Aug. 8, 1961 P. W. DOUGLAS 2,995,023

PULSATOR MECHANISM FOR WASHING MACHINES

Filed April 10, 1959 5 Sheets-Sheet 1

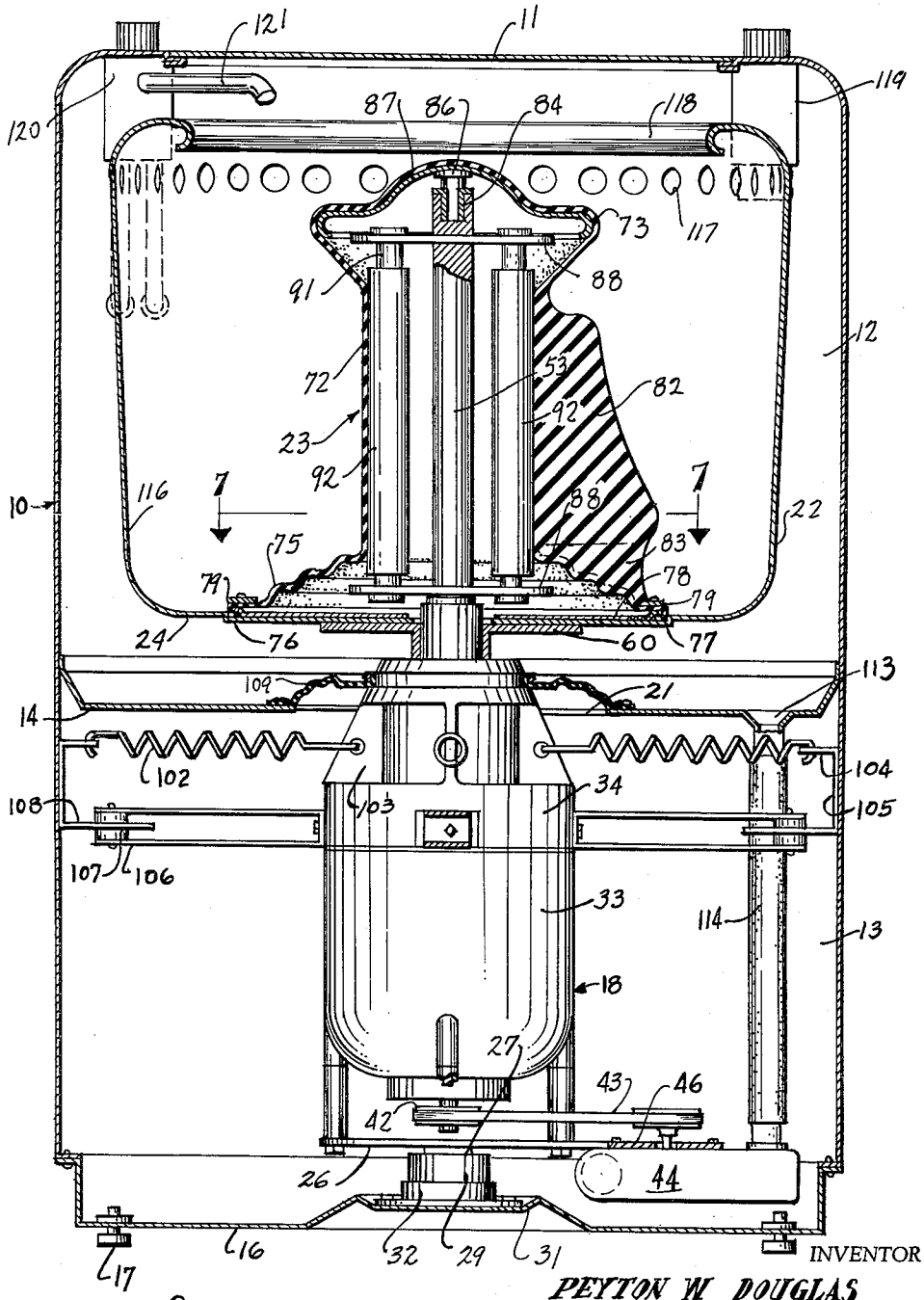

fig. 1

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PULSATOR MECHANISM FOR WASHING MACHINES

Filed April 10, 1959 5 Sheets-Sheet 2

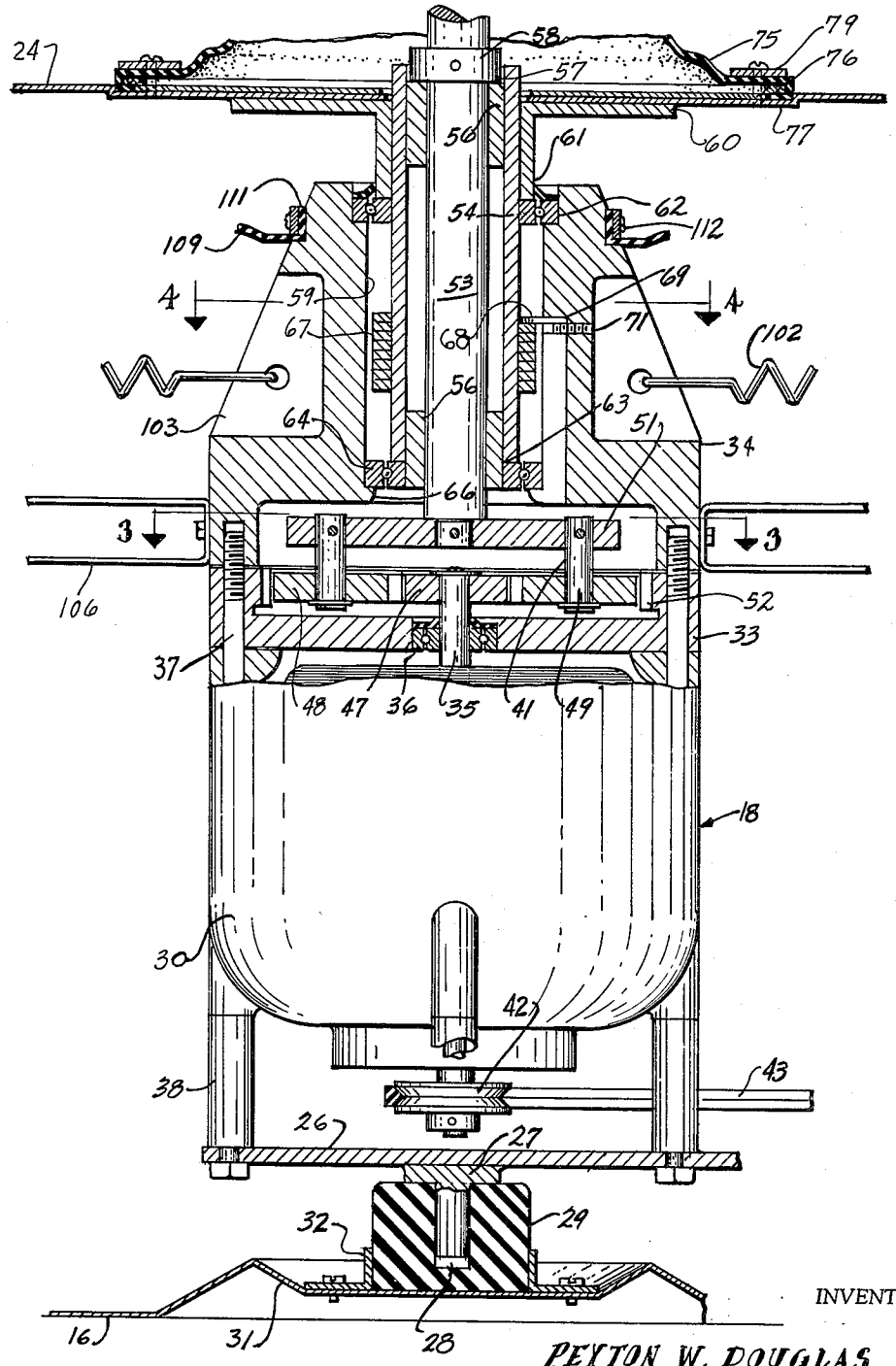

fig. 2

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PULSATOR MECHANISM FOR WASHING MACHINES

Filed April 10, 1959 5 Sheets-Sheet 3

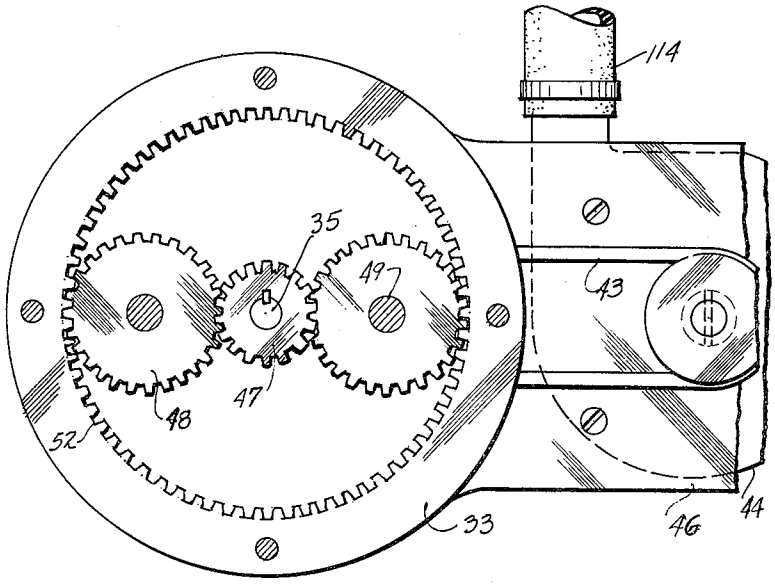

fig. 3

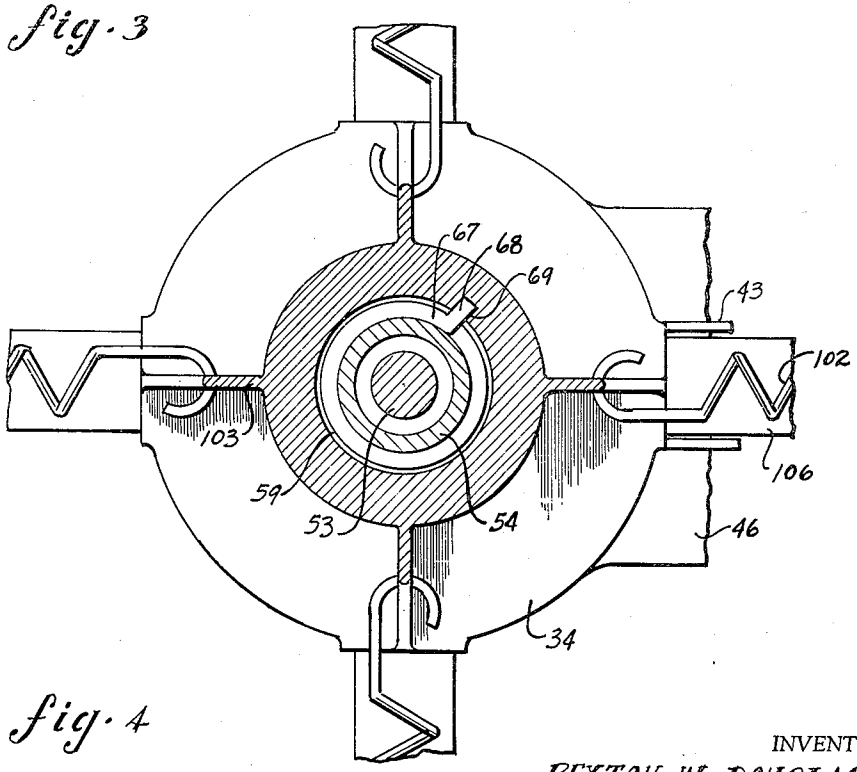

fig. 4

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PULSATOR MECHANISM FOR WASHING MACHINES

Filed April 10, 1959 5 Sheets-Sheet 4

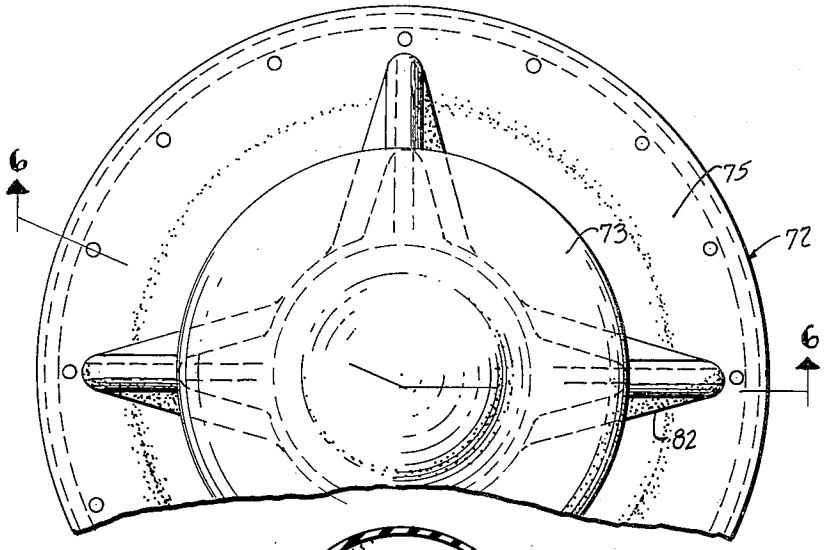

fig. 5

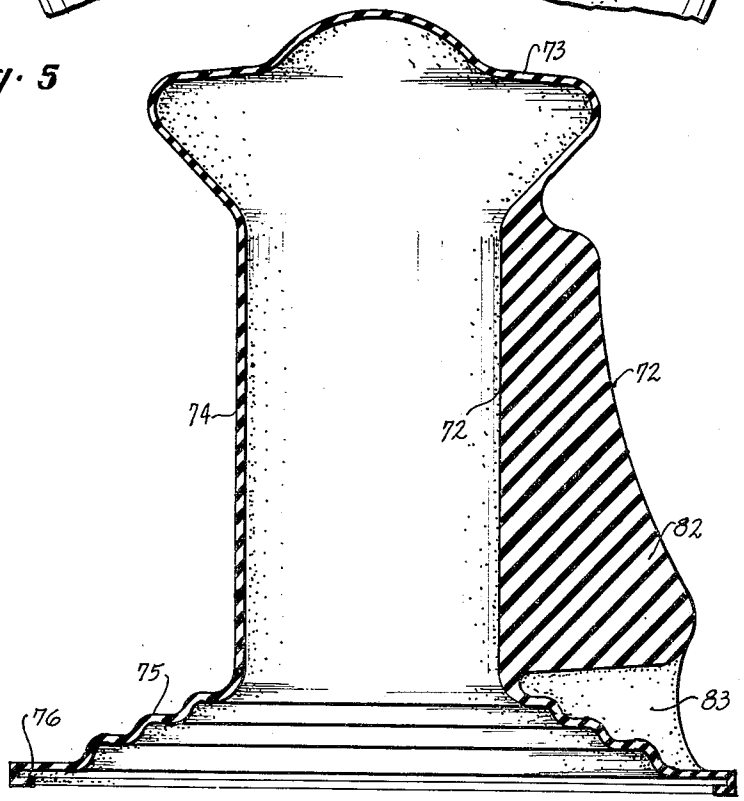

fig. 6

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PULSATOR MECHANISM FOR WASHING MACHINES

Filed April 10, 1959 5 Sheets-Sheet 5

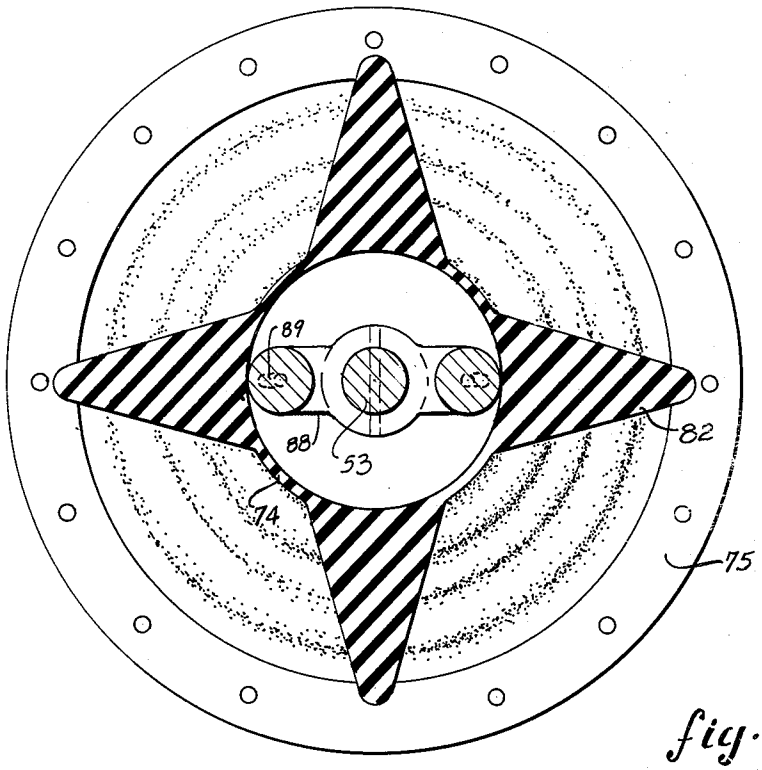

fig. 7

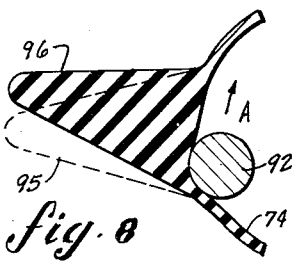

fig. 8

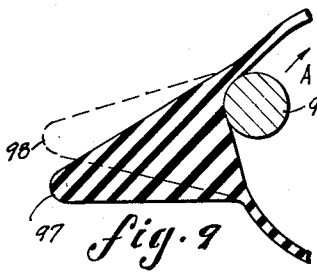

fig. 9

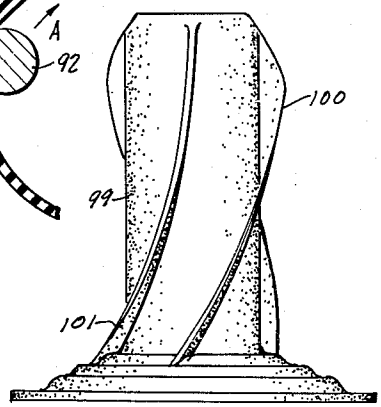

fig. 10

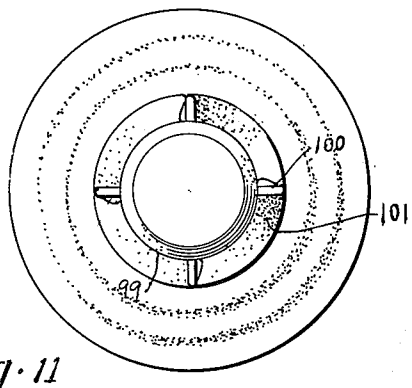

fig. 11

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United States Patent Office

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PULSATOR MECHANISM FOR WASHING MACHINES

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Filed Apr. 10, 1959, Ser. No. 805,472
24 Claims. (Cl. 68—131)

This invention relates to domestic washing machines of the type wherein a single tub is utilized for both washing and extracting operations. More particularly, the invention is directed to a single-tub machine having a pulsator operable to effect a washing operation, and is a continuation in part of my pending application Serial No. 411,233, filed February 18, 1954, and now abandoned.

Generally, washers of the domestic single-tub type include a tub and an oscillatable agitator centrally mounted therein. In these washers, the tub remains stationary during a wash period while the agitator oscillates and at the time of extraction the agitator and tub are caused to rotate together. In washers of this type it is considered necessary that, when the extraction operation commences, the agitator must be fully stopped, inasmuch as the free water in the tub is almost immediately expelled and any movement of the agitator, without sufficient water to float the clothes, would tend to trap or wedge one or more items of clothing between the relatively movable parts.

In practically all domestic washing machines equipped with an oscillatable agitator, it is necessary that the tub be filled to its specified depth before the agitator can be safely set in operation. To accomplish this, complicated controls are required and it has even been found difficult to provide controls, complicated or otherwise, which would enable changing the length of the wash cycle at the start of a tub filling operation. The reason for this, of course, is that the control is set for a definite time period for filling and the washing operation cannot commence until the end of such period. It is evident that an oscillatable agitator requires a satisfactory seal between the tub and the agitator drive and that if this seal is in any way defective, water carrying detergents may seep into the bearings or driving parts with destructive effect. Furthermore, inasmuch as the mechanism for effecting oscillator agitation is very different from that required in a spinning operation, special transmissions, reduction drives, and other operative structure of a costly nature, are required.

The present invention is directed to an extractor type washing machine and has for an important object the provision of a pulsator in lieu of an oscillatable agitator.

An important object of the invention is to be found in the fact that the pulsator, by distortion, produces washing agitation without body oscillation as occurs with conventional washer agitators.

Another object of the invention lies in the provision of a pulsator which takes the form of a hollow, impervious, central, resilient column member that is permanently secured and sealed at its base to the base of the tub in which it is mounted.

Another important object of the invention lies in the provision of mechanism within the pulsator which distends the pulsator at relatively high speed to produce a pulsating washing action within the tub.

It is also a very important object of the invention to provide a drive mechanism which not only effects operation of the pulsator but will also rotate at a speed suitable for extraction. By means of the present invention it is possible to utilize the drag upon the pulsator drive to cause gradual acceleration of the tub for extraction, of course, means being provided for holding the tub from rotating during operation of the pulsator.

It is also considered an important object, from the standpoint of economy, that the present invention, in carrying out the various steps required in laundering clothes, does so through the use of an inexpensive reduction gear, reversible motor, and overrunning clutch.

Another feature of the invention relates to the balanced construction of the operative unit which, in its entirety, is supported in the manner of an inverted pendulum and wherein vibratory forces, due to unbalanced loads in the tub, together with resulting reaction forces of the non-rotating and stationary parts, are maintained uniform in all directions and at a minimum.

It is considered an advantage of the invention that, due to the continued but gradually diminishing operation of the pulsator during initial acceleration of the tub for extraction, substantially uniform distribution of clothes within the tub is more likely to be achieved and maintained.

Other objects, advantages, and features of the invention will be more fully understood from a consideration of the following specification, taken in conjunction with the accompanying drawings; in which

FIG. 1 is a vertical sectional view of a single tub washing machine, showing, in both full line and section, a pulsator and drive mechanism embodying one form of the invention;

FIG. 2 is an enlarged view of the motor, transmission and support therefor, certain parts being shown in vertical cross section and others in side elevation;

FIG. 3 is an enlarged transverse sectional view, taken substantially on the line 3—3 of FIG. 2;

FIG. 4 is a transverse sectional view, taken substantially on the line 4—4 of FIG. 2;

FIG. 5 is a top plan view of a substantial portion of the pulsator shown in FIG. 1;

FIG. 6 is a vertical sectional view of the pulsator, being taken substantially as suggested by the line 6—6 of FIG. 5;

FIG. 7 is an enlarged transverse sectional view, taken substantially as indicated by the line 7—7 of FIG. 1;

FIGS. 8 and 9 are diagrammatic views illustrating the distorting effect of a roller on the washing pulsator;

FIG. 10 is a side elevational view of a modification of the ribs of the pulsator shown in FIG. 5; and

FIG. 11 is a top plan view of the modified pulsator shown in FIG. 10.

Referring to the drawings, and presently more particularly to FIGS. 1 and 2, the reference numeral 10 is employed to generally designate a cabinet having a top access door 11. The interior of the cabinet may be considered as divided into upper and lower compartments 12 and 13, respectively, by means of an intermediate deck 14. The walls of the compartment 12 serve as a collector tank during operation of the machine. The lower end of the cabinet is closed by a base plate 16 which is provided with leveling feet 17. In the lower compartment, a unitary housing 18 is shown which encloses a motor and reduction gearing. That portion of the housing enclosing the gearing projects upwardly through an opening 21 in the deck 14 into the compartment 12, wherein is located a wash tub 22. A pulsator 23, embodying one form of the invention, is disposed centrally of and extends upwardly from the tub base wall 24. The lower end of housing 18 is supported on a mounting plate 26 which includes an elongated boss 27 that projects downwardly into a socket 28 formed in a resilient block 29 of suitable material. The block 29 is confined in and secured to a dished portion 31 of the base plate 16 within a socket formed by an annular flanged member 32.

The housing 18, above the motor 30, may be formed in two parts, such as castings 33 and 34, the part 33 mounting a motor shaft 35 that extends through a bearing 36, this bearing taking the place of the usual upper end bell of the motor. The mounting plate 26, motor 30, and housing parts 33 and 34 are secured together by elongated bolts 37 threaded into the lower end of part 34, spacer sleeves 38 being below the motor 30 to suitably locate the entire housing above said plate. The motor is reversible in operation and the motor shaft 35 thereof projects beyond both ends, the upper end being through the bearing 36 whereby to drive a planetary reduction gearing 41, and the lower end accommodating a pulley 42 for a belt drive 43 to a pump 44 suitably supported on an extension 46 of the mounting plate 26.

The planetary gearing comprises a motor driven sun gear 47 and planet gears 48 journaled on shafts 49 carried by a spider 51. Gears 48 run in the internal gear 52 formed as a part of, or otherwise suitably fixed to, the housing part 33. An upwardly projecting shaft 53 is spider driven at a reduced speed which in practice may be about 600 r.p.m., or about a 1 to 3 reduction from a standard 1760 r.p.m. induction motor 30. The shaft 53 is journaled within a tub sleeve 54 upon upper and lower spaced bearing bushings 56, the upper of these bushings having a thrust face or shoulder 57 engaged by a thrust collar 58 affixed to the shaft 53.

The sleeve 54 is located within a bore 59 in the upper housing part 34 and extends thereabove where it is fitted with a tub support flange 60. This flange includes a depending annular shoulder 61 engaging an upper antifriction thrust bearing 62, seated in an annular recess at the upper end of the bore 59. The lower end of the sleeve 54, in conjunction with the lower bushing 56, provides an annular bearing step 63 for receiving a lower thrust bearing 64 mounted in the bore 59 and resting on an annular internal shoulder 66. Between the bearings 62 and 64, the bore 59, sufficient space is provided for the reception of a coil spring type overrun clutch, said clutch comprising a helical coil 67 formed of closely spaced resilient turns lightly engaging the exterior surface of sleeve 54. One end of this coil has a radially projecting portion 68 keyed in a slot 69 and wedged in place by a set screw 71. Engagement of the coil 67 upon the sleeve 54 is adapted to prevent rotation thereof in one direction by the prehensile gripping effect while affording free rotation of the sleeve in the opposite direction.

The shaft 53 projects upwardly through the center of the tub base 24 and within the tub is enclosed by the pulsator 23 which consists of a resilient tubular column member 72 that is closed at its upper end by a bell-like portion 73. Beneath the portion 73 the column takes the form of a straight-walled sleeve 74 which, at its lower end, terminates in a radially outwardly extending undulating base 75. The edge of this base is return-bent to provide an inwardly opening annular groove 76. The upstanding rim 77 of a disk 78, secured to the tub base 24, projects into the groove 76. A ring 79, mounted on the upper face of the base 75, clamps the edge of the base to the disk and in engagement along its periphery with the tub wall 24 in such a manner as to eliminate any possibility of the passage of liquid, contained in the tub, into the area containing the operative parts. As may be noted in FIGS. 5 and 6, the column member 72 includes a series of uniformly disposed, radial ribs 82. These ribs, from the bell shaped top portion 73 to the commencement of the flared base 75, increase in radial proportions as well as in thickness, this being clearly evident from an examination of the above mentioned figures. The lower end of each rib is made integral with the flared base 75 by a continuing rib 83 which serves to sufficiently rigidify the web without in any way interfering with the flexing thereof in operation of the machine.

The upper end of shaft 53 has a central opening in which is mounted a bushing 84. Projecting into the bushing is the small end of a headed bearing pin 86. This pin serves to support a circular metal form 87 which in turn fits the interior contour of the bell-shaped portion 73 and supports the column member in an upright position. A pair of supporting plates 88 are mounted on and secured to the shaft 53 adjacent the upper and lower ends of the straight-walled portion of the member 72. The ends of these plates are formed with radial slots 89 in which to journal the end pins 91 of a pair of rollers 92, presently shown to be positioned on opposite sides of the shaft 53. The slots 89 are of a location and length to permit the rollers 92 to take a radial inward position such that they lie within the internal relaxed vertical wall of the column member. The slots, on the other hand, extend radially outwardly to permit the rollers to move outwardly under centrifugal force when the shaft 53 is rotated at the speed indicated. The vertical wall 74 of the column member is of such resiliency as to yield to the centrifugal force of the rollers rolling on the internal surface thereof, and the effect is to produce opposed lengthwise radial bulges in the vertical wall, these bulges traveling about the column at the circumferential speed of the rotating shaft 53 therewithin. While the slots could be eliminated by positioning the rollers in position to positively distort the column, the slots permit the vertical wall to relax to normal shape and permit centrifugal force to nicely balance the degree of pulsations produced. While two rollers are shown, any balanced number, such as three, could be employed, thereby producing 50% more pulsations per revolution of the drive shaft, or the same number with a lower shaft speed.

When the shaft 53 is rotated, the rollers 92 move radially outwardly and, when passing behind the ribs 82, rock them in the manner illustrated in FIGS. 8 and 9. For example, the rib which normally lies in the dotted line position 95 (FIG. 8), will be rocked to the full line position 96 as the roller approaches the rib in rotating in the direction of the arrow A. When the roller passes beyond the rib, as in FIG. 9, the rib shifts to the position shown in full lines at 97, and thereafter returns to the normal position shown in dotted lines at 98, when the roller has passed beyond its sphere of influence. Since the tub and column member are required to be held stationary during an agitation operation, by rotating the motor shaft 53 in a direction tending to cause the coil spring clutch to hold the tub and column member stationary, the effect is to provide high frequency pulsations upon clothes suspended in a wash solution within the tub. The frequency of these pulsations is of course twice the rotational speed of the shaft 53 by reason of the provision of two rollers. It will be evident that as each roller moves behind the base of a rib, a progressive flexing of the rib occurs and such flexing will have a light scrubbing action upon any clothes momentarily coming in contact therewith.

Attention is now directed to FIGS. 10 and 11 wherein a slight variation of the rib arrangement on the column member is shown. In this instance, the column member 99 is provided with a plurality of lengthwise radially extending ribs 100 which are spiraled about the column and particularly at their lower ends 101. It is contemplated that in the use of this form of column member the rib 100, as a roller moves behind the spiral portion thereof, will create a progressive flexing of the rib from one end to the other by which to produce additional liquid turbulence within the tub.

It is contemplated that the ribs and webs described as extending radially from the tubular wall of the pulsator 23 or 99 may be eliminated. Inasmuch as the pulsator walls must be radially distorted to flex the ribs, it is believed that such progressive distortions will, of themselves, create sufficient turbulence to satisfactorily create a washing action. It is to be noted that such flexing of the pulsator can, in nowise tear, stretch or otherwise impair even the most delicate fabrics during a washing op-

eration. With or without ribs the pulsator may be caused to flex at any relatively high frequency to create a washing turbulence best suited to any given fabrics.

Referring again more particularly to FIGS. 1 and 2, it will be noted that the entire structure of the invention is in effect an inverted pendulum resiliently held in a vertical position by a plurality of radially constraining springs **102**, tensioned between webs **103** on the housing part **34** and the upper flange **104** of a U-shaped angle member **105** mounted on the inside cabinet wall beneath the deck **14**. Friction damping devices, comprising resilient return-bent members **106** secured to the upper part **34** of the housing **18**, are provided with friction pads **107** which engage opposite surfaces of the flange **108** of the angle member **105**. The central opening **21** in the deck **14** is provided with a corrugated annular boot **109**, the inner periphery of which is secured in an annular groove **111** on the part **34** by means of a clamping ring **112**. The deck **14** may slope slightly toward a constantly open drain outlet **113** which, through a suitable hose **114**, is connected to the pump **44**.

The tub **22** is adapted to rotate at high speed when the direction of rotation of the motor is reversed, the tub rotation being no longer restrained by the coil spring clutch. The tub preferably has a slightly outwardly inclined side wall **116** that culminates in a series of overflow ports **117** adjacent the inturned rim **118**. During a spinning operation, liquid will travel upwardly of the wall **116** to the ports **117** and will be thrown into the upper compartment **12** formed jointly by the cabinet walls and the deck **14**. Of course, when water is splashed on the cabinet walls, it flows downwardly onto the deck **14** and passes through the outlet **113** into the pump **44**. It is pointed out that when the motor rotates in a direction to effect a spinning operation, the rollers **92** within the column member create a drag upon this member so that gradual acceleration results, the tub eventually picking up to a speed of rotation approximately the same speed as rotation of the shaft **53**.

It will be appreciated that the unit as a whole is balanced both with respect to the rotating parts and the stationary parts so that during acceleration of rotation of the tub, any unbalanced load deflection in any direction is uniform during such acceleration to the critical speed, after which the spinning tub finds its center of mass and spins substantially free of vibration with the non-rotating parts balanced for uniform reaction in all directions.

Of course, any suitable control, such as a sequence timer **119**, may be provided to first cause the tub to be filled through the hot and cold water control valve **120** and spout **121**. Upon completing filling the tub, the timer sets the washing mechanism in operation and after a determined period of time, a brief spinning operation takes place. Thereafter, a rinse and final spin may serve to complete the washing cycle. In any such cycle, the motor is merely reversed for each spin period.

Although applicant has shown and described only one form of a mechanism for use in a single tub extractor washing machine and two forms of a pulsator, it will be understood that variations in the construction and arrangement of the parts may be made without any any way departing from the spirit and scope of the invention insofar as such variations are encompassed by the annexed claims.

Having thus set forth my invention, what I claim as new and for which I desire protection by Letters Patent is:

1. In a washing machine having a liquid receiving tub, a hollow resilient member disposed centrally within said tub and having a base sealed to the base of said tub around an opening therein, mechanical motion means concentric with said member, and drive means beneath said tub operatively connected with said means through said tub opening, said mechanical motion means, in operation, contacting the side walls of said member to create radial impulse-like distentions in said member whereby to produce a washing disturbance of liquid contained in said tub.

2. In a washing machine having a liquid receiving tub, a generally tubular resilient column disposed centrally within said tub, the upper end of said column being closed, the base of said column being fixed to the base of said tub and surrounding an opening therein, and radially extendable driven means projecting into said column through said tub opening, said means, in operation, contacting and distending the side wall of said column to produce pulsations of a frequency determined by the speed of operation of said means.

3. In a washing machine having a liquid receiving tub, a generally tubular resilient column disposed centrally within said tub, the upper end of said column being closed, the base of said column being fixed to the base of said tub and surrounding an opening therein, rotatable means co-axial with said column and mounted therein, drive means beneath said tub operatively connected with said means through said tub opening, said means, when rotated by said drive means, distending said column in continuously rotating impulses whereby to create a washing disturbance of liquid contained in said tub.

4. In a laundry machine of the type having a tub adapted to be held against rotation during washing and adapted to be released for rotation about a vertical axis during centrifugal extraction, a generally tubular resilient column disposed centrally within said tub, the base of said column being fixed to said tub and surrounding an opening therein, rotatable means in said column movable to contact and radially distend said column to produce successive pulsations when said tub is held against rotation and said means is rotated in one direction, said means, when rotated in the opposite direction, being movable to contact said column and effect rotation of said tub when said tub is released for rotation.

5. In a washing machine, a tub, a tubular walled flexible resilient pulsator disposed within said tub centrally thereof, and rotary means projecting into said pulsator and adapted to rotate relative thereto and comprising rollers rolling on the inside wall of said pulsator for vibratorily distorting the shape thereof, the path of travel of the outer portions of said rollers having a diameter greater than that of said inside wall, said pulsator having a plurality of external substantially radial ribs extending downwardly from adjacent the upper end to the base of said pulsator.

6. In a washing machine, a tub, a tubular walled flexible resilient pulsator in the form of a hollow column disposed within said tub centrally thereof, and secured to the tub bottom, a plurality of external substantially radial ribs on said column, rotary means projecting into said pulsator and adapted to rotate relative thereto and including rollers rolling on the inside wall of said pulsator for vibratorily distorting the shape thereof and flexing said ribs, the path of travel of the outer portions of said rollers having a diameter greater than that of said inside wall.

7. In a washing machine, a tub, a tubular walled flexible resilient pulsator in the form of a hollow column disposed within said tub centrally thereof, and secured to the tub bottom, a plurality of ribs integral with and extending radially from the exterior of said column, a drive shaft extending axially into said column and rotatable independently of said column, rollers carried by said drive shaft arranged parallel to and laterally disposed from said shaft, and means providing limited radial movement of said rollers into engagement with the internal wall of said column whereby, upon rotation of said shaft relative to said column, said rollers centrifugally bear upon and distort said column.

8. In a washing machine, a tub, a tubular walled flexible resilient pulsator in the form of a hollow column disposed within said tub centrally thereof, and secured to the tub bottom, a drive shaft extending axially into said column and rotatable independently of said column, rollers carried by said drive shaft arranged parallel to and laterally disposed from said shaft, and means providing limited radial movement of said rollers into engagement with the internal wall of said column, said rollers, upon rotation of said shaft relative to said column, centrifugally bearing upon said column and progressively flexing its walls whereby to produce pulsations of a frequency determined by the rate of rotation of said shaft.

9. In a washing machine, a tub, a tubular walled flexible resilient pulsator in the form of a hollow column centrally disposed within said tub, said column having a flared undulating base secured to the bottom of said tub, a generally bell-like top integral with said column, a drive shaft extending axially into said column and rotatable independently thereof, means supporting said column top on said shaft, a plurality of ribs integral with and extending radially from the exterior of said column between said top and said base, rollers carried by said drive shaft arranged parallel to and laterally disposed from said drive shaft, means providing limited radial movement of said rollers into engagement with the internal wall of said column, said rollers, upon rotation of said shaft relative to said column, centrifugally bearing upon and vibratorily distorting said column and progressively flexing its walls whereby to produce pulsations of a frequency determined by the rate of rotation of said shaft.

10. In a washing machine, a tub, a generally tubular walled flexible resilient pulsator secured in an upright position to the central base of said tub, a plurality of external substantially radial ribs on said pulsator, a shaft projecting into said pulsator and adapted to rotate relative thereto, means carried by said shaft movable radially into contact with said pulsator to an extent to distort the walls thereof when said shaft rotates, and rock said ribs.

11. In a waching machine, a tub, a generally tubular walled flexible resilient pulsator secured in an upright position to the central base of said tub, the body of said pulsator having cross sectional proportions enabling radial outward distortion, a plurality of external substantially radial ribs integral with said pulsator, said ribs, in themselves, being relatively non-distortable, a shaft in said pulsator adapted to rotate relative thereto, means carried by said shaft movable radially into contact with the body of said pulsator to an extent to laterally distend the walls thereof whereby to produce a rocking motion of each of said ribs as said means, moving with said shaft, passes to the rear of said ribs.

12. In a washing machine, a tub, a tubular walled flexible resilient pulsator disposed within said tub centrally thereof, and rotary means projecting into said pulsator and adapted to rotate relative thereto and comprising rollers rolling on the inside wall of said pulsator for vibratorily distorting the shape thereof, the path of travel of the outer portions of said rollers having a diameter greater than that of said inside wall.

13. In a washing machine, a tub, a tubular walled flexible resilient pulsator disposed within said tub centrally thereof, and rotary means projecting into said pulsator and adapted to rotate relative thereto and comprising rollers rolling on the inside wall of said pulsator for vibratorily distorting the shape thereof, the path of travel of the outer portions of said rollers having a diameter greater than that of said inside wall, said pulsator having a plurality of external ribs extending substantially lengthwise thereof.

14. In a washing machine, a tub, a tubular walled flexible resilient pulsator in the form of a hollow column disposed within said tub centrally thereof, and secured to the bottom thereof, a drive shaft extending axially into said column and rotatable independently of said column, rollers carried by said drive shaft arranged parallel to and laterally disposed from said shaft, and means providing limited radial movement of said rollers into engagement with the interal wall of said column, whereby upon rotation of said shaft relative to said column, said rollers centrifugally bear upon and distort said column.

15. In a washing machine, a tub, a tubular walled flexible resilient pulsator in the form of a hollow column disposed within said tub centrally thereof, and secured to the bottom thereof, a drive shaft extending axially into said column and rotatable independently of said column, rollers carried by said drive shaft arranged parallel to and laterally disposed from said drive shaft, and means providing limited radial movement of said rollers into engagement with the internal wall of said column, whereby upon rotation of said shaft relative to said column, said rollers centrifugally bear upon and vibratorily distort said column, said column having exteriorly thereof a plurality of lengthwise extending integral ribs.

16. In a washing machine of the type having a tub, which does not rotate during washing, in combination, a pulsator disposed within said tub and having its lower end secured to the bottom of the tub in sealing relation therewith, said pulsator having an integral tubular flexible resilient column located vertically and centrally of said tub, a rotatable shaft projecting upward through the bottom of said tub and extending into said tubular column, and drive means carried by said shaft and disposed within said column, said drive means being adapted, as said shaft rotates, to frictionally engage successive portions of the internal wall of said column in an annular path of greater diameter than that of said internal wall, whereby said drive means vibratorily flexes the column wall in radial directions.

17. The combination as claimed in claim 16, in which said column has a plurality of external ribs extending substantially lengthwise thereof.

18. The combination as claimed in claim 16, in which said drive means comprises rollers extending lengthwise of said column and mounted for limited radial movement with respect to said column, whereby centrifugal force tends to force said rollers into engagement with the internal wall of said column.

19. In a laundry machine of the type having a tub adapted to be held against rotation during washing and adapted to be released for rotation about a vertical axis during centrifugal extraction, in combination, a pulsator disposed within said tub and having its lower end secured to the bottom of the tub in sealing relation therewith, said pulsator having an integral tubular flexible resilient column located vertically and centrally of said tub, a rotatable shaft projecting upward through the bottom of said tub and extending into said tubular column, and drive means carried by said shaft and disposed within said column, said drive means being adapted to frictionally engage the internal wall of said column at circumferentially spaced points in an annular path of greater diameter than that of said internal wall whereby when said tub is held against rotation, said drive means progressively engages successive portions of the internal wall of said column and vibratorily flexes the column wall in radial directions, and when said tub is released for rotation, said drive means picks up the column due to frictional drag and produces rotation of the column and tub.

20. The combination as claimed in claim 19, in which said column has a plurality of external ribs extending substantially lengthwise thereof.

21. The combination as claimed in claim 19, in which said drive means comprises rollers extending lengthwise of said column and mounted for limited radial movement with respect to said column, whereby centrifugal force tends to force said rollers into engagement with the internal wall of said column.

22. In a washing machine having a liquid receiving tub,

a hollow resilient member disposed centrally within said tub and having a base sealed to the base of said tub around an opening therein, and centrifugally extendable rotatable driven means in said member, said means, in operation, creating radial impulse-like distentions in the side wall of said member whereby to produce a washing disturbance of liquid contained in said tub.

23. In a washing machine having a liquid receiving tub, a tubular resilient column disposed centrally within said tub, the base of said column being sealed to the base of said tub around an opening therein, drive means beneath said tub, and vertically disposed pulsating means in said column connected with said drive means through said tub opening, said pulsating means, when actuated by said drive means, serving to contact the side wall of said column and to induce pulsations in said column to an extent and of a frequency determined by the speed of operation of said drive means.

24. In a washing machine, a tub, a closed end flexible resilient pulsator disposed within said tub centrally thereof, the base of said pulsator being sealed to the base of said tub, and rotary means coaxial with said pulsator and mounted therein and adapted to rotate relative thereto and comprising centrifugally extendable parts engageable with and operable to distend the side wall of said pulsator whereby to create a washing disturbance of liquid contained in said tub.

References Cited in the file of this patent

UNITED STATES PATENTS

2,215,288	Hays	Sept. 17, 1940
2,554,573	Johnson	May 29, 1951
2,695,510	Clark	Nov. 30, 1954
2,821,076	Castricone	Jan. 28, 1958

FOREIGN PATENTS

484,385	Great Britain	May 4, 1938