Sept. 17, 1968 C. I. PLATT ET AL 3,401,540

WASHING MACHINE AGITATOR WITH ADJUSTABLE VANES

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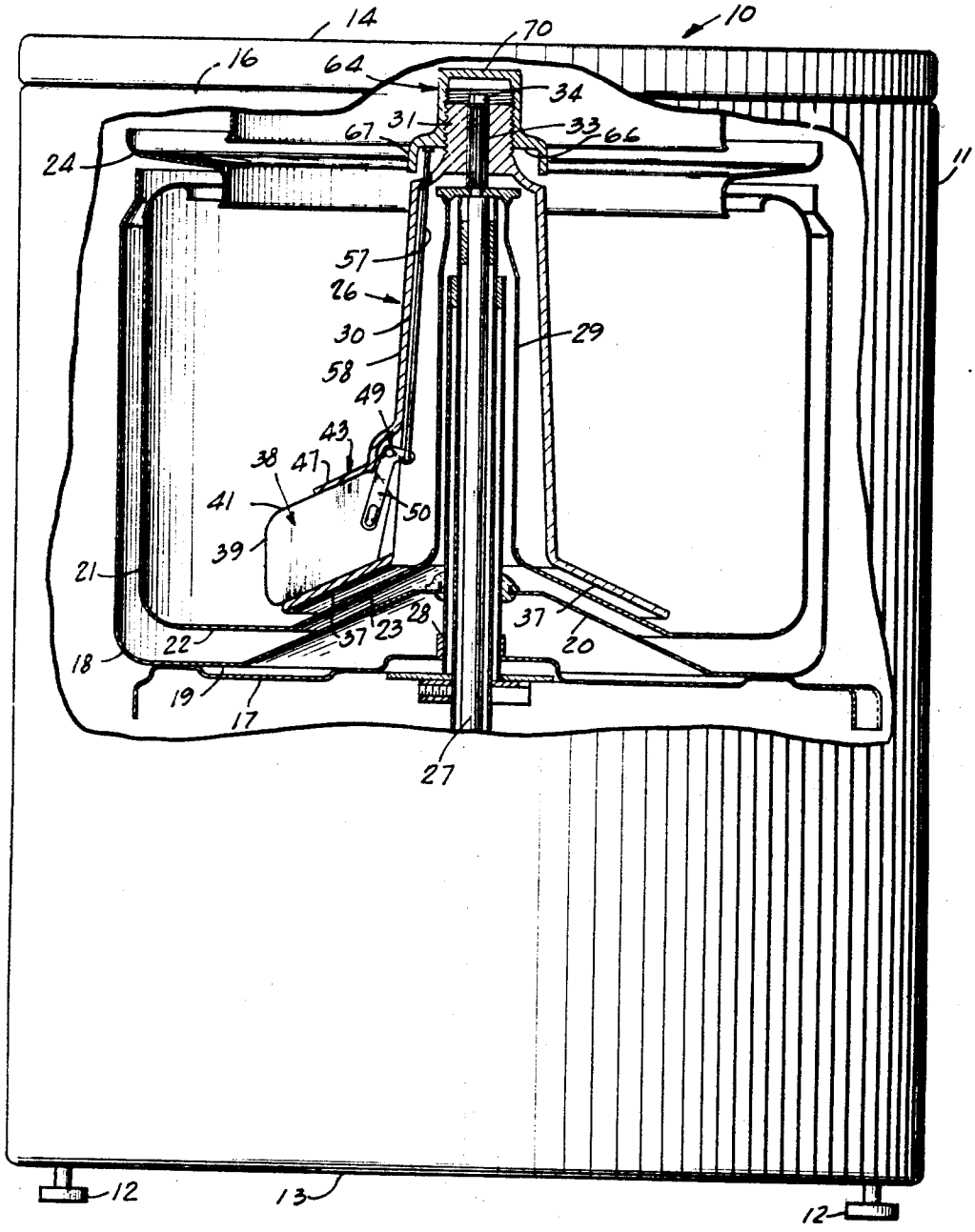
Fig. 1



INVENTORS
CLARK I. PLATT
CLIFTON A. COBB
KEITH D. SALISBURY

BY Hill, Sherman, Meroni, Gross & Simpson ATTORNEYS

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Fig. 3

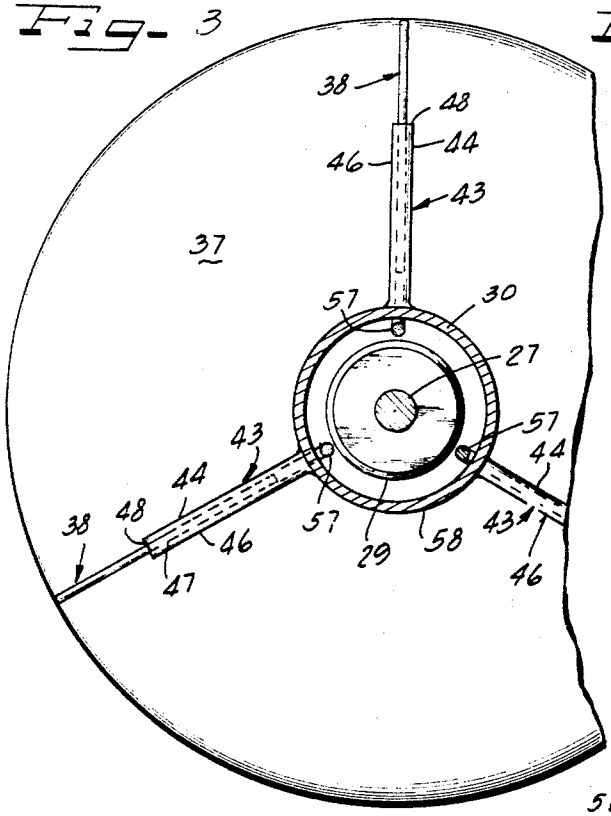
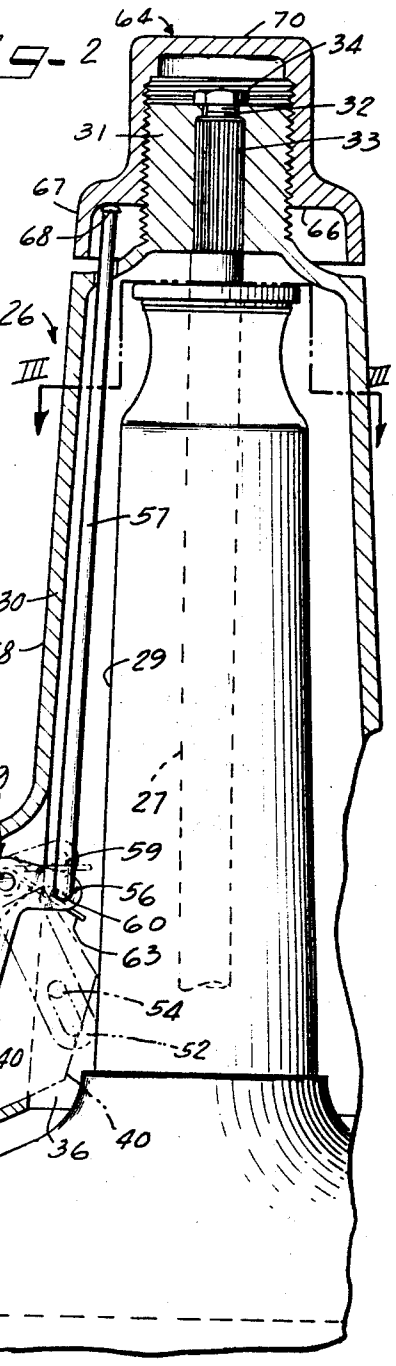


Fig. 2



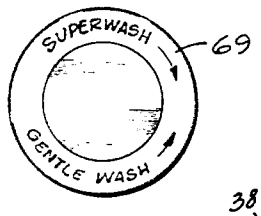


Fig. 4

INVENTORS
CLARK I. PLATT
CLIFTON A. COBB
KEITH D. SALISBURY

BY Hill, Sherman, Meroni, Gross & Simpson ATTORNEYS

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WASHING MACHINE AGITATOR WITH ADJUSTABLE VANES

Clark I. Platt, Benton Harbor, and Clifton A. Cobb and Keith D. Salisbury, St. Joseph, Mich., assignors to Whirlpool Corporation, Benton Harbor, Mich., a corporation of Delaware

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ABSTRACT OF THE DISCLOSURE

An adjustable vane agitator assembly including an agitator shell rotatable on an axis, radially movable agitator vanes supported on the shell, biasing means including spring members urging the vanes radially inwardly and follower arms connected respectively to the vanes and movable axially in response to radial movement of the vanes. An adjustment cap is mounted on the agitator shell in axial alignment with the follower arms to provide a stop for the follower arms against the bias of the spring members. The cap is axially adjustable for selectively adjusting the radial positions of the vanes simultaneously to vary the agitation characteristics of the agitator assembly.

This invention relates generally to washing machines and more particularly to a washing machine having a rotatable agitator assembly equipped with one or more 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 an adjustable agitation vane movable between limiting positions of adjustment and spring biased toward one of the limiting positions.

Another object of the invention is to provide improved means for moving an adjustable vane in a radial direction with respect to the axis of rotation of the agitator in response to axial movement of a vane adjustment mechanism.

A further object of the invention is to provide plural adjustable vanes all of which are spring biased in one direction of adjustment and the adjustment of all of which is controlled by a single adjustment control.

Another object of the invention is to provide improved adjustment means for movable vanes of a washing machine agitator.

Another object of the invention is to provide an adjustment mechanism for the movable vanes which is simple in construction, trouble free in operation and which can serve a long useful life.

A further object of the invention is to provide an agitator assembly with movable vanes and an adjustment mechanism arranged such that movement of an adjustment cap a given distance in an axial direction will result in the movement of the vane in a radial direction a distance greater than said given distance.

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 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 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 lines III—III of FIGURE 2; and

FIGURE 4 is a top plan view of an adjustment indicator of the invention.

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 household 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 principal parts of the washing machine **10** include an outer cabinet **11** having a plurality of leveling 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 which may be desired. A shroud **24** overlies the upper ends of the tub **18** and of the basket **21** to facilitate loading and unloading of the basket.

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 tur-

bulent 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, rotates or oscillates 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 rotated or 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 cylindrical 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 in FIGURES 2 and 3, the agitator assembly **26** is more particularly characterized as comprising an agitator shell **30** which is slipped downwardly in surrounding relation over the drive shaft **27** and the sleeve **29**. A reduced diameter upper end portion **31** of the agitator shell **30** is centrally apertured as at **32**, which aperture is splined so as to receive a splined upper end **33** of the drive shaft **27** in driving relation. The agitator shell **30** is securely fastened to the drive shaft **27** by means of a suitable fastener such as a threaded bolt indicated at reference numeral **34**.

A bottom end **36** of the agitator shell **30** is open to receive the sleeve **29**, and extending radially outwardly and downwardly therefrom is a skirt **37** formed integrally therewith and situated in substantially 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 120° circumferentially around the agitator shell **30**.

In the drawings the vanes are all identical and are indicated respectively at reference numerals **38**. Each of the vanes **38** 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 front and back sides **39** and **40** and top and bottom sides **41** and **42** which are parallel to each other and which slope radially outwardly and downwardly in parallel relation to the skirt **37** formed at the bottom of the agitator shell **30**.

The vanes **38** 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 **42** of each of the vanes **38** is supported on and movable with respect to the skirt **37** of the agitator shell **30**.

In order to maintain the vanes **38** in an upstanding position, a plurality of guides **43** are formed on the periphery of the agitator shell **30**. Each of the guides **43** comprises a pair of horizontally spaced vertical side walls **44** and **46** which extend upwardly from the skirt **37** and a top wall **47** which slopes radially and downwardly from the agitator shell **30** in parallel relation to the skirt **37**.

An outer end **48** of each of the guides **43** is open to receive one of the vanes **38**, and thus each of the guides **43** forms a guide way into which its corresponding vane **38** can easily slide, being supported from below by the skirt **37**.

In FIGURE 2 the vane **38** is shown in full lines in an extended poistion with respect to the guide **43**, that is, with the radially outermost end **39** of the vane **38** protruding substantially beyond the outermost end wall **48** of the guide **43**. The vane **38** is shown in dashed lines in its retracted poistion, that is, with the inner side **40** thereof in proximate spaced relation to the sleeve **29**.

In the retracted positions of the vanes **38** the outermost ends **39** thereof extend just beyond the outer ends **48** of the guides **43**. The corners of the vanes **38** as well as of the sides **44** and **46** of the guides **43** are somewhat arcuately shaped to prevent damage to the fabric or the like being agitated.

The guides **43** extend radially outwardly from the agitator shell **30** a distance which is almost equal to the corresponding radial length of the vanes **38** such that when the vanes **38** are in a fully retracted position the agitating effect is accomplished almost entirely by the guides **43** themselves. Thus the guides **43** may be characterized as fixed or stationary agitation vanes as contrasted with the movable vanes **38**.

It will be appreciated that other guide means may be substituted for the fixed vanes **43** for radially guiding the movable vanes **38**, but in the embodiment illustrated the guide means also serve themselves as stationary agitation vanes and the movable vanes **38** actually serve as extensions of the stationary vanes **43**.

The radial disposition of the movable vanes **38** determines the degree of agitation to which the laundry liquid and fabric material is subjected, assuming a constant oscillating or rotating speed of the agitator assembly **26**. If the movable vanes **38** are retracted as far as possible the agitation action is relatively subdued or gentle. However, when the movable vanes **38** are extended as far as possible the agitation action is appreciably more vigorous. Thus by adjusting the radial disposition of the movable vanes **38**, the agitation action can be varied from gentle to vigorous.

In accordance with the principles of this invention the radial disposition of all of the movable vanes **38** can be simply and quickly adjusted simultaneously and in equal incremental amounts by the operator of the washing machine by means of a conveniently located easily actuated adjustment mechanism or controller.

The movable vane adjustment mechanism comprises a plurality of bellcrank assemblies indicated generally at reference numerals **49** corresponding in number to the number of movable vanes **38** and mounted for pivotal movement on the agitator shell **30** in driving relation with a corresponding movable vane **38**.

Accordingly, each of the bell crank assemblies **49** comprises a bell crank **50** disposed within a stationary vane **43** and journalled for free rotation on a pivot pin **51**. The pivot pin **51** extends axially at right angles to the axis of rotation of the agitator shell **30** and is mounted at opposite ends on the side walls **44** and **46** of the stationary vane **43**. Thus the bell crank **50** is permitted to pivot in a plane which intersects the axis of the agitator shell **30**.

One leg **52** of the bell crank **50** extends toward the movable vane **38** and has an elongated slot **53** formed therein near the distal end thereof to receive a slightly undersized follower pin **54** projecting from one side of the movable vane **38**.

Another leg **56** of the bell crank **50** is shorter than leg **52** and extends at an angle therefrom toward the axis of the agitator shell **30**. An elongated rod-like follower arm **57** extends axially upwardly between the sleeve **29** and a peripheral wall **58** of the agitator shell **30** and is pivotally connected at a lower end **59** thereof to the short leg **56** of the bell crank **50** by means of a pin **60**.

It will thus be observed that as the bell crank **50** rocks or pivots back and forth about the pivot pin **51** the movable vane **38** is moved correspondingly radially inwardly and outwardly of the stationary vane **43**. The cooperating driving connection comprising the slot **53** and the follower pin **54** accommodates the differences between the pivotal movement of the bell crank **50** and the rectilinear movement of the movable vane **38**.

In order to provide more positive control the movable vane **38** is continuously biased by means including a torsion spring **61** to one of its limiting positions of adjustment which, in the embodiment illustrated, is the fully

retracted position. The spring **61** is also housed in the stationary vane **43** and is coiled around the pivot pin **51**. One end **62** of the spring **61** abuts the underside of the top wall **47** of the stationary vane **43** while an opposite end **63** abuts the underside of pin **60**.

Thus the movable vane **38** is constantly biased radially inwardly and the follower arm **57** is constantly biased axially upwardly.

In order to selectively control the positioning of the movable vanes **38**, an adjustment cap **64** is threaded on the upper end **31** of the agitator shell **30**. A radial wall **66** is formed within a shroud **67** at the lower end of the cap **64** and serves an as abutment wall or stop for each of the follower arms **57**, an upper end **68** of each of which is constantly biased into abutting engagement therewith by the torsion springs **61**.

Thus, as the adjustment cap **64** is threaded downwardly on the agitator shell **30** the adjustable vanes **38** are moved radially outwardly toward their fully extended position. When the adjustment cap **64** is threaded in an opposite direction the vanes **38** are biased toward their retracted positions.

In order to provide a visual indication of the appropriate direction of rotation of the adjustment cap **64** a medallion or the like disc-shaped member as indicated at reference numeral **69** in FIGURE 4 having suitable indicia thereon may be mounted on a top surface **70** of the adjustment cap **64**.

Thus described, it will be understood that the invention comprises an agitator assembly for a washing machine including a rotatable agitator shell, agitation vanes or vane extensions carried on the shell and movable between limiting positions of adjustment, biasing means for constantly biasing the movable vanes toward one of the positions of adjustment, an adjustable stop means for selectively adjusting the spacing of the movable vanes from one of such limiting positions. The adjustment mechanism comprises an axially movable adjustment cap and a cooperating linkage interposed between the adjustment cap and the movable vanes and comprising a spring biased bell crank and follower arm biased against the adjustment cap to ensure positive control in the adjustment of the movable vanes.

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 warranted 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. An agitator assembly for a washing machine comprising,

a rotatable agitator shell having an axis of rotation,

an agitator vane carried on said agitator shell and movable radially between first and second positions,

biasing means including a spring for biasing said vane toward one of said positions,

follower means operatively connected to said vane and carried on said agitator shell for axial movement in response to radial movement of said vane, and

axially adjustable stop means mounted on said agitator shell and in abutting engagement with said follower means for positioning said follower means against the bias of said spring and for selectively adjusting the spacing of said vane from said one of said positions.

2. The agitator asesmbly as defined in claim **1** wherein said one of said positions is situated radially inwardly of the other of said positions with respect to said agitator shell.

3. The agitator assembly as defined in claim **1** wherein said adjustable stop means comprises an adjustment cap selectively axially positionable with respect to said agitator shell.

4. The agitator assembly as defined in claim **3** and including additional ones of said spring biased vanes and additional ones of said follower means operatively connected to said vanes and in abutting engagement with said adjustment cap for simultaneous adjustment of the spacing of all of said vanes in response to axial adjustment of said adjustment cap.

5. The agitator assembly as defined in claim **1** wherein said biasing means comprises a torsion spring mounted on said agitator shell and operatively interposed between said agitator vane and said follower means.

6. The agitator assembly as defined in claim **5** wherein said biasing means further comprises,

a bell crank, and

a pin mounted on said agitator shell at right angles to the axis of said agitator shell and mounting said bell crank for pivotal movement thereabout between first and second positions thereof,

said spring being operative to urge said bell crank toward one of said positions thereof.

7. The agitator assembly as defined in claim **6** wherein said torsion spring is coiled around said bell crank mounting pin.

8. An agitator assembly for a washing machine comprising,

a rotatable agitator shell,

an agitator vane movably mounted on said agitator shell,

a bell crank mounted for pivotal movement on said agitator shell and having a pair of legs extending in angularly spaced relation from the pivotal axis thereof with one of said legs operatively connected to said vane, and

adjustment means connected to the other of said legs controlling pivotal movement of said bell crank and corresponding movement of said vane.

9. The agitator assembly as defined in claim **8** and including guide means for guiding said vane for rectilinear radial movement only.

10. The agitator assembly as defined in claim **8** including a pin for mounting said bell crank for pivotal movement on an axis extending at right angles to the axis of said agitator shell.

11. The agitator assembly as defined in claim **10** wherein said adjustment means comprises an axially extending follower arm connected to said other of said legs, and means for controlling the axial disposition of said follower arm.

12. The agitator assembly as defined in claim **11** wherein said controlling means comprises axially adjustable stop mens for controlling the movement of said follower arm in one axial direction.

13. The agitator assembly as defined in claim **12** wherein said controlling means further comprises biasing means including a spring for biasing said follower arm in an opposite axial direction.

14. The agitator assembly as defined in claim **9** wherein said one of said legs is longer than the other of said legs to provide for greater movement of said vane for each increment of pivotal movement of said bell crank.

15. The agitator assembly as defined in claim **14** and including a cooperating slot and a follower pin movable in said slot formed on said vane and on said one of said legs to accommodate rectilinear movement of said vane in response to pivotal movement of said bell crank.

16. In a washing machine,

a drive shaft,

an agitator shell driven by said shaft,

a radially extendible vane engageable with said agitator, and

means for adjusting the radial extension of said extendible vane including,

an adjusting cap movable longitudinally relative to said agitator shell,

a follower arm having first and second ends,

a bell crank pivotally mounted on said agitator shell and having a first leg connected to said extendible vane and a second leg connected to said second end of said follower arm, and

biasing means for biasing the first end of said follower arm into continual engagement with said adjusting cap whereby the longitudinal disposition of said adjusting cap establishes the amount of radial extension of said extendible vane.

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WILLIAM I. PRICE, *Primary Examiner.*

IRVING BUNEVICH, *Assistant Examiner.*