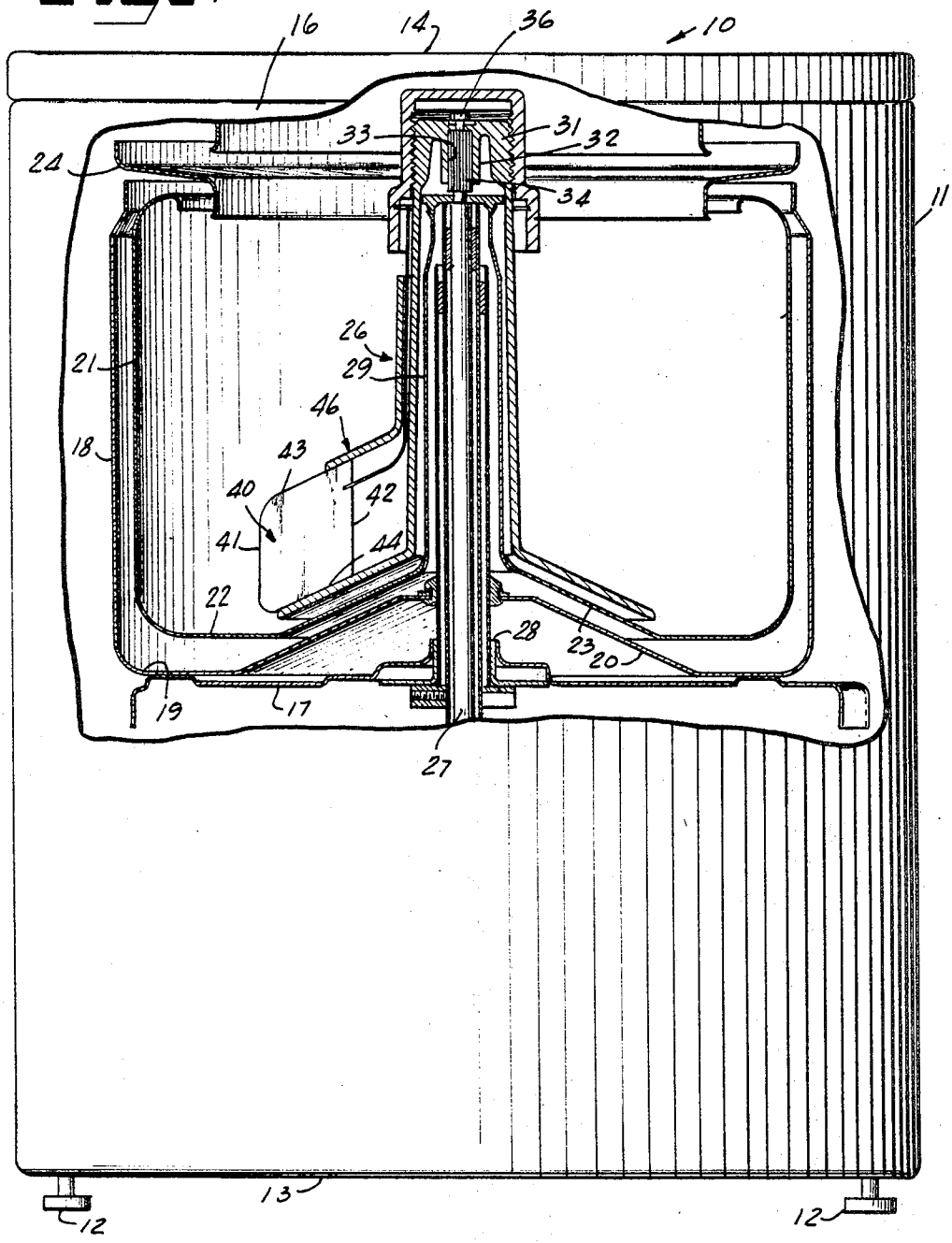
Sept. 3, 1968 K. D. SALISBURY ETAL 3,399,552

WASHING MACHINE AGITATOR WITH ADJUSTABLE VANES

Filed Oct. 10, 1966 3 Sheets-Sheet 1

Fig. 1



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Fig. 2

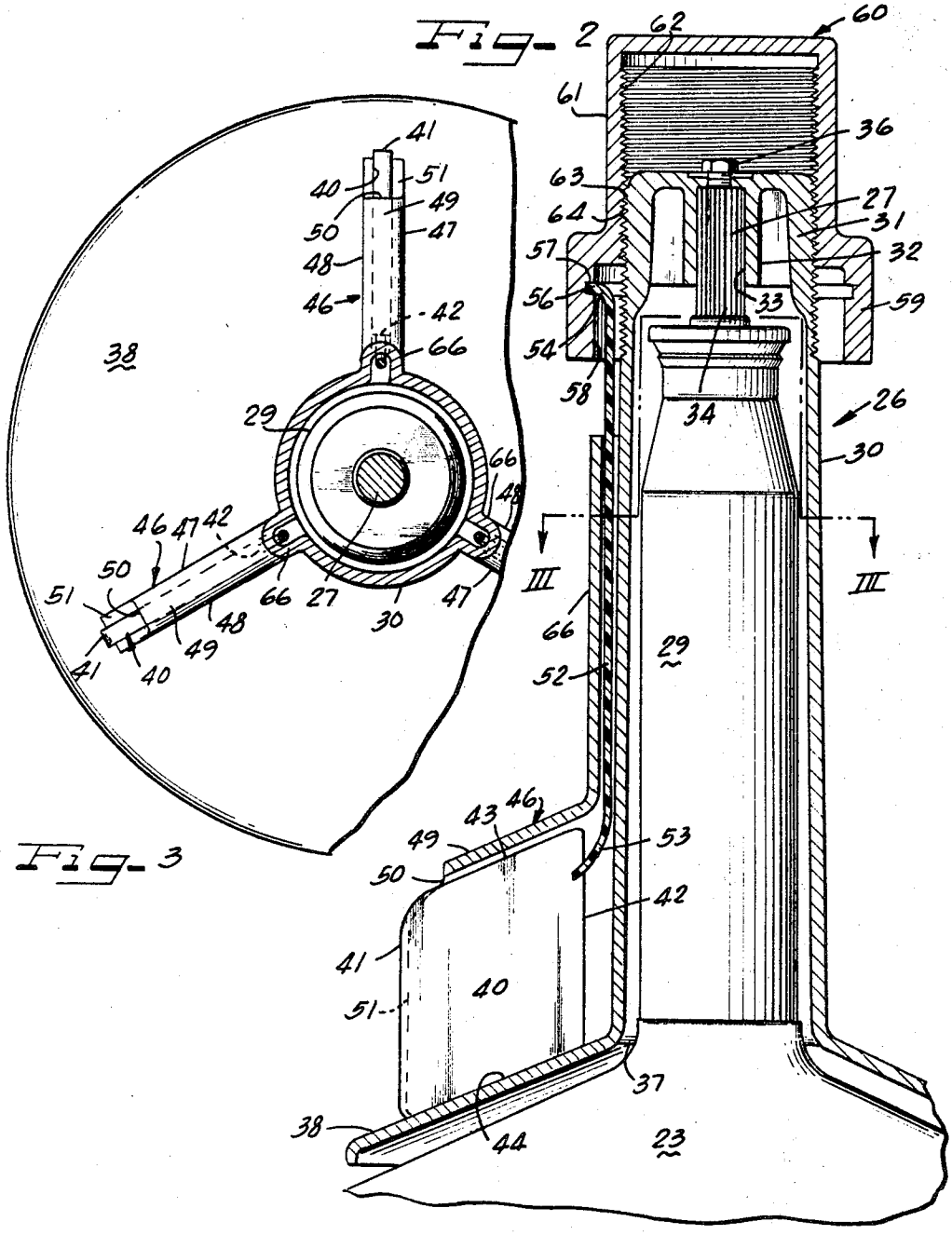


Fig. 3

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Fig. 4

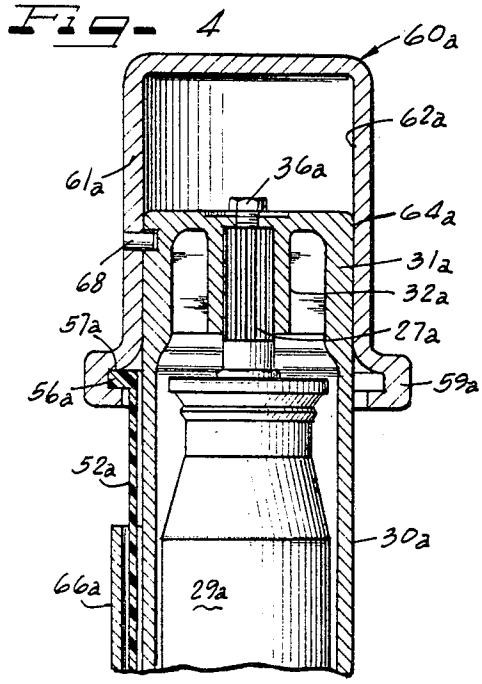


Fig. 5

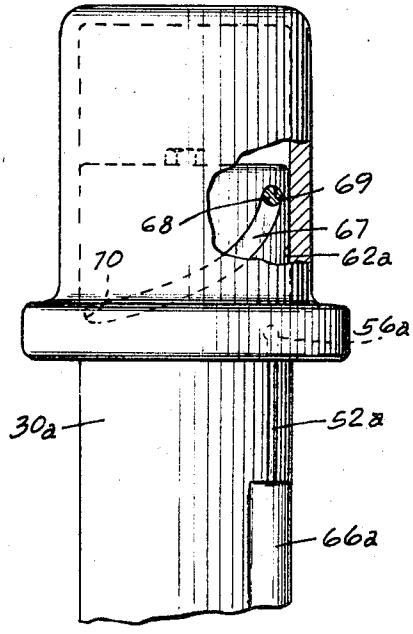


Fig. 6

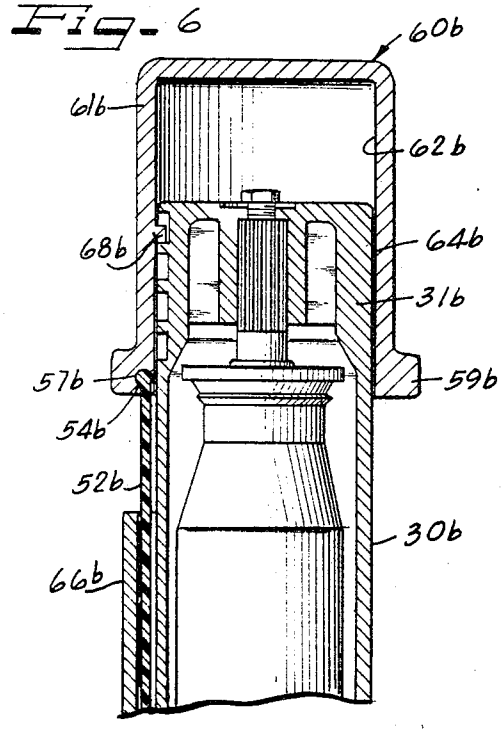
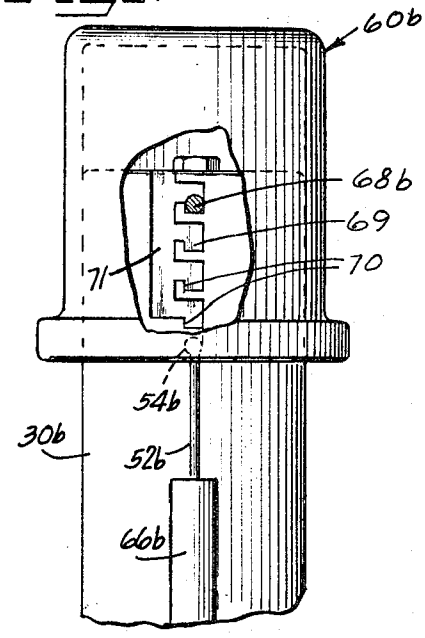


Fig. 7



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WASHING MACHINE AGITATOR WITH ADJUSTABLE VANES

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13 Claims. (Cl. 68—134)

ABSTRACT OF THE DISCLOSURE

An adjustable vane agitator including an agitator shell rotatable on an axis and having one or more radially extensible vanes supported thereby. The radial extension of the vanes may be selectively adjusted by manipulation of control rods carried on the agitator shell and movable in an axial direction to vary the degree of washing action caused by oscillatory movement of the agitator.

This invention relates generally to washing machines and more particularly to a washing machine having a rotatable agitator assembly equipped with one or more radially adjustable agitation vanes whereby the degree of agitation to which the laundry liquid and fabrics are subjected can be varied and controlled.

An object of the invention is to provide means for selectively regulating the agitation effect of the agitator while maintaining the speed of rotation or oscillation of the agitator constant.

Another object of the invention is to provide an adjustable agitation vane extensible in a radial direction whereby the radial extent and thus the tip speed of the vane can be varied and controlled.

Another object of the invention is to provide a rotatable agitator with one or more adjustable vanes and means for moving the vane rectilinearly radially to adjust the radial disposition of the vane with respect to the agitator.

Another object of the invention is to provide a rotatable agitator with a plurality of radially extensible agitation vanes and means for adjusting the radial extent of the vanes simultaneously.

A further object of the invention is to provide means whereby the operator of an agitator type washing machine can quickly and easily adjust the magnitude of the agitation without varying the speed of the agitator.

Another object of the invention is to enable the operator to vary the degree of agitation of the machine by merely turning a knob or the like relatively rotatable member mounted on the agitator.

Yet another object is to enable an operator of an agitator type washing machine to vary the agitation effect of a number of agitation vanes by merely adjusting a single easily accessible and simply operated regulator or control mechanism.

An additional object is to provide a rotatable washing machine agitator having a fixed or stationary agitation vane of a given substantially constant vertical dimension along the radial extent thereof with a radially adjustable vane extension whereby the effective radial extent of the vane can be varied without changing the vertical dimension of the vane along the radial extent thereof. Still another object of the invention resides in the provision of adjusting means movable axially with respect to the axis of rotation of the agitator in order to vary the radial disposition of the agitation vanes.

Another object of the invention involves the provision of means for selectively varying the radial disposition of the vanes and then for locking the vanes in place after they are adjusted.

Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and to the accompanying sheets of drawings, in which preferred structural embodiments incorporating the principles of the present invention are shown by way of illustrative example only.

On the drawings:

FIGURE 1 is a vertical elevational view of a washing machine constructed in accordance with the principles of the present invention with portions of the various wall members cut away and other parts shown in section to reveal the relative disposition of various parts of the agitator;

FIGURE 2 is an enlarged fragmentary vertical sectional view of the agitator assembly of the machine of FIGURE 1;

FIGURE 3 is a fragmentary horizontal sectional view of the agitator taken along line III—III of FIGURE 2;

FIGURES 4 and 5 are sectional and elevational views, respectively, of an upper portion of the agitator shown in FIGURE 2 but including another embodiment of the agitation vane adjusting mechanism; and

FIGURES 6 and 7 are similar to FIGURES 4 and 5 but illustrate another embodiment of the vane adjusting mechanism.

As shown on the drawings:

Although the principles of the present invention are applicable to a variety of agitation and washing mechanisms a particularly useful application is made to domestic washing machines of the agitator type. An illustrative embodiment of such a washing machine having a vertically disposed agitator and constructed in accordance with the principles of the present invention is shown in FIGURE 1 and indicated generally at reference numeral **10**.

Some of the principle parts of the washing machine **10** include an outer cabinet **11** having a plurality of levelling legs **12** mounted respectively at the four corners of a bottom wall **13** for supporting the machine on a floor or other suitable support member. A hinged door **14** is provided for gaining access into the interior of the machine **10** through a top wall **16** thereof having an access opening formed therein.

Situated within the washing machine **10** at about the elevational midpoint is a horizontal support wall **17** securely fastened to the walls of the cabinet **11** in order to support a vertically upstanding cylindrically shaped imperforate tub **18**. The lower end of the tub **18** is closed by a bottom wall **19** which includes a central portion **20** shaped conically and extending upwardly toward an apex situated on the longitudinal axis of the tub **18**.

The upper end of the tub **18** is open and disposed therewithin is a complementarily shaped but somewhat smaller perforate receptacle or basket **21**. A bottom wall **22** of the basket **21** is situated in spaced relation to the bottom wall **19** of the tub **18** and includes a central portion **23** which extends in generally parallel relation to the central portion **20** of the tub wall **19**.

The upper end of the basket **21** is also open in order to receive material to be laundered through the top wall **16** of the cabinet **11**. During a washing operation the tub **18** receives a quantity of laundry liquid as well as detergents, additives and the like. A shroud **24** overlies the upper ends of the tub **18** and of the basket **21** to facilitate the loading and unloading operations.

During a washing operation the material to be laundered is immersed in the laundry liquid and subjected to a washing action which results from the rapid and turbulent agitation of the material and the laundry liquid within the basket **21**.

Such agitation is conferred by an agitator assembly **26** which is disposed within the basket **21** and which, during

a washing operation operates about a vertical axis to impart a scrubbing and rollover action to the material and turbulence to the laundry liquid.

The agitator assembly **26** is oscillated by a vertical drive shaft **27** which extends upwardly from a lower portion of the washing machine **10** through a central aperture **28** formed in the horizontal support wall **17** and into an upstanding cyclindrical sleeve **29** which extends upwardly from the conical portion **23** of the basket **21**. The lower end of the drive shaft **27** is connected to a suitable oscillating mechanism which may preferably be driven by an electric motor.

Referring to the enlarged views of FIGURES 2 and 3, the agitator assembly **26** is more particularly characterized as comprising a tubularly shaped agitator shell **30** which is slipped downwardly in surrounding relation over the drive shaft **27** and the sleeve **29**. An upper end **31** of the shell **30** is closed and comprises a downwardly depending concentrically aligned tubular portion **32** having an inner wall **33** shaped to receive a splined upper end **34** of the drive shaft **27** in driving relation. The shell **30** is securely fastened to the drive shaft **27** by means of a suitable fastener such as a threaded bolt indicated at **36**.

A bottom end **37** of the shell **30** is open to receive the sleeve **29**, and extending radialy outwardly and downwardly therefrom is a skirt **38** formed integrally therewith and situated in substantialy parallel relation to the conical portion **23** of the basket bottom wall **22**.

The actual agitation of the fabric or other material to be laundered and the laundry liquid is accomplished by one or more agitation vanes which project radially outwardly from the agitator shell **30**. The number of agitation vanes may vary and in the exemplary embodiment herein shown there are three vanes spaced from each other 120° circumferentially around the periphery of the agitator shell **30**.

In the drawings the agitation vanes are all identical and indicated by reference numerals **40**. Each of the vanes **40** comprises a flat or disc-shaped structure which is relatively thin in horizontal cross-section and which is shaped in a front elevational view in the form of a parallelogram, having two vertical sides **41** and **42** and two other sides **43** and **44** which slope radially outwardly and downwardly in parallel relation with the skirt **38** formed at the bottom of the agitator shell **30**.

The vanes **40** are separate, individual structures made of either rigid material such as molded plastic or of elastic or resilient material such as rubber or polyethylene or polypropylene or synthetic rubber material. The bottom side **44** of each of the vanes **40** is supported on the skirt **38** of the agitator shell **30** and the vanes are relatively adjustable with respect to the shell **30**.

In order to maintain the vanes **40** in an upstanding position, a plurality of guides **46** are formed on the periphery of the agitator shell **30**. Each of the guides **46** comprises a pair of horizontally spaced vertical side walls **47** and **48** which extend upwardly from the skirt **38** and a top wall **49** which slopes radially downwardly from the agitator shell **30** in parallel relation to the skirt **38**.

An outer end **50** of each of the guides **46** is open to receive one of the vanes **40**, and thus each of the guides **46** forms a guideway into which its corresponding vane **40** can easily slide, being supported from below by the skirt **38**.

In FIGURE 1 the vanes **40** are shown in extended positions with respect to the guides **46**, that is, with the radially outermost end **41** of the vanes **40** protruding substantially beyond an outermost end of wall **51** of each of the guides **46**. In FIGURES 2 and 3 the vanes **40** are shown in retracted positions, that is, with the inner ends **42** thereof in close relation to the periphery of the agitator shell **30**.

In the retracted positions of the vanes **40** the outer ends **41** thereof extend just beyond the outer ends **51** of the guides **46**. The corners of the vanes **40** as well as the corners of the sides **47** and **48** of the guides **46** are somewhat arcuately shaped to prevent damage to the fabric or the like being agitated.

The guides **46** extend radially outwardly from the agitator shell **30** a distance which is almost equal to the corresponding radial length of the vanes **40** such that when the vanes **40** are in a fully retracted position the agitating effect is accomplished almost entirely by the guides **46** themselves. Thus the guides **46** may be characterized as fixed or stationary agitation vanes as contrasted with the movable vanes **40**.

It will be appreciated that means other than the fixed vanes **46** may be provided for radially guiding the movable vanes **40**. In the preferred embodiment illustrated, however, the fixed guides **46** also serve as agitation vanes and the movable vanes **40** may be described as providing variable extensions of the fixed vanes **46**.

The radial disposition of the movable vanes **40** determines the degree of agitation to which the laundry liquid and fabric material is subjected, assuming a constant rotating or oscillating speed of the agitator assembly **26**. If the movable vanes **40** are retracted as far as possible the agitation action is relatively subdued or gentle. However, when the movable vanes **40** are extended as far as possible the agitation action is appreciably more vigorous. Thus, by adjusting the radial disposition of the movable vanes **40**, the agitation action can be varied from gentle to vigorous.

In order that the radial disposition of all of the movable vanes **40** can be adjusted simultaneously and in equal incremental amounts by a simple manual adjustment by the operator of the washing machine, a plurality of axially extending flexible control rods **52** are situated in proximately spaced relation to the periphery of the agitator shell **30** and are connected respectively at lower ends **53** thereof to one of the movable vanes **40**. Any suitable means may be used for securing the control rods **52** to the vanes **40**, such as a heat or adhesive bond as long as there is an inseparable connection between the two. The lower ends **53** of the control rods **52** are bent radially outwardly so that motive forces imposed by the control rods **52** on the movable vanes **40** will be substantially in a direction corresponding to the direction of movement of the vanes **40**.

An upper end **54** of each of the control rods **52** is bent outwardly and a terminal end portion **56** is housed in a circumferentialy continuous groove **57** formed in an inner wall **58** of an enlarged lower portion **59** of an adjustment or control cap or sleeve **60**.

The cap **60** is essentially cylindrically shaped and is more particularly characterized as comprising a reduced diameter upper portion **61** having a cylindrical inner wall **62** which is threaded complementarily to threads **63** formed on a peripheral wall **64** of the upper end **31** of the sleeve **30**.

As the adjustment cap **60** is threaded on the upper end **31** of the agitator shell **30**, thereby moving axially with respect to the shell **30**, the elongated control rods **52** are also moved axially since the upper terminal ends **56** thereof are disposed in the groove **57**. Downward axial movement of the control rod **52** effectively moves the vanes **40** simultaneously radially outwardly while an upward axial movement of the control rods **52** has the effect of moving vanes **40** radially inwardly.

Although the control rods **52** are flexible, particularly at the lower ends **53** thereof, to move into and out of the fixed vanes **46**, they must be sufficiently rigid to sustain a compressive force adequate to urge the movable vanes **40** radially outwardly of the fixed vanes when the control rods **52** are moved axially downwardly.

In order to maintain the control rods **52** in their proper positions along the periphery of the agitator shell **30**, a corresponding number of axially extending guide ways **66** are formed on the shell **30** to house the control rods **52**

and to prevent them from becoming misaligned circumferentially or from buckling along their axial extent. The guide ways **66** may be formed integrally with the agitator shell **30** and are hollow and slightly oversized with respect to the control rods **52** to permit free axial movement of the control rods while preventing any substantial bending of the rods. Thus, it will be appreciated that the radial disposition of the movable vanes **40** can be easily adjusted by the machine operator merely by rotating the adjustment cap **60** one way or the other depending upon whether a vigorous or gentle agitation action is sought. The vanes **40** are adjusted simultaneously since all of the control rods **52** are moved the same distance as the cap **60** is threaded on the agitator shell **30**.

The movable vanes or vane extensions **40** may be made of rigid or flexible material and need not necessarily be sloped downwardly as illustrated but, instead, the configuration of the agitator assembly **26** can be such that the vanes **40** extend horozontally radially outwardly. An important advantage of the agitator assembly **26** of this invention is that it can be installed on existing washing machines of the vertical agitator type which employ an agitator assembly utilizing fixed vanes.

As noted, an important advantage of the present invention is that the washing action of the machine **10** can be varied substantially while maintaining a constant speed of rotation or oscillation of the drive shaft **27**. For example, a criterion of washing action or washability is the number of instances per unit of time that a piece of material being washed in an agitator-type washing machine rises from the bottom of the basket **21** to the top of the laundry liquid and rolls over to descend again to the bottom of the basket. With the movable vanes **40** fully retracted, the magnitude of "rollover" may be quite low. Extension of the vanes **40** about half way may result in rollover four or five times as great as in a fully retracted position, and with the vanes **40** in a fully extended position to provide the most vigorous agitation action, rollover may be in the order of twelve times as great as that in the fully retracted position. Another advantage of the present invention resides in the fact that for a given angular adjustment of the cap **60**, all of the movable vanes move simultaneously at an equal distance with respect to their corresponding stationary vanes **46**. As a result, not only is the agitation effect provided by each vane changed by the same amount, but also the agitator assembly **26** is more evenly balanced with respect to the radial forces imposed thereon, thus maintaining the washing machine in a more balanced condition.

It should also be appreciated that the radial movement of the vanes **40** is rectilinearly in a direction parallel to the skirt **38**. Thus, the vertical dimension of the vanes, including both the fixed vanes **46** and the movable vanes **40**, remains substantially constant along the entire radial extent of the vanes regardless of whether the movable vanes **40** are in a fully retracted or extended position or somewhere in between. The agitation effect which results from an extension of the movable vanes **40** has essentially similar characteristics to the agitation which is effected merely by the stationary vanes **46** since the movable vanes **40** do not vary the overall silhouette of the vanes except in so far as the radial extent is concerned.

In FIGURES 4 and 5, wherein parts similar to those shown in FIGURES 1–3, are identified by similar reference characters with the suffix *a* added, another embodiment of the movable vane adjustment mechanism is shown wherein the adjustment cap **60***a* is not threaded to the upper portion **31***a* of the shell **30***a* but instead has a smooth cylindrical inner wall **61***a* which telescopes over a smooth outer wall **64***a*.

An outwardly opening helical groove **67** is formed in the upper portion **31***a* of the agitator shell **30***a* and receives a follower pin **68** mounted fixedly on and projecting radially inwardly of the peripheral wall **61***a* of the adjustment cap **60***a*. Thus, as the cap **60***a* is rotated between limiting positions determined by end walls **69** and **70** of the groove **67**, the adjustment cap **60***a* and the vertical rods **52***a* will move axially at a corresponding distance.

In the embodiment shown in FIGURES 6 and 7, where the suffix *b* has been added to the reference numerals, the inner and outer walls **62***b* and **64***b* of the adjustment cap **60***b* and the agitator shell **30***b*, respectively, are once again smooth to permit free axial movement therebetween. In this embodiment, a follower pin or protuberance **68***b* which extends inwardly from the peripheral wall **61***b*, can be selectively moved into any one of several vertically spaced stops or ledges **69** which are formed in the peripheral wall **64***b* of the upper end **31***b* of the agitator shell **30***b*. Note, that a short axial shoulder **70** prevents an undesired change of position of the adjustment cap **60***b* by serving as a retainer wall and separating the recesses which comprise the stops **69** from an axially extending groove **71** which communicates the respective stops **69**.

Note, also, that in this embodiment the upper ends **54***b* of the vertical rods **52***b* are enlarged or shaped in the form of beads rather than outturned, and the bead is housed in a complemental groove **57***b* in this instance, as a result of the minimal rotation of the adjustment cap **60***b*, the vertical rods **52***b* do not rotate relative to the adjustment cap but instead are firmly affixed thereto.

Although minor modifications might be suggested by those versed in the art, it should be understood that we wish to embody within the scope of the patent warrented hereon all such modifications as reasonably come within the scope of our contribution to the art.

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

1. In a washing machine,
a drive shaft,
an agitator oscillated by said shaft about an axis,
a plurality of radially extendible vanes engageable with said agitator, and
adjusting means connected to said extendible vanes and movably mounted on said agitator,
said adjusting means being movable axially relative to said agitator for simultaneously adjusting the radial extension of all of said vanes.

2. The apparatus as defined in claim **1** including cooperating helical groove and pin means formed on said adjusting means and on said agitator for moving said adjusting means axially relative to said agitator in response to relative rotation between said adjusting means and said agitator whereby the axial movement of said adjusting means is effected by rotational movement thereof.

3. An agitator assembly for a washing machine comprising:
a rotatable agitator shell having an axis of rotation,
a radially movable vane carried on said shell, and
vane adjusting means carried on said shell and movable axially relative thereto and connected to said vane for moving said vane rectilinearly radially relative to said shell in response to axial movement of said vane adjusting means relative to said shell.

4. The agitator assembly as defined in claim **3**, and including at least one additional vane and wherein said vane adjusting means is adapted to move all of said vanes simultaneously rectilinearly radially in response to axial movement thereof relative to said shell in order to adjust simultaneously the radial disposition of all of the said vanes.

5. In a washing machine,
an agitator assembly including a rotatable agitator shell having an axis of rotation,
a plurality of radially movable vanes on said shell, and
vane adjusting means carried on said shell for simultaneously adjusting the radial disposition of all of said vanes,

said vane adjusting means comprising means connected to said vanes and movable axially with respect to said shell for imparting radial movement to said vanes.

6. The washing machine as defined in claim 5 wherein said vane adjusting means comprises first means operatively connected to said vanes and movable axially with respect to said shell for imparting radial movement to said vanes and second means operatively connected to said first means and rotatable with respect to said shell to move said first means axially.

7. The washing machine as defined in claim 6, and including cooperable means on said second means and on said shell for guiding the second means in a helical movement with respect to the axis of rotation of said shell.

8. A washing machine comprising:

a receptacle for receiving material to be laundered, and an agitator assembly in said receptacle comprising:

a rotatable vertical tubular shell,

an agitator vane,

a guide on said shell for guiding said vane in radial movement with respect to said shell, and a control rod connected to said vane and movable axially with respect to said shell to move said agitator vane radially.

9. The washing machine as defined in claim 8, wherein said control rod is flexible and extends along a portion thereof in substantially parallel relation with respect to the axis of said agitator shell.

10. The washing machine as defined in claim 9, including control rod guide means for maintaining said portion

of said control rod in parallel relation with the axis of said agitator shell.

11. The washing machine as defined in claim 8, and including:

control rod adjusting means carried on said agitator shell for axial movement therewith and connected to said control rod, and

cooperable means on said control rod adjusting means and on said agitator shell for selectively adjusting the axial disposition therebetween.

12. The washing machine as defined in claim 11, wherein said control rod adjusting means is rotatable relative to said agitator shell and said cooperable means comprises a helical groove and a follower in said groove whereby said control rod adjusting means is movable axially with respect to said agitator shell upon relative rotation therebetween.

13. The washing machine as defined in claim 11, wherein said cooperable means comprises a plurality of axially spaced stops and a protuberance engageable with said stops.

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