United States Patent

Salisbury

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[45] **Mar. 28, 1972**

[54] LAUNDRY MACHINE AGITATOR

[72] Inventor: **Keith D. Salisbury**, St. Joseph, Mich.

[73] Assignee: **Richard R. Walton**, Boston, Mass.

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[21] Appl. No.: **695,805**

Related U.S. Application Data

[63] Continuation of Ser. No. 464,706, June 17, 1965, abandoned.

[52] **U.S. Cl.** **68/134**

[51] **Int. Cl.** **D06f 13/02**

[58] **Field of Search** 68/53, 54, 132, 133, 134, 136, 68/138

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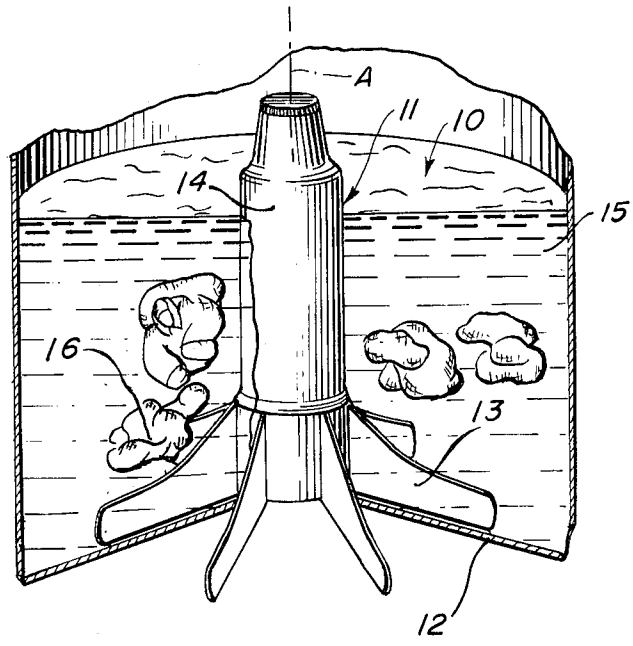
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Primary Examiner—William I. Price
Attorney—W. R. Hulbert

[57] **ABSTRACT**

A washing machine agitator having a centerpost and a plurality of vanes molded integrally therewith and extending radially outwardly from a lower portion thereof. The vanes are deflectable to provide improved low wear, high efficiency washing action.

1 Claim, 6 Drawing Figures



PATENTED MAR 28 1972 3,651,672

SHEET 1 OF 2

Fig. 1

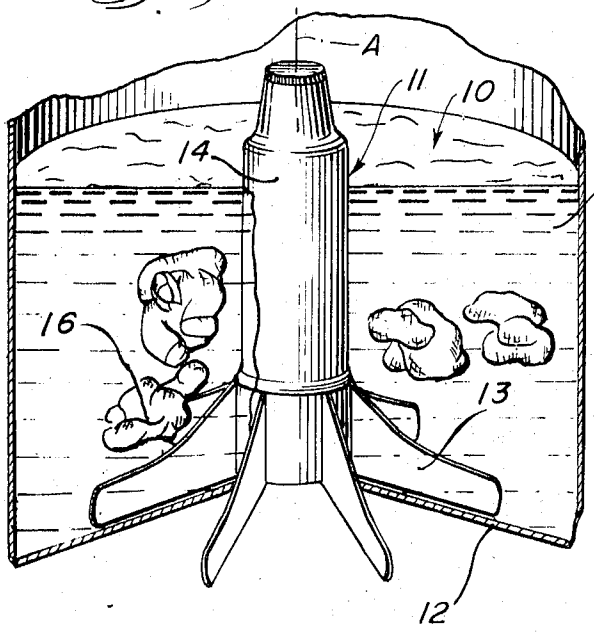
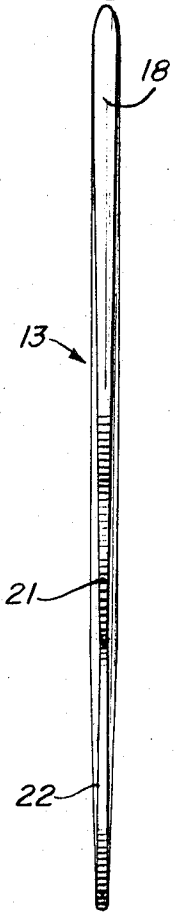


Fig. 3



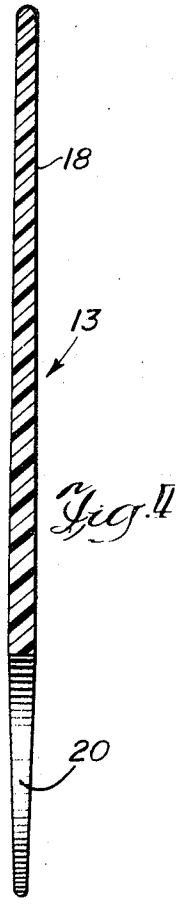


Fig. 4

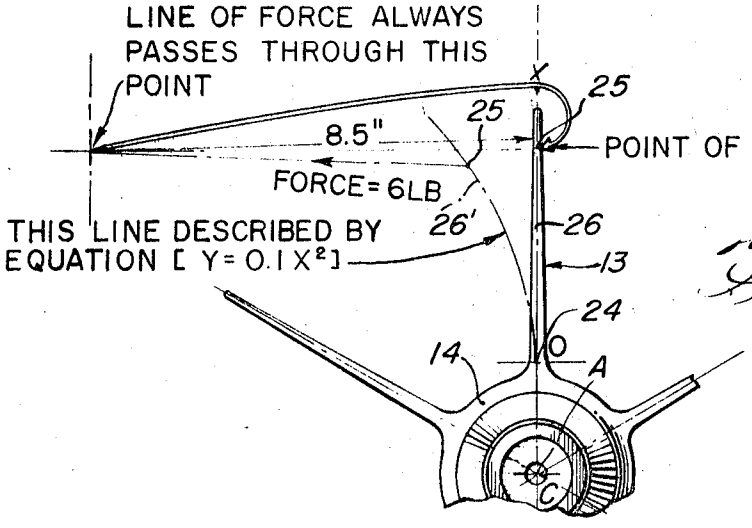


Fig. 5

TEST SET-UP

INVENTOR
Keith D. Salisbury

By Hoffman, Wegner, Allen, Stellman & McCord

ATTORNEYS

Fig. 2

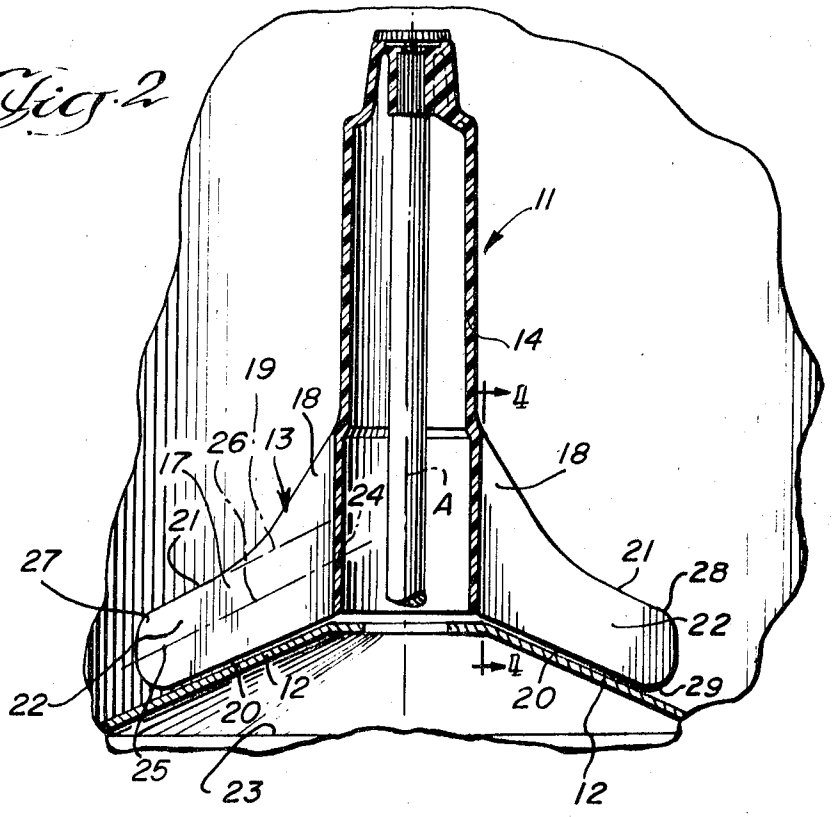
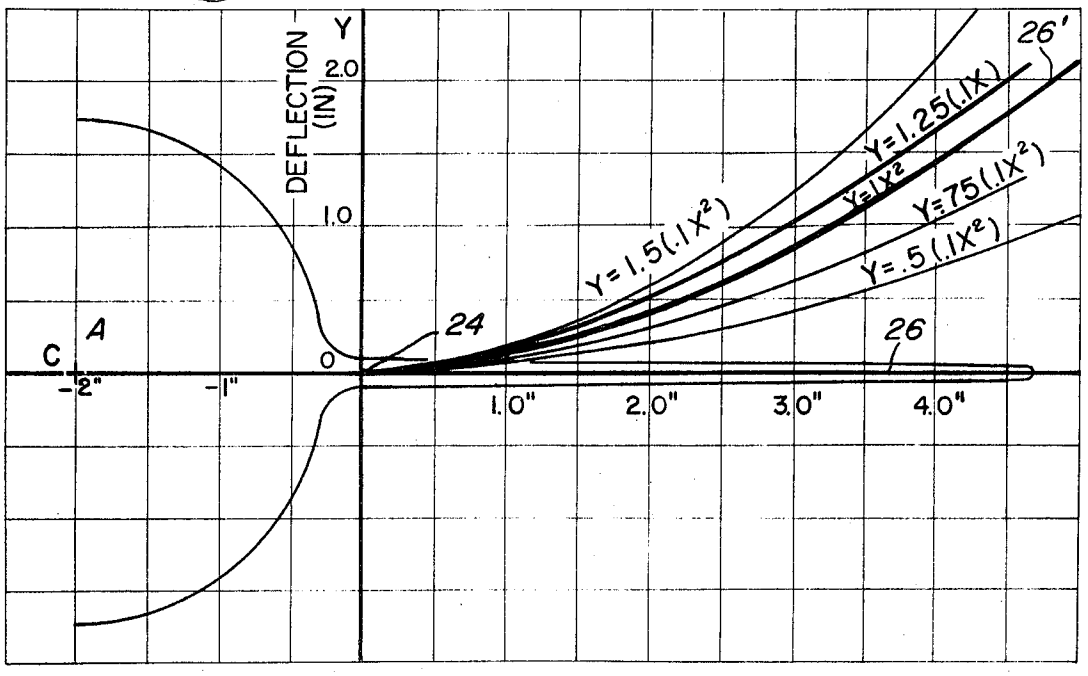

11
14
4
19
18
26
13
17
24
A
18
21
21
27
28
22
22
4
12
20
20
29
25
23
12

Fig. 6


Y
DEFLECTION (IN)
2.0
1.0
0
A
C
-2"
-1"
1.0"
2.0"
3.0"
4.0"
24
26
26'
Y=1.5(.1X²)
Y=1.25(.1X²)
Y=1X²
Y=.75(.1X²)
Y=.5(.1X²)

LAUNDRY MACHINE AGITATOR

This application comprises a continuation of my copending application Ser. No. 464,706, **filed June** 17, 1965, and now abandoned.

This invention relates to laundry apparatus and in particular to laundry apparatus utilizing oscillating agitators for effecting a laundering operation.

In one conventional form of laundry apparatus, an agitator is disposed coaxially in a tub for oscillation about a vertical axis. The agitator includes a plurality of circumferentially spaced flexible vanes radiating from an axial, vertical centerpost and cantilevered therefrom, which agitate the laundry liquid and effectively tumble or roll fabrics in the liquid so as to effect a laundering thereof.

A flexible vane type of agitator, wherein the vanes extend substantially unsupportedly outwardly from the post, has been found to provide improved washability as compared to some conventional rigid vane agitators. However, a serious problem has arisen in such flexible vane agitators in that they have been found to cause excessive clothes damage concurrently with improved washability. In efforts to solve this problem, flexible vane agitators have been made with the vanes having varying degrees of flexure. In general it has been found that the best washability is attained by agitators having vanes that are relatively stiff and thus have relatively little flexure. The relatively stiff vaned agitators, however, cause excessive clothes damage. Increasing the amount of vane flexure in general decreases the amount of clothes damage, but also decreases the washability of the agitator. Thus, the desirabilities of low wear and damage of the laundry fabrics and high efficiency of washing appeared to be mutually exclusive.

The present invention, however, has solved this vexatious incompatibility problem in a novel and simple manner, thereby permitting the use of the highly desirable flexible vane construction to provide both low wear and damage to the laundry fabrics and high washing efficiency.

Thus, a principal feature of the present invention is the provision of a new and improved washing machine agitator.

Another feature of the invention is the provision of such a washing machine agitator having a new and improved vane construction having a preselected flexibility providing concurrently low fabric wear and damage characteristics and high washing efficiency characteristics.

Still another feature of the invention is the provision of such a laundry machine agitator including at least one vane comprising a thin, upright, flexible wall element extending radially outwardly from a support portion on the agitator post and substantially perpendicular to a plane normal to the axis of the post, the vane being constructed to have a linear portion thereof extending from the support portion to an outer distal portion of the vane spaced from the post axis 4 inches greater than the spacing of the support portion from the post axis, and to define when projected onto the plane, a curve having a portion extending to the vane distal portion from a point spaced from the post axis approximately 2 inches greater than the spacing therefrom of the support portion said curve portion generally described by the equation $Y = C\ (0.1\ X^2)$ as the result of the flexing of the vane by a 6 pound force being applied to the vane distal portion and directed toward a point spaced 8½ inches from the undeflected vane distal portion in a direction parallel to the plane and perpendicular to a radial line from the post axis to the distal portion, wherein *C* is a constant within the range of approximately 0.5 to 1.5.

A further feature of the invention is the provision of such a laundry machine agitator wherein *C* is a constant within the range of approximately 0.75 to 1.25.

Yet another feature of the invention is the provision of such a laundry machine agitator wherein *C* substantially equals 1.

A further feature of the invention is the provision of such a laundry machine agitator wherein substantially the entire vane is described by the above-indicated equation.

Another feature of the invention is the provision of such a laundry machine agitator wherein the curve of the thusly flexed vane lies substantially fully within the family of curves

described by said equation where *C* is a constant in the range of approximately 0.5 to 1.5.

Yet another feature of the invention is the provision of such a laundry machine agitator as indicated immediately above where *C* is a constant lying within the range of approximately 0.75 to 1.25.

A further feature of the invention is the provision of such a laundry machine agitator wherein substantially the entire vane lies substantially fully within the above-indicated family of curves.

Another feature of the invention is the provision of a laundry machine including a tub having a bottom wall, an agitator in the tub and having a vertical centerpost and a plurality of circumferentially spaced vanes radiating from the post, at least one of the vanes comprising a thin, flexible wall element having a lower edge spaced not more than one-fourth inch from and extending substantially parallel to the tub bottom wall, the vane having a top edge parallel to or slightly converging toward the bottom edge in the direction of the distal end of the vane to preclude tangling of laundry about the vane and subsequent degradation thereof as by rubbing against the bottom wall during an agitating operation of the laundry machine.

Other features and advantages of the invention will be apparent from the following description taken in connection with the accompanying drawings wherein:

FIG. **1** is a fragmentary perspective view of a laundry machine having an agitator embodying the invention disposed superjacent a tub bottom wall;

FIG. **2** is an enlarged vertical diametric section thereof;

FIG. **3** is an outer end view of a vane thereof;

FIG. **4** is a vertical section taken substantially along the line **4—4** of FIG. **2**;

FIG. **5** is a fragmentary top plan view of the agitator illustrating the method of determining the curvature equation thereof; and

FIG. **6** is a diagrammatic graph illustrating the vane curvatures.

In the exemplary embodiment as disclosed in the drawing, a laundry apparatus generally designated **10** is shown to comprise a washing machine agitator **11** disposed superjacent a tub bottom wall **12**. The agitator **11** is arranged to be oscillated about its vertical axis A by suitable conventional mechanism (not shown) for moving a plurality of vanes **13** radiated from the lower end of the post **14** of the agitator through a body of washing fluid **15** surrounding the agitator and in which laundry fabrics **16** are provided for laundering thereof in the apparatus **10**.

As indicated briefly above, the invention comprehends an improved vane construction which provides for reduced wear and damage to the laundry fabrics **16** during the agitating laundering operation while yet providing high efficiency in the washing thereof. As best seen in FIG. **2**, the vanes **13** comprise a generally rhomboidal lower paddle portion **17** and an upper generally triangular web or root portion **18** sloping upwardly from paddle portion **17** and extending above a line **19** parallel to an outwardly, downwardly inclined lower edge **20** and continuing inwardly from an upper edge **21** of the distal or radially outermost portion **22** of the paddle portion **17** to merge with the centerpost **14** and define a support portion **24** therewith. Each vane **13** herein is of generally thin, upright configuration perpendicular to a plane **23** normal to the axis A of the post **14**.

As shown in FIG. **2**, the upper edge **21** and lower edge **20** are rectilinear. A point **25**, located vertically midway between upper edge **21** and lower edge **20** at a position spaced from axis A approximately 4 inches greater than the spacing of support portion **24** therefrom, lies on a line **26** extending parallel to bottom edge **20** through outermost support portion **24** and generally bisecting the paddle portion **17**. Herein, the post has an outer radius at its lower end of approximately 2 inches and, thus, the point **25** is spaced from the axis approximately 6 inches. The outer radius of the vane illustrated herein is ap-

proximately 6½ inches and, thus, the vane extends somewhat beyond the point **25** to define a generally rounded distal end **27** of the vane. The vane may have a thickness of approximately 0.175 inches at edge **20** adjacent post **14** with approximately ¼° draft per side upwardly therefrom so that the vane has a substantially uniform cross section. The edge **20** may have a thickness of approximately 0.08 inches at the distal end **27** with a similar ¼° draft per upwardly therefrom. The vane herein may have a longitudinal extent along post **14** of approximately 4.66 inches and the outer portion **22** of the paddle **17** may have a vertical height of approximately 2 inches. In the illustrated embodiment, the upper edge **21** is disposed at an angle of approximately 25° to the horizontal. As indicated above the lower edge **20** may be generally parallel to edge **21**, herein it is arranged at a slightly smaller angle such as 22° to the horizontal to provide a slight vertical narrowing of the vane outwardly from the post. The agitator **11** may be formed of a sturdy wear resistant plastic such as polypropylene, as by molding.

As indicated above, agitator **11** provides an improved low wear, high washing efficiency laundering operation. More specifically, vanes **13** are constructed to have a preselected flexibility as disclosed in FIGS. **5** and **6**. Thus, vane **13** is arranged to define a curve having its outermost portion, herein its outer half, define a curve generally described by the equation $Y = C(0.1\ X^2)$. The derivation of this curve is illustrated in FIG. **5** wherein an application of a force of 6 pounds to point **25** on the distal portion **22** of the vane **13** directed toward a point spaced 8½ inches perpendicularly from the vertical plane through point **25** and axis A of the post **14** in alignment with point portion **25** when the vane is in the undeflected planar configuration of FIG. **5**. The vane is deflected by this force to a curved configuration defined by the curve line **26'** representing the deflected disposition of the line **26**. The force of 6 pounds is meant herein to be the ultimate force applied to the vane. The spaced point through which the force is applied is fixed and therefore as the vane deflects, the angle at which the force is applied with respect to the vane will vary. Stated differently, the force is initially applied normal to the upright portion of the vane at point **25**. The force of 6 pounds is maintained until the vane reaches a position of equilibrium, at which time the force will be applied at an angle other than 90° with respect to the upright portion of the vane.

Referring now to FIG. **6**, it has been found that the above-described flexible construction of vane **13** provides the above indicated curve **26'** which is defined by the above indicated equation where C is a constant substantially equal to 1. Further, however, a variation in the flexibility of the vane as by changing the thickness thereof provides excellent concurrent wear resistance and washing efficiency characteristics wherein the curvature is defined by said equation wherein C is a constant within the range of approximately 0.75 to approximately 1.25. Still further a range of satisfactory concurrent wear resistance and washing efficiency characteristics is obtained where the flexibility is such as to provide a curvature limited by the outermost curves of FIG. **6** wherein the minimum value of C is approximately 0.5 and the maximum value is approximately 1.5.

As shown in the graph of FIG. **6**, the family of curves originates at support portion **24**. The X axis of the graph lies in plane **23** parallel to the longitudinal axis of the vane **13** in its unflexed position. The Y axis of the graph is of course perpendicular to the X axis. In the equation Y is the deflection of the vane and X is the distance outwardly of the support portion **24**. As discussed above, the invention comprehends that the curvature of the vane be described by the above-indicated equation in the outer portion thereof. Thus, a variation from the curve equation in the inner portion of the vane, that is the portion extending from outermost support **24** approximately half way out, will detract only limitedly from the desirable functioning of the vane. However, in the preferred form as disclosed above, the entire vane is described by the indicated equation to provide optimum characteristics.

Where the inner 2 inch portion of the projected curve of the flexed vane digresses from the equation and lies outside the range defined by the equation where C is approximately 0.5 and 1.5, the curvature of the outer portion of the vane must digress somewhat from the equation in order to have the outer portion, herein approximately the outer half of the vane, define a curve lying within the disclosed range. Such a result may occur for example when the exponent of X is varied near the limits of C or when a numerical constant is added to the equation. Thus, the invention comprehends a variation in the curvature of the outermost portion from the curvature described by the above-indicated equation, such that the outermost portion is caused to have a curvature generally of the type described by the equation, that is exponential, and lying within the maximum limits of curvature defined by the equation where the constant is approximately 0.5 and 1.5. Still further, the invention comprehends the provision of the vane **13** with a curvature along its entire length lying within the maximum curve limits although deviating somewhat from the curvature defined by the above-indicated equation.

It should be noted that the above disclosed family of curves is in no way meant to limit the amount of vane deflection which may occur if forces greater than 6 pounds are exerted against the vanes. The curves are, however, indicative of the relative stiffness and nature of flexure necessary to give optimum washing results with a flexible vane agitator. The nature of flexure is such that during a washing operation the vanes react against fabrics and tend to move the fabrics in a direction perpendicular to the vane at the point of contact. This reaction takes place throughout the range of curves disclosed and is desirable in that the fabrics being washed are directed generally toward the peripheral wall of the tub rather than tangentially of the wall as with rigid vane agitators. This movement of fabrics toward the tub wall promotes fabric turnover within the tub since the agitator vanes act in a manner similar to the vanes of a pump to force fabrics against the tub wall and thence upwardly along the wall as more fabrics are picked up by the agitator vanes and directed toward the tub wall. Stated simply, the agitators of this invention produce an improved toroidal action as compared to most fixed vane agitators.

It has been found, however, that the improved toroidal action occurs primarily over the range of curves disclosed. Stiffer vanes tend to cause clothes abrasion and more flexible vanes have a tendency to deflect to such an extent that they in effect slip by the clothes and do not impart the necessary motion thereto.

As further indicated briefly above, the vanes **13** are arranged so as to preclude tangling of the fabrics and the like therearound during the agitating action. In the embodiment shown in FIG. **2** the lower portion **20** of the vane is spaced approximately one-eighth inch from the tub bottom near the agitator post and approximately three-sixteenths inch from the tub bottom near the tip of the vane. Since the bottom portion of the vane is relatively closely spaced from the tub bottom, clothes wear may be a problem due to rubbing against the tub bottom. As the minimum vertical dimension of the paddle **21** is at the distal end **27**, there is no tendency for the fabrics to be retained on the vane as often occurs in agitator vane designs where the outermost portion is enlarged relative to the vane portions inwardly thereof. In addition to the slight tapering of the vane toward its distal end **27**, there are provided rounded edges **28** and **29** having radii of curvatures in excess of one-half inch. Thus, fabrics do not tend to collect on the vanes **13** so that rubbing of the collected fabrics on the tub bottom wall **12** is effectively precluded thereby further preventing wear of the laundry fabrics and cooperatively with the novel controlled freeing action of the vanes as discussed above effectively minimizing the fabric wear.

As shown herein vanes **13** taper from support portion **24** to the distal end by approximately ¼°. However, the invention comprehends untapered vanes falling with the curvatures herein disclosed.

While I have shown and described certain embodiments of my invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as defined in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. An agitator for a top loading home clothes washing machine including a centerpost adapted for mounting upright in the tub of the washing machine for rotational oscillation about a vertical axis, said agitator having

a lower center post portion and an upper center post portion,

said lower portion carrying a plurality of circumferentially mutually spaced radially outwardly extending vanes for operation at the bottom of the tub,

at least two of said vanes being flattened, lying in vertical planes, being symmetrically spaced with respect to each other, elongated in the direction of their radial length and having a predetermined degree of flexibility substantially in the direction of oscillation,

said flexible vanes having at least a substantial portion of said length freely protruding outwardly from the centerpost portion and terminating in outer clothes selecting and impelling edges which are extended in length, generally vertical and located to impel liquid and articles being washed outwardly along the bottom of the tub,

said flexible vanes being further so constructed and arranged that when said agitator is rotationally oscillated through a total arc of about 180° such vanes will deform under washing load with respect to the centerpost axis not less than about 10° nor more than about 38° from center position of the vanes as measured at the vane tips,

at least a substantial part of said upper centerpost portion being free of elements having any substantial effect on the circulation of the liquid and articles being washed.

* * * * *