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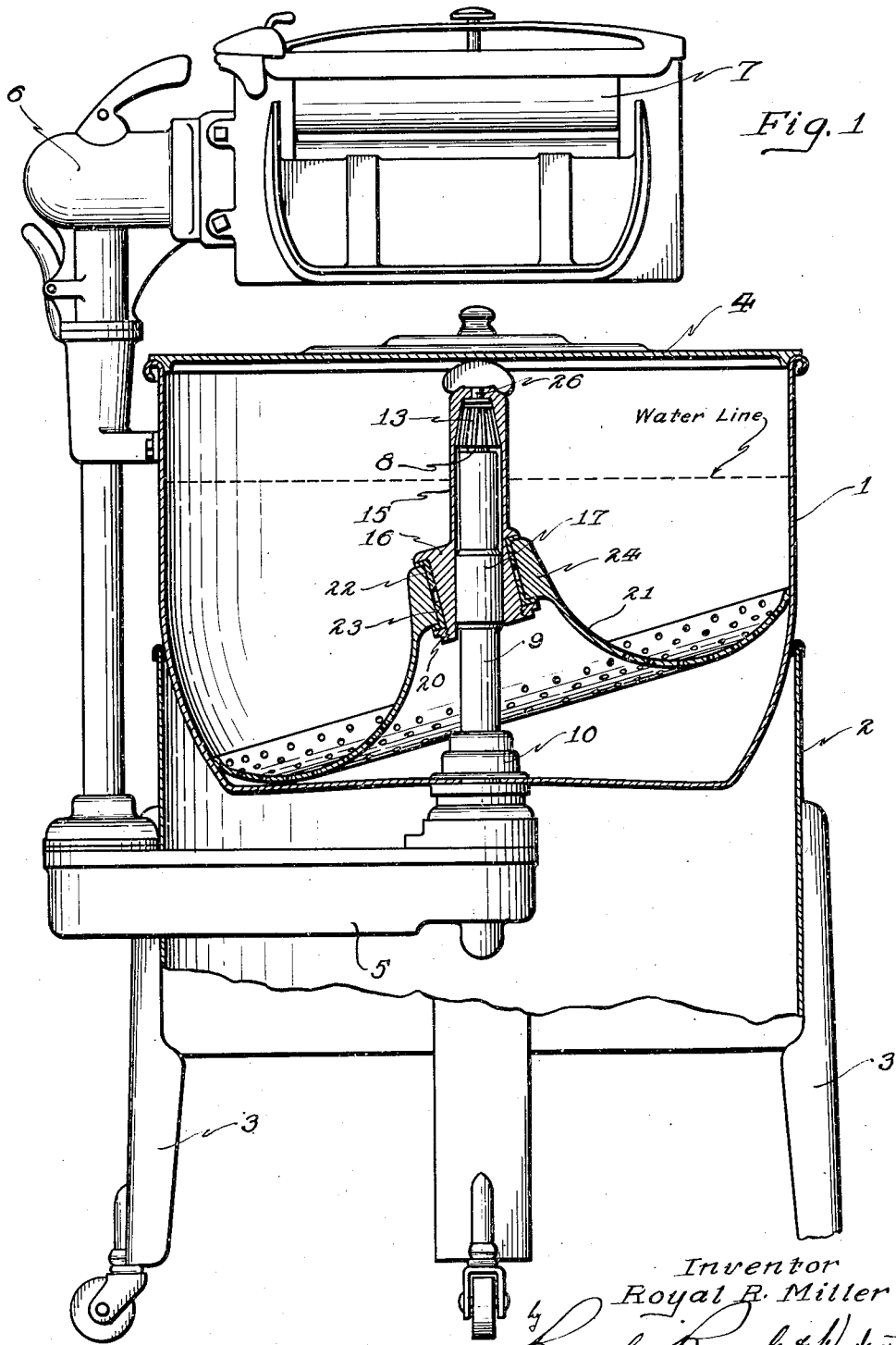
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2,138,501

WASHING MACHINE

Filed Dec. 26, 1935

3 Sheets-Sheet 1



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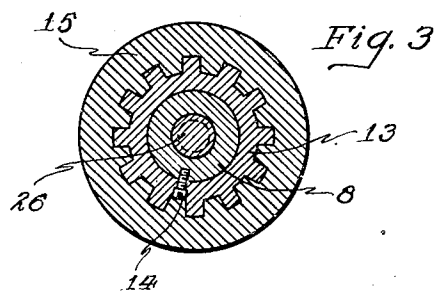
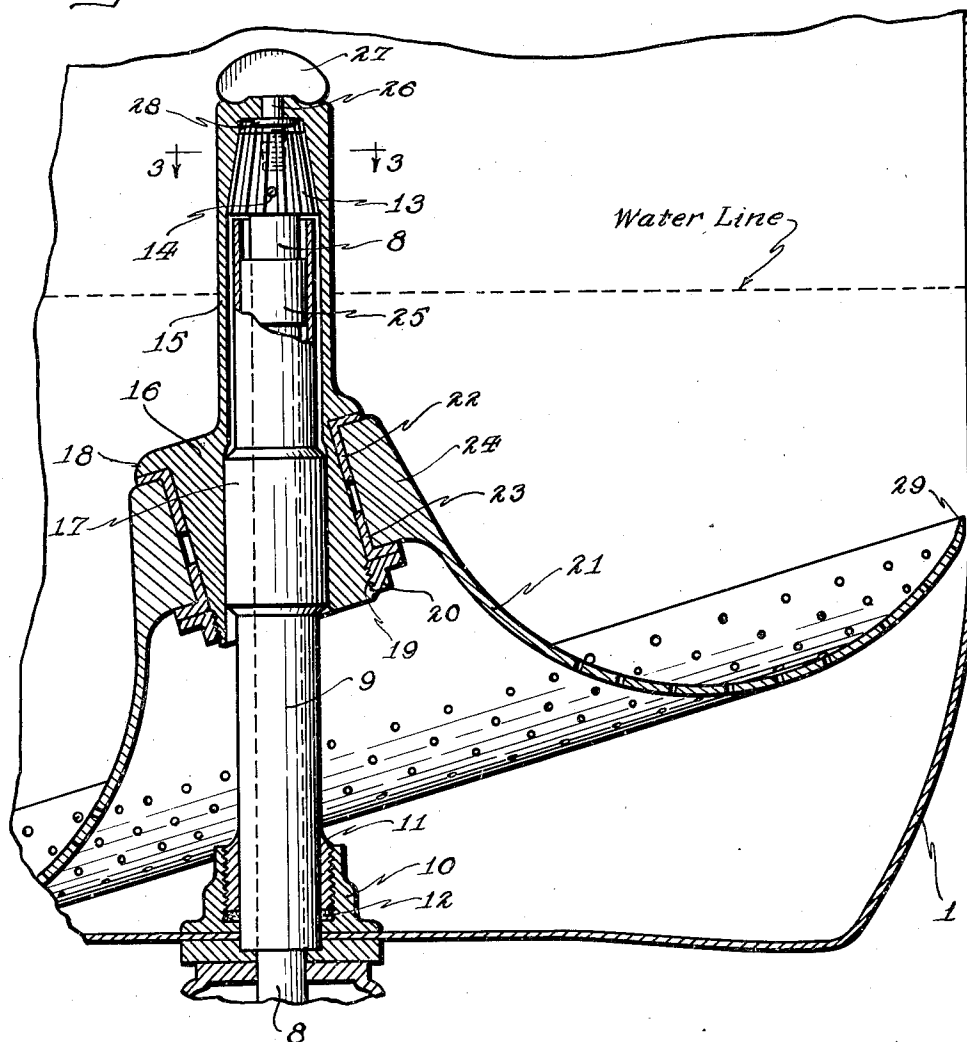
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Fig. 2



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Fig. 4

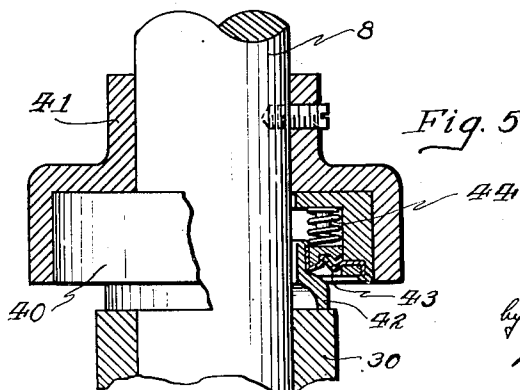
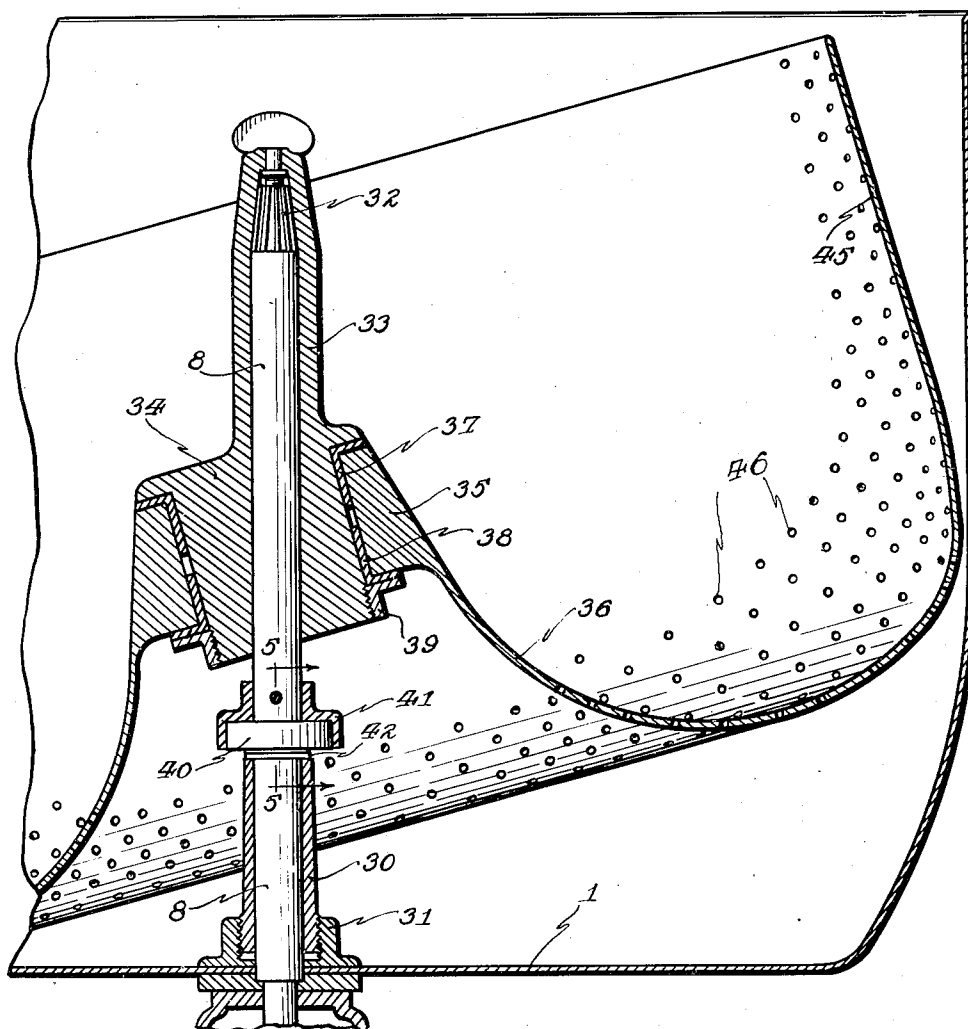


Fig. 5

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UNITED STATES PATENT OFFICE

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WASHING MACHINE

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Application December 26, 1935, Serial No. 56,192

11 Claims. (Cl. 68—152)

This invention relates to washing machines of the rotating agitator type and particularly to washing machines of the type disclosed in my copending application, Serial No. 9803, filed March 7, 1935, wherein a rotatable agitator is arranged to gyrate about a fixed vertical axis while simultaneously oscillating pendulously about a fixed point on the said vertical axis. This application is a continuation in part of the said copending application Serial No. 9803, filed March 7, 1935.

The main objects of this invention are to provide an improved mounting for gyratory oscillating agitators; to provide an improved actuating arrangement for such agitators; to provide an improved and simplified mounting and actuating arrangement for such agitators; to provide a mounting arrangement for such agitators having a simplified arrangement for preventing leakage of water along the drive shaft; to provide a washing machine of the gyratory oscillating agitator type having an improved bowl or tub-shaped agitator; to provide such a washing machine wherein an improved suspended-tumbling action is had upon the material being washed in the device; and to provide an improved method of mechanically washing articles of clothing.

Specific embodiments of this invention are shown in the accompanying drawings wherein:

Figure 1 is a view partially in section showing the improved washing machine in vertical elevation.

Fig. 2 is an enlarged fragmentary sectional view showing the agitator mounting and actuating arrangement in detail.

Fig. 3 is a sectional view taken on line 3—3 of Fig. 2, showing the arrangement for connecting the agitator actuating means and the drive shaft.

Fig. 4 is an enlarged sectional view showing a modified arrangement of agitator mounting and actuating means and showing also a modified form of agitator.

Fig. 5 is a sectional view taken on line 5—5 of Fig. 4 showing in detail an improved arrangement for preventing leakage of water along the agitator drive shaft.

In the form shown in the drawings, my improved washing machine comprises a tub or water bowl having a generally spherical side wall at its lower portion and a circular bowl or tub-shaped agitator rotatably mounted upon a vertical central shaft extending through the bottom of the tub, the agitator being journaled upon a bearing or journal fixedly mounted angularly on the drive shaft so as to impart a gyratory

oscillating motion to the agitator when the shaft is rotated.

Such agitator motions have been heretofore obtained by mounting the agitator upon an angular shaft carried by a crank arm extending laterally from a central shaft, the angular shaft being gyrated about the central shaft through rotation of the crank arm. In the present invention, however, the same motion is obtained by a simplified arrangement in which the crank arm and the angular shaft have been eliminated, thus providing an efficient mechanism that is less costly to manufacture.

As shown herein the present invention is embodied in a washing machine of well-known design, wherein a water bowl or tub 1, having a substantially flat bottom and a side wall extending upwardly therefrom, is mounted in a circular base portion 2 supported on suitable legs 3 and arranged to hold the tub in an elevated position relative to the floor upon which the machine stands.

The side wall of the tub 1 is generally spherical in form in the portion adjacent the tub bottom and becomes cylindrical at its upper portion; and the spherical lower portion is substantially housed within the base portion 2 so that the machine as a whole has a generally cylindrical appearance, a suitable cover 4 being provided for the top of the tub 1.

As shown in Fig. 1 a drive casing 5 is housed in the base portion 2 and the agitator drive shaft extends upwardly from the drive casing 5 through the bottom of the tub 1. The casing 5 is arranged to extend through one side of the base portion 2 for connection with the drive mechanism 6 of a wringer 7 suitably mounted on the side of the washer.

As shown in Fig. 2 the agitator drive shaft extends upwardly into the tub 1 through a hollow sleeve or tube 9 which is secured in the bottom of the tub 1 in any suitable manner that will provide ample support for the sleeve 9 and at the same time prevent leakage of water through the bottom of the tub. Due to the fact that in this arrangement the sleeve 9 carries a substantial part of the lateral load or thrust imparted by the agitator, it is necessary that the fastening to the bottom of the tub be of sufficient size and design to prevent bending or breakage of the sleeve 9; and the particular means illustrated in Fig. 2 comprises a hollow internally threaded flanged fitting 10 which is suitably fastened to the bottom of the tub and through which the shaft 8 and the sleeve 9 extend.

A circular externally threaded nut 11 secured on the sleeve 9 is arranged for threaded engagement with the fitting 10; and a packaging 12, disposed within the fitting 10, is pressed about the sleeve 9 to seal the joint against the passage of water by the clamping action of the nut 11 as it is screwed into the fitting 10.

As shown, the sleeve 9 extends upwardly to a point well beyond the upper limit of the water level in the tub 1, so as to obviate the possibility of water flowing into the end of the sleeve and passing downwardly along the shaft 8. The shaft 8 projects upwardly through the sleeve 9 beyond the upper end thereof and a tapered splined head 13 is secured on the upper end of the shaft by means of a set screw 14.

The agitator mounting means, as shown in Fig. 2, comprises a hollow member having sleeve-like portion 15 arranged to be placed telescopically over the end of the sleeve 9 and carrying at its end an enlarged cylindrical arbor or journal 16 arranged with its body disposed eccentrically relative to the axis of the sleeve-like portion, the axis of the arbor or journal being at a predetermined angle relative to the axis of the sleeve member 15. The bore of the agitator mounting means extends from the lower end of the journal or bearing 16 to a point adjacent the upper end of the sleeve-like portion 15 and while the bore of the journal 16 is co-axial with the bore of the sleeve-like portion 15, it is of somewhat greater diameter in the journal or bearing portion to receive a bushing 17 which is secured on the outside of the sleeve 9.

The upper end of the portion 15 is closed and the upper end of the bore thereof is inwardly tapered and splined to receive the tapered splined head 13 secured on the end of the shaft 8. The splined interfitting of the head 13 and the end of the bore of the portion 15 provides a positive driving connection between the shaft 8 and the agitator mounting means.

The journal or bearing 16 is provided with an annular flange 18 at its upper end and its lower end is externally threaded as at 19 to receive a flanged nut 20 by means of which an agitator 21 is secured on the journal 16. A pair of oppositely-disposed externally-flanged bushings 22 and 23 are disposed on the outside of the journal 16 to provide a bearing surface for hub 24 of the agitator 21, the hub 24 being freely rotatable on the bushings 22 and 23.

As shown in Fig. 2 the lateral thrust of the agitator 21 is carried by the sleeve 9 on which bushing 17 is mounted and a bushing 25 is also provided between the shaft 8 and the inner surface of the sleeve 9 at a point adjacent the upper end thereof, so that the entire assembly is free from any looseness or play.

As aforesaid the sleeve-like portion 15 is secured to the shaft head 13 by means of the interfitting of the splined portion of the head 13 and the end of the portion 15. However, a screw 26, extending through the end of the portion 15 and into a threaded bore in the end of the shaft 8, is provided to draw the sleeve-like portion 15 onto the head 13. The screw 26 is provided with a winged head 27 by means of which it may be manually turned and is rotatably fastened in the end of the portion 15 by means of a fixed collar 28 which engages the portion 15 at the end of its bore.

Thus, upon assembling the agitator 21 and its mounting means to the shaft 8, the journal portion 16 is placed over the end of the shaft and

dropped downwardly over the sleeve 9 until the head 13 engages the tapered, splined end of the sleeve-like portion 15. The screw 26 is then brought into threaded engagement with the aforesaid bore in the end of the shaft 8 and screwed into the same to draw the member 15 downwardly into firm engagement with the head 13.

The screw 26, because of the collar 28 which prevents separation of the screw and the mounting means, also serves to separate the mounting means from the head 13 when it is desired to remove the mounting means and agitator. The screw, because of its great leverage, readily forces the head 13 out of the tapered end of the portion 15 of the mounting means, so that the entire mounting means and agitator assembly can be lifted off the shaft 8 by hand.

The agitator 21 is mounted on the journal or bearing 16 before the mounting means is placed on the shaft 8 and in assembling the agitator 21 to the journal 16, the bushing 22 is first placed in position with its flange engaging the flange 18, then the hub 24 of the agitator is placed over the bushing 22 after which the bushing 23 is inserted in the space between the hub 24 and the journal and the nut 20 threaded on to the end of the journal 16 into engagement with the flange of the bushing 23. The parts are then drawn together until the point is reached where free play axially of the hub 24 is eliminated and the agitator 21 is still freely rotatable on the bushings 22 and 23.

All of the bushings used in the constructions herein shown are preferably made of a metal alloy upon which water will serve as a lubricant; thus obviating the use of any oil or grease within the interior of the tub 1.

The agitator 21 shown in Figs. 1 and 2 is of substantially the same form as disclosed in my before-mentioned copending application, particularly Fig. 1 thereof, the only difference being in the form and arrangement of the agitator hub. As shown the device comprises a circular dish-shaped element having a raised center portion in which the hub 24 is formed and an upwardly curved side wall terminating, below the level of the hub 24, in an annular margin 29.

In operation the agitator 21 will gyrate and oscillate about a fixed point determined by the intersection of the axis of the journal or bearing 16 and the axis of the drive shaft 8, due to the eccentric and angular arrangement of the journal 16 relative to the mounting means as a whole and the shaft 8. The arrangement is also such that the point of intersection of the axes of the journal or bearing 16 and the shaft 8 is the spherical center of the curved lower portion of the tub 1 so that during oscillating movement of the agitator the margin 29 thereof will follow the curvature of the tub wall and always be spaced the same distance therefrom. The proportions of the agitator 21 are preferably such that the margin 29 will be spaced approximately 1/8th of an inch from the wall of the tub.

In the modified form of mounting arrangement shown in Fig. 4, the shaft 8 extends upwardly through the bottom of the tub 1 in the same manner as shown in Fig. 2. However, the shaft 8 extends through a relatively short heavy sleeve or tube 30 which is screwed into an internally threaded flanged fitting 31 suitably secured to the bottom of the tub. The shaft extends upwardly toward the top of the tub 1 and its upper end 32 is tapered and splined instead of being

provided with a separate tapered and splined head.

The agitator mounting means, which comprises a sleeve-like portion 33 having an eccentric journal 34 at its lower end, is also of substantially the same shape as the mounting means shown in Fig. 2, except that its bore is the size of the shaft 8 so that both the sleeve-like portion 33 and the journal 34 directly engage the shaft 8.

The hub 35 of agitator 36 is mounted on the journal 34 in the same manner as shown in the arrangement of Fig. 2, there being two bushings 37 and 38 between the journal 34 and the hub 35 and a locking nut 39 to hold the agitator in place.

Leakage of water between the shaft 8 and the sleeve 30 is prevented by means of a seal 40 carried in a cup-shaped housing 41 suitably mounted and secured on the shaft 8. In this arrangement, there is a metal sealing ring 42 carried by a flexible diaphragm 43 which in turn is secured to the outer shell of the seal 40. The sealing ring 42 directly engages the end of the sleeve 30 which is suitably faced to provide a plane bearing surface for the sealing ring 42. The ring 42 frictionally and rotably engages the faced end of the sleeve 30 and is urged toward the same by spring 44.

The modified agitator 36, shown in Fig. 4, is itself a circular tub or basket-shaped element having side walls 45 extending upwardly a considerable distance beyond the hub 35. The lower portion of the side wall 45 has a spherical contour similar to that of the lower portion of the side wall of the tub 1 and the clearance between the side wall 45 and the wall of the tub 1 is such that there will be no contact between the agitator and the tub. As indicated, the entire surface of the agitator, comprising both the bottom and side wall area, is perforated, as at 46, to permit the ready flow of water into and out of the agitator as it is gyrated and oscillated about the point of intersection of the shaft and journal axes.

The operation of the agitator 36 is substantially the same as that of the agitator 21 shown in Fig. 1 with the exception that the high side wall 45 of the agitator 36 causes a greater quantity of water to be lifted and directed toward the center of the washer. This provides a more rapid movement of the material being washed and increases the tumbling action of the same as it is directed from one portion of the agitator to another.

In the operation of each of the devices herein shown, the shaft 8 is rotated, by suitable mechanism not shown; first in one direction and then in the opposite direction so that an alternate back-and-forth movement of the agitator is had. The agitator mounting means is positively driven by the shaft 8 so that the journal or bearing portion, which is mainly eccentric relative to the shaft, is gyrated about the shaft axis carrying with it the agitator, and since the journal or bearing is fixed at an angle with respect to the shaft axis one portion of the agitator is always higher than the diametrically opposite portion. Thus the high portion tends to sweep back and forth angularly around the tub 1.

The agitator is, however, freely journaled on the journal or bearing portion of the mounting means and because of drag caused by water friction and the material being acted upon, the agitator will not move angularly to the same extent as the journal and often will move in one direc-

tion only despite reversal of the direction of movement of the journal. This results in a pendulous wobble movement or oscillation of the agitator about the point determined by the intersection of the axes of the journal or bearing and the shaft and the effect is a progressive wave-like motion of the agitator margin relative to the side wall of the tub 1.

In practice it has been found that the amount of rotation of the shaft 8 in either direction, before reversing, should be approximately $1\frac{1}{2}$ revolutions or turns and that the speed of the shaft be such that approximately 30 cycles per minute of back-and-forth movement are had, each cycle comprising a movement of about 405° in one direction and 405° in the opposite direction.

This speed and extent of movement of the agitator causes such a turbulation of the water in the tub that the material being washed rotates around the axis of the shaft 8 constantly and in one direction, at the same time traveling constantly from the center of the tub to the side thereof and back again in vertical substantially circular cycles. During this movement each piece, or article, of the material being washed tends also to turn over and over in a tumbling manner, in small substantially circular cycles which travel angularly about the interior of the tub as well as laterally from the center to the side and back again.

As a result of this suspended tumbling action the material being washed is subjected, somewhat, to a rubbing action arising from contact between different portions of each article as well as contact with other articles; and at the same time the washing water is forced through each part of all of the articles, passing through the interstices in the weave of the material and thoroughly washing out all particles of dirt or soil lodged therein and among the fibres of the several threads. As the agitator is vigorously oscillated, jets of water are forced upward through the perforations on the descending side of the agitator and there is a slight suction created on the ascending side. Also water is forced upwardly, in sheets along the tub wall, through the space between the agitator margin and the wall of the tub, on the descending side of the agitator, in such a manner as to direct the material across the upper portion of the tub toward the center of the same; and the force of these sheets, together with the speed of the agitator movement, is such that the agitator margin ascends and descends before such force is dissipated, renewing the upward movement of the water, so that material in the bottom of the tub next to the agitator margin is prevented from entering the space between the agitator and the tub wall during ascending movement of the agitator rim. Such jets of water and suction action cause the water to pass through the material being washed and also serve to maintain the articles in suspended state in the tub and to increase the turbulation or agitation.

With the above-mentioned speed of operation of 30 cycles per minute, it has been found that the material being washed will make one complete revolution around the drive shaft axis for each 5 cycles of oscillation of the journal and will travel thus in one direction constantly.

During such water turbulation and material agitation each article of material being washed is, due to the tumbling action, flexed many times in practically every direction. Such flexing, however, is accomplished without whipping or

snapping of the ends or edges of the articles so that there is no likelihood of danger of the ends or edges becoming distorted or frayed.

In addition to the tumbling and flexing of the articles being washed, all of the material is constantly subjected to a cushioned beating action set up by pressure variations in the entire body of water and material in the tub. The pendulous movement of the agitator causes alternate compression or packing and releasing or expansion of the material in the vertical direction, the weight of the material together with the water above the agitator providing the resistance against which the agitator acts during the compressing or packing action, resulting in a beating action similar to that had by the use of a pressure plate such as that disclosed in my before-mentioned copending application Serial No. 9803, filed March 7, 1935, but with the advantage that the beating action is cushioned by the yieldability of the mass causing the pressure variations.

Thus the weight of the material being washed is an aiding factor in the washing operation, and the washing operation is actually faster with a heavy load than with a light load. This is contrary to the results had in present washing machines in which the time required to cleanse a charge or load of material is directly proportional to the weight of the load. Furthermore, by the present invention a washing machine, having substantially the same volume capacity as an ordinary machine, can more rapidly cleanse a material load of substantially twice the weight that can be handled by the ordinary machine.

Although but two specific embodiments of my invention are herein shown and described, it will be understood that details of the constructions shown may be altered or omitted without departing from the spirit of the invention as defined by the following claims.

I claim:

1. An agitator mechanism comprising a rotatable shaft, a journal on said shaft and secured thereto to rotate therewith, and an agitator having a hub rotatably journaled on said journal, said journal being disposed relative to said shaft with its axis at a predetermined angle with the axis of said shaft and intersecting the same within the body of said journal.

2. An agitator mechanism comprising a rotatable shaft, a journal surrounding said shaft and secured thereto to rotate therewith, and an agitator having a hub rotatably journaled on said journal, said journal being disposed with its axis at a predetermined angle with the axis of said shaft and intersecting the same within the body of said journal.

3. An agitator mechanism comprising a rotatable shaft, a cylindrical journal surrounding said shaft and removably secured thereto for rotation therewith, said journal having an angular bore to receive said shaft therethrough, said bore intersecting the axis of said journal, and an agitator having a hub journaled on said journal.

4. In a washing machine comprising a tub, a rotatable shaft extending into said tub, a sleeve-like agitator mounting means telescopically positioned over the end of said shaft and secured thereto for rotation therewith, said mounting means having a journal portion surrounding said shaft and spaced from the end thereof, said journal portion being angularly disposed relative to said shaft with its axis intersecting the axis of said shaft, and an agitator having a hub journaled on said journal portion.

5. In a washing machine comprising a tub, a rotatable shaft extending into said tub, an agitator mounting means on said shaft arranged for rotation therewith, said mounting means comprising a cylindrical journal surrounding the axis of said shaft and disposed angularly relative to said shaft with its axis intersecting the axis of said shaft, and an agitator having a hub journaled and secured on said journal.

6. A washing machine comprising a bowl-shaped tub, a rotatable drive shaft extending upwardly into said tub through the bottom thereof, a hollow sleeve surrounding said shaft and secured to the bottom of said tub, said sleeve and shaft extending above the maximum water level in said tub, a sleeve-like agitator mounting means telescopically positioned over said sleeve and shaft and secured to said shaft for rotation therewith, said mounting means having a journal portion surrounding said sleeve at a predetermined distance below the end thereof, and said journal portion being disposed angularly relative to said shaft, and an agitator having a hub journaled on said journal portion.

7. A washing machine comprising a bowl-shaped tub, a rotatable drive shaft extending upwardly into said tub through the bottom thereof, a hollow sleeve surrounding said shaft and secured to the bottom of said tub, said sleeve and shaft extending above the maximum water level in said tub, a sleeve-like agitator mounting means telescopically positioned over said sleeve and shaft and secured to said shaft for rotation therewith, said mounting means having a bearing portion surrounding said sleeve at a predetermined distance below the end thereof, and said bearing portion being disposed angularly relative to said shaft, and an agitator having a hub journaled on said bearing portion.

8. A washing machine comprising a bowl-shaped tub, a rotatable drive shaft extending upwardly into said tub through the bottom thereof, a hollow sleeve surrounding said shaft and secured to the bottom of said tub, said sleeve and shaft extending above the maximum water level in said tub, a sleeve-like agitator mounting means telescopically positioned over said sleeve and shaft and secured to said shaft for rotation therewith, said mounting means having a bearing portion surrounding said sleeve at a predetermined distance below the end thereof, and said bearing portion being disposed angularly relative to said shaft with its axis intersecting the axis of said shaft, and an agitator having a hub journaled on said bearing portion.

9. In a washing machine comprising a tub, a rotatable shaft extending into said tub, an agitator mounting means on said shaft arranged for rotation therewith, said mounting means comprising a cylindrical journal surrounding the axis of said shaft and disposed angularly relative to said shaft with its axis intersecting the axis of said shaft, and a circular perforated dish-like agitator having a hub journaled and secured on said journal.

10. A washing machine comprising a tub, a rotatable drive shaft extending upwardly into said tub through the bottom thereof, a hollow sleeve surrounding said shaft and secured to the bottom of said tub, said shaft extending into said tub beyond the end of said sleeve, an agitator mounting means on said shaft arranged to rotate therewith, said mounting means comprising a journal surrounding said shaft and

disposed angularly relative thereto, an agitator having a hub journaled on said journal, and means fixed on said shaft arranged to close the end of said sleeve and prevent leakage of water therethrough.

5 11. In a washing machine comprising a tub, a rotatable shaft extending into said tub, an agitator mounting means on said shaft arranged for rotation therewith, said mounting means
10 comprising a cylindrical journal surrounding the

axis of said shaft and disposed angularly relative to said shaft with its axis intersecting the axis of said shaft, and a circular perforated bowl-shaped agitator having a raised central bottom portion and an upwardly extending side wall, said agitator having a hub in its raised bottom portion journaled on said cylindrical journal.

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