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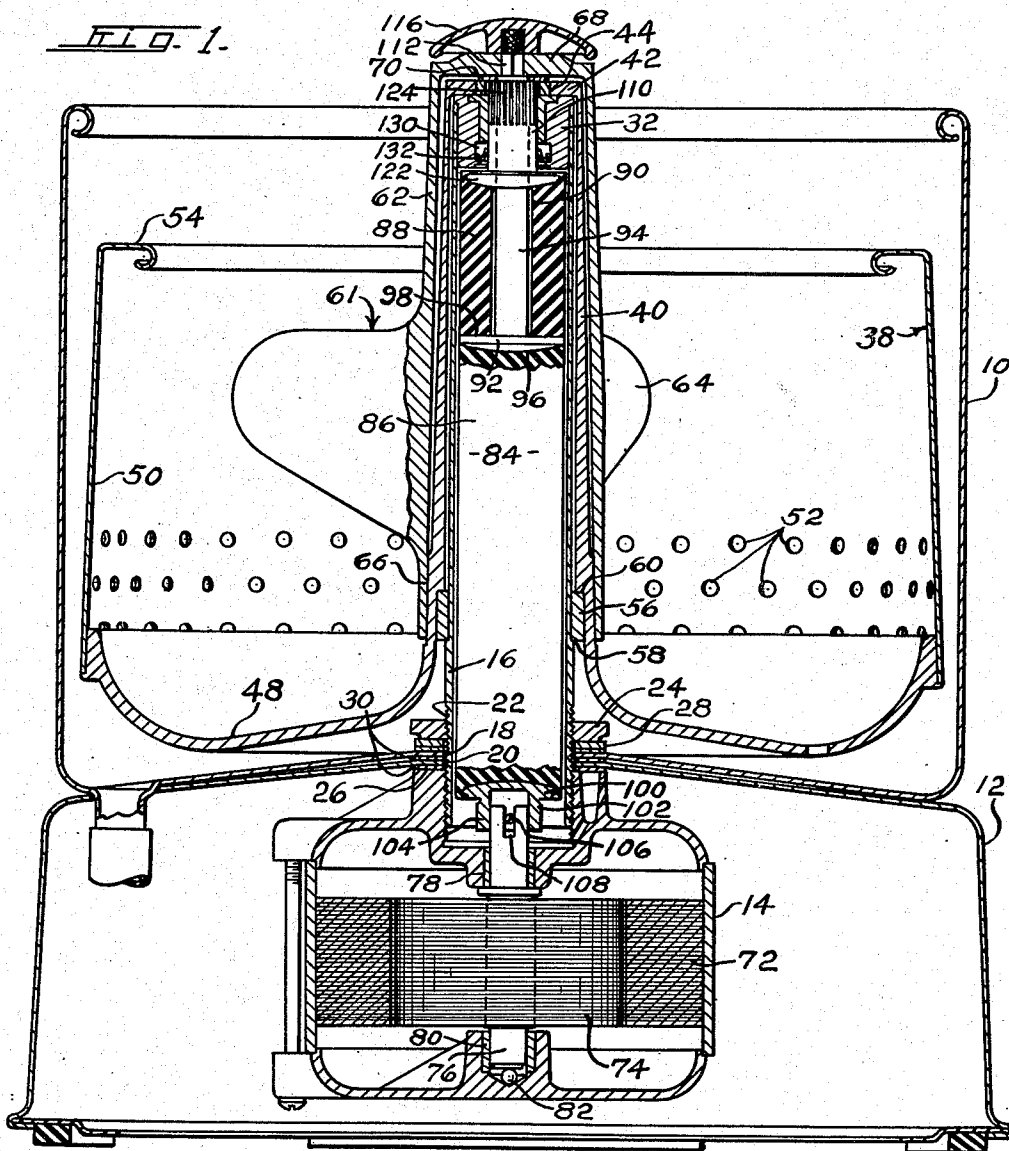
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2,660,044

WASHING MACHINE WITH DIRECT MOTOR DRIVE

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2 Sheets-Sheet 2

FIG. 2.

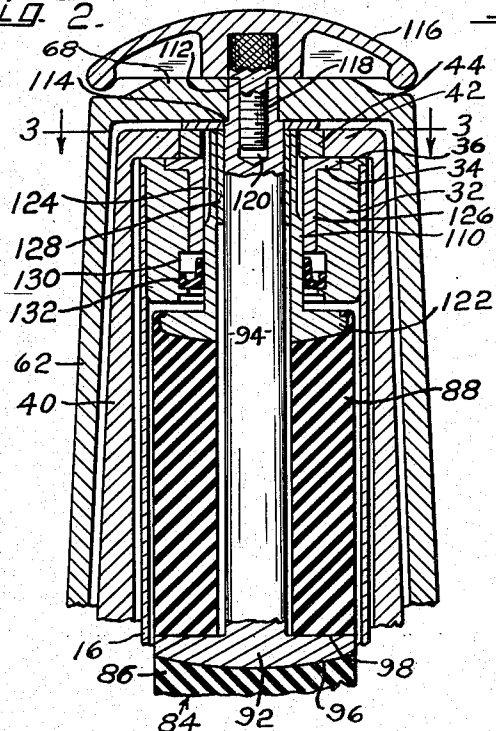


FIG. 4.

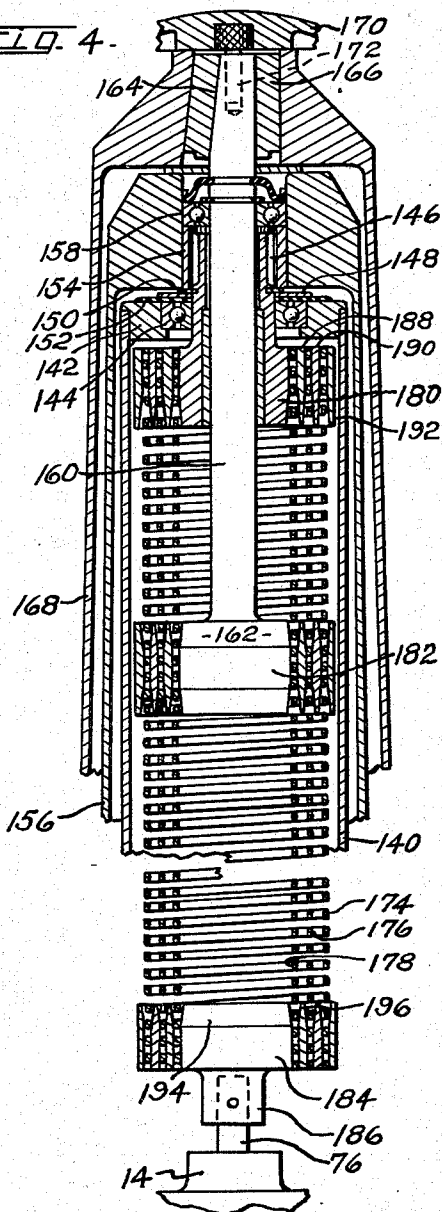
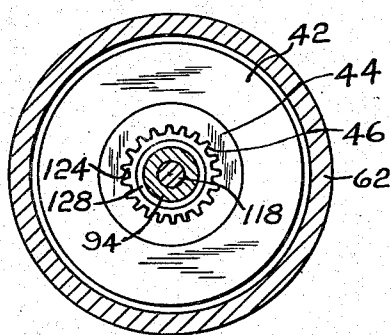


FIG. 3.



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WASHING MACHINE WITH DIRECT
MOTOR DRIVE

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10 Claims. (Cl. 68—23)

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This invention relates to washing machines, and more particularly to washing machines of the single tub type having a central oscillating agitator and a centrifugal extraction.

In washing machines of the type described, it has generally been necessary to provide two drive mechanisms, one providing oscillatory motion for agitation and the other continuous rotary movement for centrifugal extraction. Such mechanisms, deriving power from a single motor, require coupling arrangements, as well as mechanism for speed reduction and producing oscillating motion. In an application Serial No. 793,159, filed December 22, 1947, there is shown an arrangement in which oscillatory or rotary motion is derived from a single motor by a resilient drive element connected to the motor and the tub, the tub having agitating vanes, and serving to agitate by oscillatory motion and dry by centrifugal extraction resulting from continuous high speed rotation. In such arrangement, the motor itself is adapted by reason of the resilient connecting member to reverse its rotation periodically to provide the oscillatory motion and to rotate continuously in one direction to provide the continuous rotation for centrifuging.

The present invention is directed to a mechanism in which the agitator is independent of the tub and caused to oscillate with respect to the tub through a resilient coupling or link connected to a motor adapted to periodically reverse itself. The arrangement is also such that the agitator and tub may be caused to rotate together for centrifuging by the same motor, when rotated continuously in one direction. The invention is further directed to the provision of simplified means for accomplishing the above results without the use of clutches, anchoring mechanism, brakes and the like, such means being in effect a single resilient member interconnected between the motor, agitator and tub. The arrangement is such that either a desired washing action or centrifugal extraction may be had, without requiring any of the usual shifting of gears, clutches, couplings or brakes.

The above and other novel features of the invention will appear more fully hereinafter from the following detailed description when taken in conjunction with the accompanying drawings. It is expressly understood that the drawings are employed for purposes of illustration only and are not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

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In the drawings, wherein like reference characters indicate like parts:

Figure 1 is a vertical section taken through a washing machine illustrating the essential driving elements;

Figure 2 is an enlarged fragmentary sectional view of the upper end of the driving unit of Figure 1;

Figure 3 is a transverse section taken substantially on the line 3—3 of Figure 2; and

Figure 4 is a fragmentary vertical sectional view showing the application of a modified resilient coupling to the structure of Figure 1.

Referring to the drawings, and particularly to Figures 1, 2, and 3, there is shown a tub 10 mounted on a base structure 12 comprising an open bottom skirted member providing a compartment for a motor 14. The tub is supported upon the base and secured thereto by a central sleeve 16 projecting through central apertures 18 and 20 in the tub bottom and base 12. The sleeve is threaded externally as at 22, and has mounted threadedly thereon the motor 14 and a clamp nut 24. The nut 24 and the shoulder 26 on the motor, together with suitable washers 28 and spacers 30, are adapted to securely hold the tub upon the base in leak-tight fashion, and to secure the motor within the base in a central position with the axis of the motor armature aligned concentrically with the tub 10 and the sleeve 16.

The sleeve 16 extends upwardly through the tub 10, and is provided at its upper end with an annular bearing block 32, within which is a flanged bearing sleeve 34, the flange 36 of which constitutes a thrust bearing for supporting a centrifuge basket or tub 38. The basket 38 comprises a central sleeve 40 arranged concentrically around the sleeve 16. The upper end of the sleeve 40 is flanged inwardly as at 42 and is provided with an annular bearing insert 44 having internal driving splines 46. The insert 44 is rigidly secured within the intumed flange 42 by a press fit or other means. The lower end of the sleeve 40 flares outwardly to form the bottom 48 of the centrifuge basket, the latter being provided with a circular shell or side wall 50, the latter being provided with a number of apertures 52 for free flow of wash water therethrough between the tub 10 and the washing space within the basket 38. The upper end of the shell 50 is provided with an intumed beaded flange 54. The sleeve 40 is provided with an annular bearing ring 56 engaging the sleeve 16. Such ring may

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rest on a shoulder 58 in the sleeve 16, and against a shoulder 60 in the sleeve 40.

Within the centrifuge basket 38 is an agitator comprising a third sleeve member 62 having suitable agitator blades 64, preferably formed integral therewith. The agitator sleeve 62 is journaled at its lower end upon the sleeve 40 as is indicated at 66, and supported at its upper end by the integral closure 68 formed on the end of the sleeve 62, such closure or end being adapted to bear through a thrust washer or bearing 70 upon the bearing ring 44. The agitator 61 is adapted to rotate relative to the basket 38, and the basket 38 is adapted to rotate relative to the sleeve 16.

The motor 14 is provided with a stator 72 and a rotor 74, and is generally of the induction motor type having multiple poles whereby relatively low speed rotation of the rotor 74 may be had. In practice, twelve poles may be preferred whereby a rotation speed in the order of 600 R. P. M. may be had. Such a rotation speed, when coupled to the basket 38 for centrifugal extraction, provides a satisfactory extraction speed. The rotor 74 is mounted upon a motor shaft 76 journaled in motor casing bearings 78 and 80, and the end of the shaft is supported upon a ball thrust bearing 82. The motor, being of the induction motor type, is capable of having its rotor rotate in either direction, depending upon the direction of initial rotation imparted to it. Such motors are generally provided with a starting winding, normally causing initial rotation in one direction. The present motor may have a starting winding for initially starting in one direction if desired, and a further consideration of the desirability of having a starting winding or dispensing with the same will appear hereinafter.

Located within the sleeve 16 is a resilient drive means 84 comprising resilient rubber or rubber-like blocks 86 and 88, the block 86 being an elongated cylindrical member and the block 88 being likewise an elongated cylindrical member having a central bore 90 extending axially therethrough. The block 86 and the block 88 are joined together by a disk-like head 92 affixed to a shank 94 extending upwardly through the bore 90 of the block 88. The disk-like head 92 is bonded or otherwise securely fastened to the upper end 96 of the block 86, and the lower end 98 of the block 88. The lower end of the block 86 is secured to the head portion 100 of a cap-like member 102 having a sleeve 104 telescoping over the upper end of the rotor drive shaft 76. A transverse pin 106 extending across the sleeve portion 104 of the cap 102 and received in an axially extending notch 108 in the end of the shaft, provides a driving connection between the rotor shaft 76 and a resilient drive block 86.

The shank 94, extending upwardly through the bore of the resilient drive block 88, projects upwardly through a headed sleeve member 110 to the end portion 68 of the agitator 61. Such shank at its upper end is provided with a squared end 112 received in a complementary squared aperture in the end 68 so that the agitator 61 is driven from the shank 94. The squared drive portion is of somewhat reduced diameter from the diameter of the shank 94, so as to provide a support shoulder 114 against which the agitator end 68 is securely held by reason of the cap 116. The cap has a threaded shank member 118 extending into an internal threaded bore 120 in the end of the shank 94, and is adapted to thereby clamp the agitator end 68 upon the end of the shank 94. The sleeve member 110 is provided with a

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disk-like head 122 which is bonded or otherwise secured to the upper end of the drive block 88. The sleeve is also splined at its upper end as at 124 to engage the splines 46 of the bearing ring 44. The sleeve 110 is journaled in the sleeve portion 126 of the flanged bearing member 34. Within the sleeve 110 and adjacent the upper end thereof, is a bearing sleeve 128 providing a suitable bearing for the shank 94, previously described as connecting to the agitator 61. Within the annular block 32 and beneath the flange bearing 34, is an annular cavity 130 in which there is positioned an annular channel sectioned sealing ring 132 effecting a seal between the block 32 and the splined sleeve 110.

From the assembly thus described, it will be seen that the motor shaft 76 will drive through the resilient block 86, shank 94 connected to the agitator 61, and will additionally drive through the resilient block 88 to the splined sleeve 110 which is drivably connected to the basket 38. Thus, if the rotor of the motor is caused to rotate in one direction or the other, it will be seen that the resilient coupling provided by the blocks 86 and 88 will effect rotation of both the agitator 61 and the basket 38 substantially together.

This is particularly true in the absence of any substantial resistance to the rotation of the basket 38, a situation which is normally present when the tub 10 is empty.

If the tub 10, however, is filled with wash solution and laundry contained within the basket 38, there is a considerable damping effect to the rotation of the basket 38. Under such circumstances, the rotor of the motor may commence to rotate in one direction or the other, and torsionally twist the resilient drive blocks 86 and 88 before any substantial rotation of the basket 38 takes place. The rotor will thus be permitted to rotate through a turn or more, but due to the damping effect of the wash water resisting the rotation of the basket 38, the rotor will stall while the drive blocks 86 and 88 are torsionally strained. As soon as the rotor stalls, the torsional strain of the drive blocks 86 and 88 will initiate rotation of the rotor in the opposite direction. The rotor will turn a few revolutions in the opposite direction, relieving the strain or torsional twist on the drive blocks and establish a torsional twist in the opposite direction. The rotor will thereby again be stalled, whereupon the torsion set up in the drive blocks will initiate rotation of the rotor in the original direction. During the oscillatory movement of the rotor, the basket 38, by reason of the damping effect of the surrounding wash solution, will not rotate to any substantial degree in either direction. However, the agitator, which is driven by the shank 94 extending to the disk 92 located between the drive blocks 86 and 88, will be caused to oscillate. The angle through which such agitator will oscillate will depend upon the relative length of the drive blocks 86 and 88, and the angle through which the motor oscillates.

The motor may be provided with a starting winding initially causing the rotor to rotate in one direction. Such starting winding, however, will be ineffective to prevent the resilient drive blocks from stalling the rotor after rotating through a turn or so, when rotation of the basket is dampened by wash fluid. Such starting winding, however, will not be effective to prevent the stored energy in the resilient drive blocks from initiating rotation of the rotor in the opposite direction at a speed sufficient to cause the motor to

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rotate in such direction, developing torque and resulting in twisting or torsionally straining the drive blocks in the opposite direction. When the torsional strain upon the resilient blocks arrives at the value required to stall the motor, the rotor will, of course, be momentarily stopped, and the rotor will thereafter be set in rotation in the opposite direction by the combined effect of the starting winding and the stored energy in the drive blocks 86 and 88. By reason of the starting winding having a tendency to cause the rotor to turn in one direction, the strain upon the drive blocks will be slightly greater in stalling the motor against the torque induced in the rotor by the starting winding, as well as the torque resulting from the normal field winding. During the washing operation, where a starting winding is used, the agitator will oscillate through a greater angle in one direction than the other, and the basket will be caused to rotate in one direction, although such rotation will have imparted to it a slight oscillation due to the reaction effect of the drive blocks in stalling the rotor.

It will be observed that the rotor initially is free to turn in either direction except as resisted by the resilient drive blocks. In other words, the resistance to the rotation of the rotor increases from zero in proportion to the angle through which the rotor turns in twisting the drive blocks. Thus, to initially effect rotation of the armature, a relatively light starting torque in one direction is sufficient to impart initial rotation. Once rotation is started, it is resisted by the torsional twist set up in the drive block, and as soon as rotation is stalled, the rotor is set in motion in the opposite direction. Its oscillatory motion upon starting increases in amplitude with each oscillation until the maximum amplitude of oscillation is attained. Since the rotor requires little starting torque, it may be desirable to dispense with a starting winding, since starting can be effected by manually rotating the basket which will have the effect of initially setting the rotor of the motor in movement, after which the oscillatory motion will commence in the same manner as though there were employed a starting winding.

As previously described, the basket during this oscillatory motion will oscillate to a very small degree, whereas the agitator within the basket, by reason of the shank and its connection to an intermediate point in the resilient means 84, will oscillate relative to the basket and through a substantial angle whereby to agitate the wash fluid, resulting in effective washing.

When the washing operation is completed, all that is required to render the machine effective to centrifugally extract the washing fluid from the laundry contained therein, is the operation of draining the tub 10. As soon as the tub is emptied, the damping effect of the wash water upon the basket 38 is removed, so that the basket commences to oscillate through an increased angle in opposition to and in reaction to the rotor. If the motor is provided with a starting winding, the oscillations in one direction will be of increased amplitude, causing the basket, while oscillating, to also rotate in that direction. After a substantial number of oscillations, the amplitude of the oscillations in one direction will increase relative to the amplitude in the other direction, effecting an increase in average in rotation speed of the basket, and eventually as the motor increases its speed and the basket follows along, the resilient oscillatory

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effect of the drive blocks 86 and 88 will disappear, and the rotor and basket, together with the agitator, will rotate at approximately the inherent speed of the motor to effect centrifugal extraction.

If the motor has no starting winding, the spinning operation may be started by manually rotating the basket in one direction or the other, and the operation will be substantially the same as though a starting winding were provided, since once the rotor of the motor commences to turn in one direction at a greater rate of speed than it rotates in the opposite direction, the characteristics of the induction motor are such as to enhance the power applied to the rotor during its rotation in that direction with the ultimate result that the rotor and basket finally attain normal speed with the oscillation effect resulting from the resilient coupling disappearing.

In normal practice, the motor will be provided with a starting winding. If desired, the starting winding may be arranged in a circuit with a manually operable switch, whereby the starting winding may be disconnected once either the oscillatory movement or the centrifuging rotation has been effected.

The operation of the washing machine, particularly if used in conjunction with non-rinsing detergents, is relatively simple, in that once the washing operation is commenced, it is only necessary, at the proper stage, to drain the tub, whereupon the detergent will be centrifugally extracted from the laundry, following which the rotation of the basket is stopped and the laundry removed. Of course, if desired, rinsing operations may be interposed between the washing operation and the final centrifugal extracting operation, as will be well understood in the art. It may be found desirable to provide a timer control for draining the tub after an elapsed time sufficient to satisfactorily wash, whereupon the apparatus will automatically centrifugally extract. By providing additional time control means, as well understood in the art, the centrifugal extraction operation may be automatically discontinued after a proper period of time therefor.

In Figure 4, a modified form of a resilient coupling or link is disclosed in which coil springs are employed in place of resilient rubber blocks. The central supporting sleeve 140 is provided with an annular bearing block 142 supporting a thrust bearing 144. The thrust bearing in turn supports a splined drive member 146 through thrust washers 148, 150, and 152. The splined member engages an internally splined drive sleeve 154 mounted within the upper end of the basket-supporting sleeve 156. The splined sleeve 154 in turn provides support for a thrust bearing 158 adapted to support the shank 160 of the agitator drive member 162, the upper end of which is flattened as at 164 and provided with a drive block 166 upon which the agitator sleeve 168 is mounted. The agitator sleeve is held in place by a cap 170 having a shank 172 screw-threaded in the end of the shank 160. Multiple concentric coil springs 174, 176, and 178 are secured to the head 180 of the splined drive member 146 and to the head 182 of the shank drive member 162, as well as to the head 184 of the motor drive member 186. Such coil springs are rigidly secured to the members 180, 182, and 184 by concentric sleeves such as 188, 190, and 192, such sleeves being shrunk about the respective coil springs 174, 176 and 178, in order to rigidly secure the respective ends to the heads 180 and 184, respec-

tively. The coil springs at a point intermediate their length are gripped about the head 182 in a similar fashion. Each of the head members 180, 182, and 184 is relieved as at 196 to provide annular grooves radially flared so as to control the maximum deflection of the initial free turns of each of the coil springs 174, 176 and 178. By thus fixing a limit to the deflection of the initial turns, breakage of such springs due to high stress concentration at the ends or at the intermediate points where joined to the head 182 is eliminated. The construction is more particularly described in an application Serial No. 54,971, filed October 16, 1948. The operation of the modification thus described is substantially the same as that shown in Figures 1, 2, and 3, the coil springs providing a resilient coupling having substantially the same effect as the rubber blocks 86 and 88, constituting the resilient coupling 84.

It will be seen that the drive connection between the motor and the agitator and the basket constitutes in effect a single resilient element, nesting within the central sleeve 16 or sleeve 140, with the result that space requirements are minimized. It will also be seen that moving parts are minimized, and that except for bearings, there are no wearing surfaces. At the same time, the agitator and the basket may be readily removed from the tub for cleaning or inspection. The assembly is such that inspection of the driving unit may be quickly made by the mere removal of the central sleeve 16 or 140.

Although a single embodiment of the invention has been illustrated and described, it is to be understood that the invention is not limited thereto. As various changes in the construction and arrangement may be made without departing from the spirit of the invention, as will be apparent to those skilled in the art, reference will be had to the appended claims for a definition of the limits of the invention. A divisional application Serial No. 345,367, filed March 30, 1953, is directed to the resilient drive unit.

What is claimed is:

1. In combination, in a washing machine, a centrifuging tub, an oscillatable agitator concentrically arranged therein and rotatable relative thereto, a reversible induction motor, a resilient coupling having its ends connected between said motor and tub, and means drivably connecting said agitator to said coupling at a point intermediate the ends thereof.

2. In combination, in a washing machine, a base, an upstanding tubular sleeve, a reversible motor in said base having its rotor arranged coaxially with and below said sleeve, a centrifuging tub journaled on said sleeve, an oscillatable agitator rotatable relative to said tub and therewithin, a resilient connecting link between said tub and rotor extending through said sleeve, and a driving connection between said agitator and a point intermediate the ends of said resilient link.

3. In combination, in a washing machine, a tub, a centrifuging basket, an oscillatable agitator concentrically arranged therein and rotatable relative thereto, a reversible induction motor, a resilient coupling having its ends connected between said motor and basket, and means drivably connecting said agitator to said coupling at a point intermediate the ends thereof.

4. In combination, in a washing machine, a base, a tub, an upstanding tubular sleeve extending into said tub, a reversible motor in said base having its rotor arranged coaxially with and below said sleeve, a centrifuging tub journaled on

said sleeve, an oscillatable agitator rotatable relative to said centrifuging tub and therewithin, a resilient connecting link between said centrifuging tub and rotor extending through said sleeve, and a driving connection between said agitator and a point intermediate the ends of said resilient link.

5. In combination, in a washing machine, a tub having an upstanding central sleeve, a centrifuging tub journaled on said sleeve, an oscillatable agitator concentrically arranged therein and rotatable relative thereto, a reversible induction motor, a resilient coupling composed of rubber-like material positioned within said sleeve and having its ends connected between said motor and centrifuging tub, and means drivably connecting said agitator to said coupling at a point intermediate the ends thereof.

6. In combination, in a washing machine, a base, an upstanding tubular sleeve, a reversible motor in said base having its rotor arranged coaxially with and below said sleeve, a centrifuging tub journaled on said sleeve, an oscillatable agitator rotatable relative to said tub and therewithin, a resilient connecting link composed of rubber-like material extending between said tub and rotor and extending through said sleeve, and a driving connection between said agitator and a point intermediate the ends of said resilient link.

7. In combination, in a washing machine, a base, an upstanding tubular sleeve, a reversible motor in said base having its rotor arranged coaxially with and below said sleeve, a centrifuge tub having a central sleeve journaled on said upstanding sleeve, an agitator journaled on said central sleeve, a connecting link of resilient rubber-like material having its ends connected respectively with said rotor and the central sleeve and extending through said upstanding sleeve, and means for coupling said agitator to a point intermediate the ends of said link.

8. In combination, in a washing machine, a base, an upstanding tubular sleeve, a reversible motor in said base having its armature arranged coaxially with and below said sleeve, a centrifuge tub having a central sleeve journaled on said upstanding sleeve, an agitator journaled on said central sleeve, a connecting link of resilient rubber-like material having its lower end coupled to said armature and its upper end coupled to said central sleeve, said link being composed of an upper tubular member bonded to a lower member through an agitator drive head located at a point intermediate the ends of said link, and means coupled to said agitator and extending into said aperture and drivably connected to said drive head and to said link at a point intermediate the ends thereof.

9. In combination, in a washing machine, a base, a tub, an upstanding tubular sleeve extending into said tub, a reversible motor in said base having its rotor arranged coaxially with and below said sleeve, a centrifugal tub within said first-named tub and having a central sleeve journaled on said upstanding sleeve, an agitator journaled on said central sleeve, a connecting link of torsionally resilient rubber-like material extending through said tubular sleeve having its lower end coupled to said rotor and its upper end coupled to said central sleeve, the upper end having a central aperture extending to a point intermediate the ends of said link, and means coupled to said agitator and extending into said aperture

and bonded to said link at a point intermediate the ends thereof.

10. In combination, in a washing machine, a base, a tub, an upstanding tubular sleeve extending into said tub, a reversible motor in said base having its rotor arranged coaxially with and below said sleeve, a centrifuge tub within said first-named tub and having a central sleeve journaled on said upstanding sleeve, an agitator journaled on said central sleeve, a connecting torsionally resilient link extending through said tubular sleeve and having its lower end coupled to said rotor and its upper end coupled to said

central sleeve, and means drivably connecting said agitator to said link at a point intermediate the ends thereof.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,106,737	Haire -----	Feb. 1, 1938
2,279,878	Suits et al. -----	Apr. 14, 1942
2,300,013	Sampson -----	Oct. 27, 1942
2,313,984	Breckenridge et al. --	Mar. 16, 1943