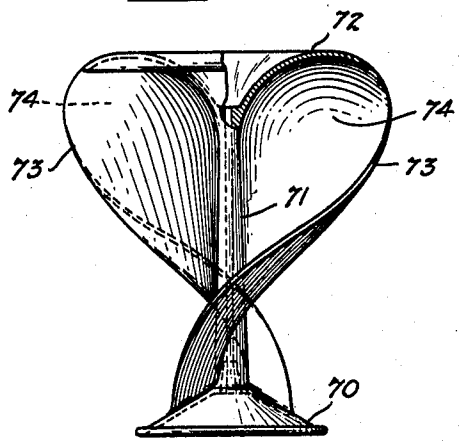


Fig. 13

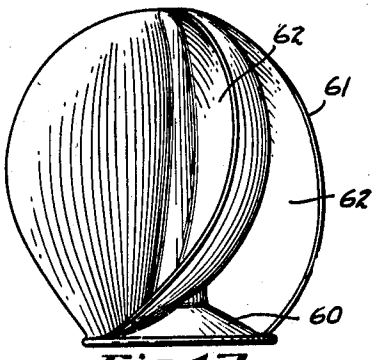


Fig. 12

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Patented Jan. 7, 1941 2,228,057

UNITED STATES PATENT OFFICE

2,228,057

WASHING MACHINE

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

Application May 18, 1936, Serial No. 80,252

4 Claims. (Cl. 68—54)

This invention relates to washing machines and it involves certain improvements and modifications of the agitators shown in my copending applications

Serial No. 598,552 filed March 14, 1932, now Patent No. 2,134,084, dated Nov. 1, 1938;

Serial No. 670,923 filed May 13, 1933, now Patent No. 2,089,559, dated Aug. 10, 1937;

Serial No. 690,035 filed September 18, 1933, now Patent No. Re. 20,313, dated Mar. 30, 1937.

This invention has for its objects the provision of a washing machine in which two separate batches of clothes may be washed at the same time with different degrees of washing intensity; the provision of an improved form of agitator in which the articles being washed are scrubbed, flexed and unfurled; the provision of a washing machine in which the articles being cleansed are circulated continuously in one direction and subjected successively to different types of washing action, as for example, scrubbing and then flexing and unfurling; the provision of a washing machine in which all of the articles being washed are subjected at substantially all times to a washing action of one kind or another during the operation of the washing machine, as distinguished from machines wherein the clothes are moved repeatedly through a more or less definite path and presented to the washing action of an agitator in relatively restricted zone with the result that they are subjected to no substantial washing action throughout the major portion of their movement; and the provision of a washing machine in which efficient and maximum use is made of the available space in a washing machine tub.

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 drawings which show, merely by way of illustration, structure adapted for carrying out the aforesaid objects of the invention.

In the drawings, Figure 1 is an axial sectional view in elevation of a washing machine, illustrating one form of the invention; Figure 2 is an enlarged side elevational view of the agitator shown in Figure 1, with a portion broken away to illustrate the interior construction of the agitator; Figure 3 is a plan view of the agitator shown in Figure 2; Figure 4 is a side elevational view of a modified form of agitator adapted for use in the wasing machine shown in Figure 1; Figure 5 is a plan view of the agitator shown in Figure 4; Figure 6 is a side elevational view in which the agitator shown in Figure 4 has been rotated ninety degrees about its axis of oscillation in a counter-clockwise direction; Figure 7 is a perspective view of a slight modification of the agitator shown in Figures 1 to 3; Figure 8 is a perspective view of a modification of the agitator shown in Figures 1 to 3 and 7, in which the top side of the outer agitator blades are of concave curvature; Figure 9 is a modification of the agitator shown in Figures 7 and 8, differing therefrom in that the top side of the outer agitator blades are convex; Figure 10 is a side elevational view of a modified form of agitator in which the cone of the agitator has been reversed from the position it occupies in the forms of the invention shown in Figures 7 to 9; Figure 11 is a plan view of a modified form of agitator; Figure 12 is a side elevational view of the agitator shown in Figure 11; and Figure 13 is a side elevational view of yet another form of agitator.

The washing machine shown in Figure 1, for the purpose of illustrating one mode of practicing the invention, is of conventional construction insofar as the tub and gearing are concerned. This machine comprises a tub 1 carried on a supporting structure 2, beneath which suitable mechanism may be provided for effecting the oscillation of an agitator 3, which is located inside the tub. The agitator 3 is operatively connected to one end of a shaft 4 which is journaled in a suitable bearing 5 located below the bottom of the tub 1. The agitator shaft 4 is provided at its lower end with a pinion 6. An associated rack bar or gear segment 7, meshes with the pinion 6 and upon its reciprocation an oscillatory movement will be given to the shaft 4 and the washing agitator 3. Suitable power means (not shown) are provided for driving the rack bar.

Many of the details of the operating mechanism of the washing machine illustrated herein are not shown as it is intended to follow what is now more or less conventional or standard practice. In washing machines of the type disclosed, it is customary to operate the agitator at speeds of from fifty to sixty-five oscillations per minute, with strokes of from one hundred and sixty-five to two hundred degrees.

The agitator 3 comprises an upstanding conical base member 8, the apex of which joins with the apex of a reversely arranged hollow conical body member 10. The body member 10 is provided with apertures 11 to provide for the circulation of water through such member. A series of inclined and preferably equi-distantly spaced blades 12 extend upwardly from the base 8 and

wind about the surface of the cone 10. In the agitator shown in Figures 1 to 3, three blades are used. The blades 12 are the same general type of blade or vane, as is disclosed in my above referred to copending application Serial No. 690,035, which constitutes a reissue application of Patent No. 1,834,492 issued December 1, 1931.

The number of blades may be increased or decreased from the number shown. It is preferred, however, that the number of blades be not less than two and for practical purposes it has been found that three blades will work satisfactorily and provide a form of agitator which may be cast without difficulty. The blades 12 are substantially normal to the surface of the cone 10. The upper and lowermost portions of the blades are substantially vertical and the intermediate portions of the blades are inclined with respect to the horizontal.

The hollow cone 10 is intended to be used as a separate washing compartment for the laundering of small delicate articles. This cone is provided with inwardly facing blades or vanes 13 which serve to agitate the liquid contents of the cone. Three of these vanes are spaced equi-distantly about the axis of the cone and the number of the vanes may be increased or decreased if desired. The normal level of washing liquid is at or near the top of the cone 10, as shown in Figure 1.

A socket 14 is formed at the place where the conical base member 8 joins with the conical body member 10. The interior of this socket is formed with prismatic sides 15 adapted to receive the upper end of the shaft 4 which has a tapered prismatic end complementary to the socket 14.

While the blades 12 may be formed with smooth imperforate surfaces, as in the case of my patent previously referred to, it is preferred to provide these blades with longitudinally extending scrubbing ribs 16 and 17, between which perforations 18 may be provided. The combined action of the ribs and the perforations enhance the washing action of this agitator. The perforations promote increased flow of washing fluid through the pores of the articles being washed, and they also operate the same time to draw the articles against the ribs 16 and 17 where they are scrubbed and rubbed as they are circulated during the operation of the agitator.

The agitator shown in Figures 1 to 3 has a rapid and positive washing action. The articles being washed are alternately sucked into and expelled from the channels or spaces between the blades, all of the contents of the tub are being continuously worked upon or agitated at one and the same time and a pronounced alternately up and down movement or pumping effect may be observed in the region about the upper end of the agitator during its operation. In addition to the foregoing effects, during the operation of the machine, the articles being washed appear to separate into three groups spaced more or less evenly about the axis of the agitator and the individual articles of each group may be observed to follow the back and forth movements of one or the other of the blades of the agitator while at the same time such articles are thrown generally outwardly from the advancing face of the blade and sucked generally inwardly at the trailing face of the blade. The aforesaid segregation of the clothes manifests itself by the presence of a space between each of the adjacent blades which is practically free of clothes.

The operation of the washer defined by the conical body member 10 is more gentle in its action than is the washing action which takes place in the space between this member and the side walls of the tub 1. In the operation of the inner washer, washing fluid splashes in and out over the top of the member 10 due to its movement and the movement of the surrounding fluid and such fluid as may escape from the inner container is replaced by fresh fluid from the tub 1 which enters by way of the openings 11. This constant circulation of fluid through the container 10 also promotes the washing action taking place therein by reason of the agitation set up by the blades 13.

In the modification of the invention illustrated in Figures 4 to 6, the agitator illustrated therein comprises a circular base or a body portion 20 in the shape of a cone which supports an upstanding vertically corrugated cylinder 21. The axis of the cylinder is located to one side of the center of the base 20. The sides of the cylinder 21 extend from substantially the center of the base 20 to the edge thereof and they are provided with holes 22 adjacent to the bottom of the cylinder for the circulation of water in the cylinder.

An inclined dished vane or blade 23 which is shaped like some of the impellers shown in my application Serial No. 670,923, winds about one side of the cylinder 21, with the outer margin of the portion of the vane or blade to the left of the axis of the agitator, as shown in Figure 4, spiraling downwardly about the axis of the agitator. The surface of the vane or blade 23 is inclined generally with respect to the horizontal and also with respect to the surface of the cylinder. Due to these different inclinations of the vane, it will scoop up water when the agitator moves in a counter-clockwise direction and upon reverse movement of the agitator, the blade will slip through the water and clothes without, however, an equivalent reverse action on the fluid and clothes, with the result that a circulatory movement in a counter-clockwise direction is imparted to the vat contents as the agitator is oscillated about its vertical axis.

The corrugated sides of the cylinder 21 assist in the washing action by scrubbing the clothes, particularly at the side of the agitator away from the blade 23. Due to the fact that the clothes are circulated continuously about the tub in one direction, they will be exposed part by part and piece by piece both to a scrubbing action by the corrugated cylinder and to a flexing and unfurling action by the blade 23.

The interior of the cylinder 21 is provided with a vane or impeller 24 which agitates the liquid contents inside the cylinder. The liquid inlet openings 22 provide for the circulation of water in the cylinder in much the same manner as for the inner washer previously described. The corrugations of the cylinder also assist in the washing action by scrubbing the articles inside the cylinder.

The base 20 of the agitator shown in Figures 4 to 6 is provided with a socket 25 similar to the socket 14 previously described and this socket is adapted for attachment to the agitator shaft 4.

In both forms of the invention previously described, it is intended that the uppermost part of the agitator extend a slight distance above the normal liquid level in the tub. During the operation of these agitators, liquid will freely circulate between the inner and outer compartments of the washer while at the same time the

articles being laundered in the different compartments are kept separate from each other. Due to the provisions of the apertures in the inner compartment, the liquid in the two washing compartments is maintained at substantially the same level.

The form of the invention illustrated in Figure 7 is substantially the same as the agitator shown in Figures 1 to 3 except that the ribs **16** and the holes **18** in the blades of the agitator have been omitted in this latter form of the invention. Like numerals have been used to indicate corresponding parts in these two different forms of the invention and in Figure 7 the modified form of blade is indicated by the numeral **12a** and the agitator is indicated generally by the numeral **3a**.

The form of the invention illustrated in Figure 8 comprises a conical base **30** and a reversely arranged cone defining a container **31**, as in the case of the form of agitator first described. The conical container **31** is provided with apertures **32** to provide for fluid circulation inside this container and the liquid therein is agitated by means of blades **33** similar to the blades **13** previously described.

The outer blades **34** of the agitator are concave on their top side, particularly as the lower portions of the blades are approached. The concave portion of the blade is indicated by the numeral **35**. The lowermost parts of the blades may be provided with a relatively short, vertical portion **36** which bends over and then winds about the surface of the conical container **31** as the top of the agitator is approached. The operation of the agitator just described, differs from the action of the agitator shown in Figure 7 in that a rather pronounced circulatory movement is imparted to the tub contents in a clockwise direction when the agitator is being oscillated. The water action of this agitator otherwise is quite similar to the action of the agitator shown in Figure 7.

The form of the invention illustrated in Figure 9 comprises a conical base **40** and a conical container **41** which is provided with apertures **42** in its side to permit the circulation of water through the container. Agitator blades **43** are mounted inside the conical container and agitator blades **44** are located on the outside of the container in a manner similar to that for the agitator shown in Figures 7 and 8.

The top sides of the blades **44** are of convex configuration, the convex portion being indicated by the numeral **45** and because of the curvature or convexity of the blades **44**, a counter-clockwise circulatory movement is imparted to the tub contents. The lowermost portions of the blades **44** are substantially vertical to the base **40**, as in the case of some of the previously described agitators. The washing action of the agitator illustrated in Figure 9 is substantially the same as the agitator shown in Figure 8, with the difference that the general circulatory movement of the tub contents about the tub axis is in an opposite direction than it is for the agitator shown in Figure 8.

In the form of the invention illustrated in Figures 1 to 3 and 7 to 9, the top of the conical container extends over a very considerable portion of the top surface of the washing liquid. The cross-sectional dimensions of the outer agitator blades are gradually reduced as their upper ends are approached and as the upper ends of the blades merge into the top part of the conical container. By reason of this arrangement, the effectiveness of the blades is progressively reduced as their upper ends are approached, and in this manner, excessive splashing by the blades is prevented and the washer may be operated with the cover removed without danger of the agitator throwing water out of the machine and wetting the operator.

In the forms of the invention illustrated in Figures 1 to 3 and 7 to 10, the outer margins of the blades lie substantially within the surface of an imaginary vertical cylinder and the edges of the blades define substantially spiral or helical lines on such cylinder.

Because of the fact that the outer margins of the blades of the agitator shown in Figures 7 to 10 extend upwardly at substantially the same distance from the agitator axis throughout their length and because such blades also extend throughout the entire height of the washing fluid, practically all of the articles being washed are constantly subjected to the action of such blades and it is impossible for such articles to move out of the sphere of action of the blades to any substantial extent. In other words, the blades of the agitator act at all times upon substantially the entire contents of the tub.

Because of the arrangement of the blades of the agitators shown in Figures 1 to 3 and 7 to 9, there is no noticeable circulation of the clothing outwardly and upwardly from the lower level of the tub and then inwardly and downwardly back again to the lower level as is the case of underwater agitators whose blades do not extend for any great distance above the tub bottom. During a cycle of this sort, the clothes are outside of the sphere of agitation for about three-fourths of the distance of the paths through which they travel, with the result that no pronounced washing action takes place on the clothes during three-fourths of their movement.

The form of agitator shown in Figure 10 comprises a conical body part **50** terminating in an outwardly flared lower edge **51**. The cone **50** is provided with agitator blades **52** similar to the blades used in connection with the form of the invention illustrated in Figure 9. The upper side of the blades **52** are of concave curvature, providing cupped portions such as **53** in the upper parts of the blades.

The cross-sectional area of the blades **52** of the agitator shown in Figure 10 progressively increase as the upper end of the agitator is approached and the washing action of this agitator increases in intensity as its upper portion is approached, thereby differing from some of the earlier described forms of the invention in which the greatest washing action takes place at the lower portions of the agitator. Due to the convexity of the blades **53**, a general clockwise movement will be imparted to the vat contents.

The agitators shown in Figures 7 to 9 are secured to the agitator shaft **4** in the same manner as for the agitator **3**. The agitator shaft **4** may be extended to the upper part of the agitator shown in Figure 10, where a socket similar to the socket **14** may be provided for securing the agitator in place on the drive shaft.

The agitator shown in Figures 11 and 12 is provided with a conical base part **60** and three blades **61** which wind about the axis of the agitator. The top surface **62** of each of these blades is of concave curvature so that upon oscillation of the agitator, a general circulatory movement in a clockwise direction is imparted to the contents of the vat. The edges of the blades define curves

extending from the outer margin of the base to the top of the agitator where the blades join each other at the top of a center post **63** which extends from the top of the conical base part **60** to the uppermost end of the agitator. The margins of the blades thus wind or spiral about the axis of the agitator and the agitator may be secured to its drive shaft in a manner similar to that for the agitator shown in Figure 10.

The agitator shown in Figure 13 comprises a conical base part **70**. A central spindle or center post **71** extends from the top of the conical base part **70** and terminates in a saucer-shaped dome **72**, the margin of which flares outwardly and downwardly and extends laterally around the axis of the agitator. This form of agitator is provided with two blades **73** which extend from the base part **70** and wind about the axis of the agitator in a counter-clockwise direction. The upper ends of the blades merge into the dome **72** and they are there provided with cupped portions **74** facing in a clockwise direction. The cupped portions **74** tend to circulate the fluid and clothes in a clockwise direction during the operation of this agitator.

The cross-sectional area of the blades **73** increases as the upper end of the agitator is approached and because of this, the washing action progressively increases from the bottom to the top of the tub in which the agitator is mounted. Ordinarily this would cause excessive splashing of the top surface of the washing fluid. This objection is overcome by reason of the provision of the dome **72** which prevents such splashing while at the same time permitting the greatest amount of washing action to take place at the top of the agitator.

The foregoing description and the accompanying drawings to which it relates, describes what might be termed the preferred modes of practicing the invention.

Having thus described my invention what I claim is:

1. In a washing machine of the type wherein a washing element is mounted for oscillatable movement about a vertical axis substantially centrally of a tub containing clothes and washing fluid, an agitator comprising a body portion having a disk-like base part mounted adjacent to the bottom of the tub with a hollow-inverted, substantially cone-shaped part projecting upwardly therefrom and upwardly-extending, fluid-impelling blades projecting outwardly from the surface of said body part, the outer marginal portion of each of said blades being substantially the same distance from the axis of the agitator throughout their height and winding about the axis of the agitator in the same general direction, said blades having relatively small apertures for the passage of washing fluid and rubbing projections for rubbing and scrubbing the clothes.

2. In a washing machine of the type wherein a washing element is mounted for oscillatable movement about an axis substantially centrally of a tub containing clothes and washing fluid, an agitator comprising a body portion having a vertically-disposed, cone-shaped member with a disk-like member attached thereto at the narrower end of the cone-shaped member, and upstanding, fluid-impeller blades extending outwardly from said cone-shaped member in the space between said members and winding about the axis of the agitator in one general direction, the radial dimensions of said blades being generally inversely proportional to the diameter of said cone-shaped member for different elevations between the ends of the cone-shaped member.

3. An agitator comprising a body portion having a vertically-disposed, hollow, cone-shaped member, a base comprising a shallow, truncated cone joined to said member at the lower end thereof and upstanding fluid-impeller blades extending outwardly from said cone-shaped member in the space between said member and base and winding about the axis of the agitator in one general direction, the radial dimensions of said blades being generally inversely proportional to the diameter of the said cone-shaped member for different elevations between the ends of the cone-shaped member.

4. An agitator comprising a body portion formed of two hollow, oppositely-disposed, truncated cones, said cones being rigidly connected to each other and coaxially arranged, a plurality of liquid-impelling vanes winding about the axis of the agitator in one direction in the space between said cones, said vanes being secured to the outer surfaces of both of said cones and having radial dimensions generally inversely proportional to the diameter of said cones for different elevations between the ends of said cones.

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