Aug. 23, 1955 J. B. KIRBY 2,715,826

COMBINED WASHING MACHINE AND EXTRACTOR

Filed Aug. 3, 1948 3 Sheets-Sheet 1

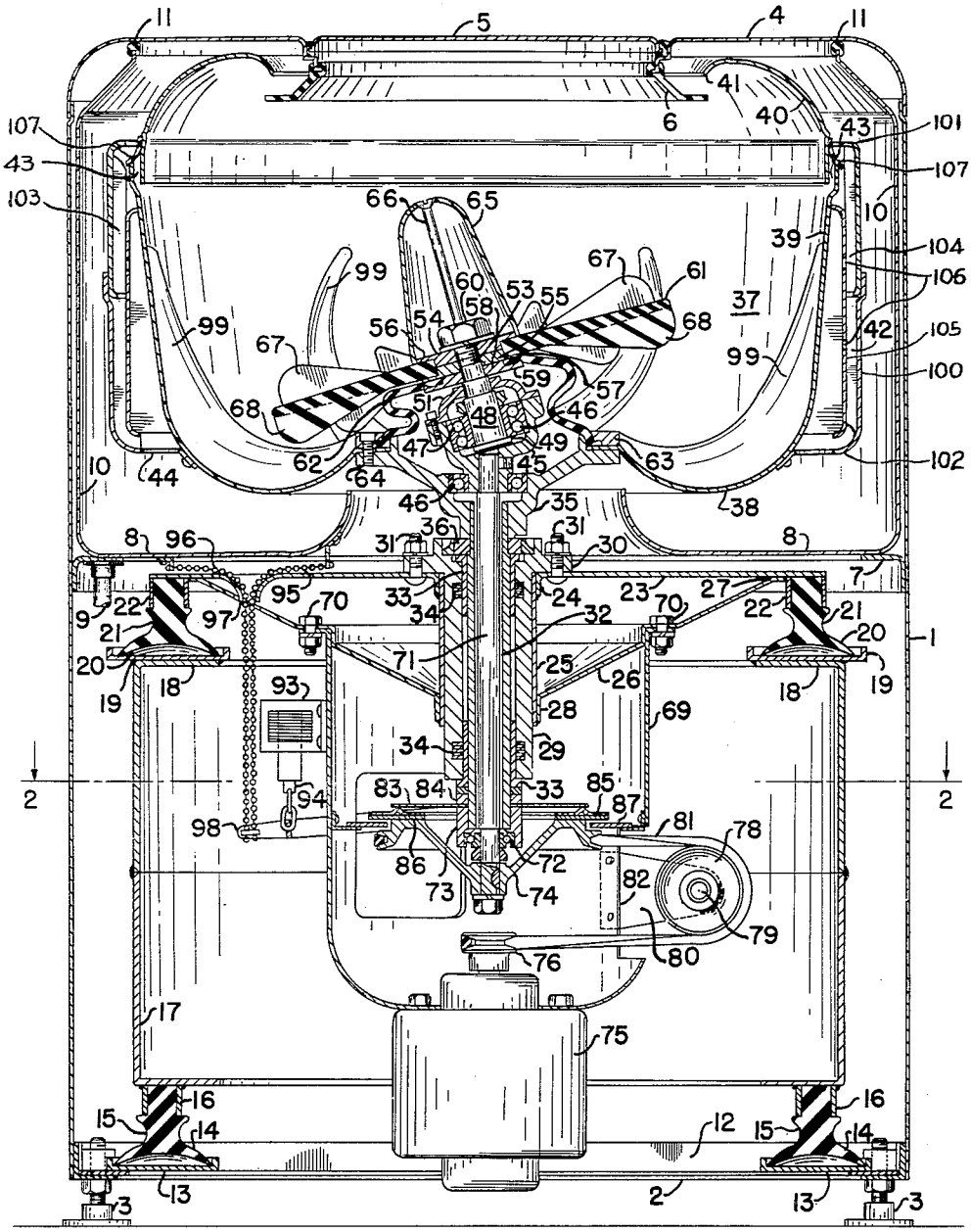


FIG. 1

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Filed Aug. 3, 1948 3 Sheets-Sheet 2

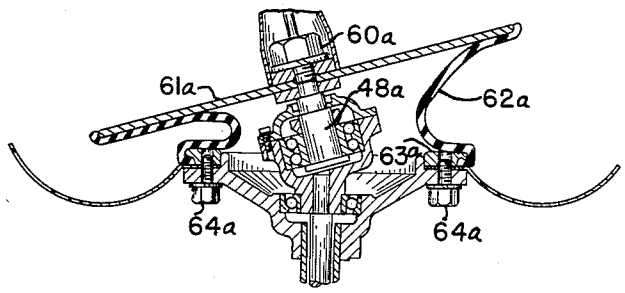


FIG. 3

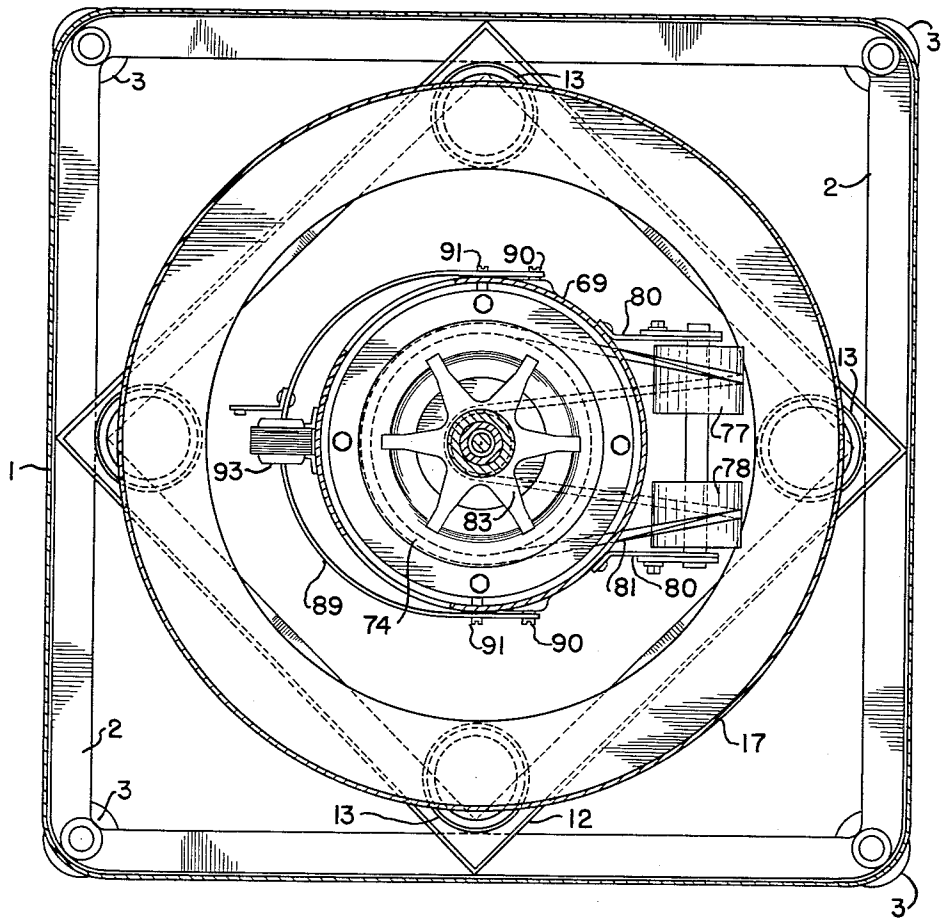


FIG. 2

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COMBINED WASHING MACHINE AND EXTRACTOR

Filed Aug. 3, 1948 3 Sheets-Sheet 3

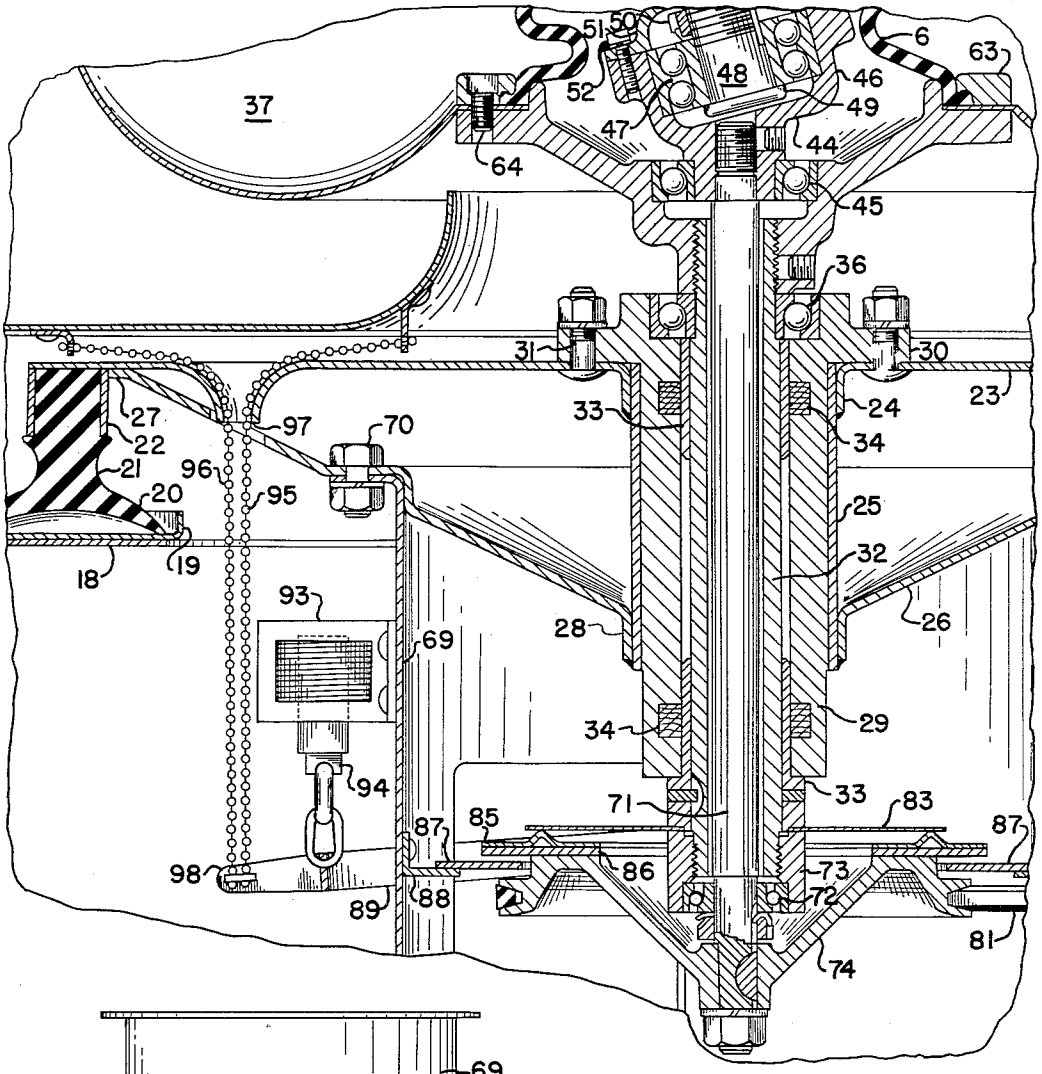


FIG. 4

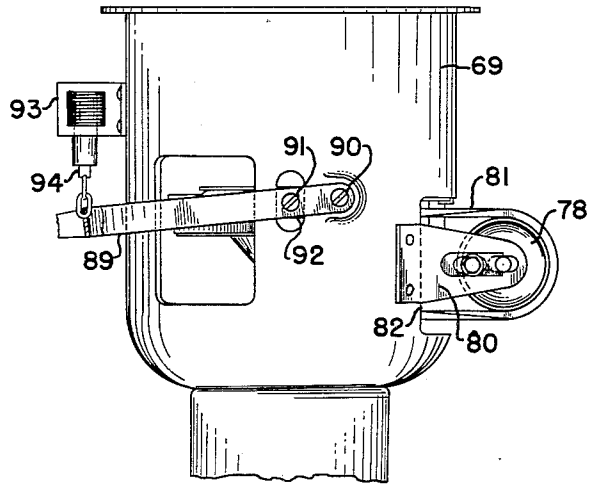


FIG. 5

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2,715,826

COMBINED WASHING MACHINE AND EXTRACTOR

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Application August 3, 1948, Serial No. 42,192

3 Claims. (Cl. 68—23)

This invention relates to washing machines, particularly to machines of the combined washer and extractor type, and is an improvement on the machine disclosed in and embodies certain of the inventions claimed in my copending application Serial No. 619,849 filed October 2, 1945.

One object of this invention is to effect an improved washing action in a combined washing machine and extractor by means of an agitating member operated by continuous rotation at a speed similar to the speed of rotation for extracting.

Another object is to produce a rapid and effective washing action, while distributing the clothes about the container and preventing tangling or the like, by the combination of an agitator wobbled at high speed by a continuously rotating member and washing ribs fixed to the interior of the container.

Another object is to improve and simplify means for limiting acceleration or the speed of rotation of the clothes container in an extractor when an out of balance load in the container exceeds the capacity of the balancing device.

Reference should be had to the accompanying drawings forming part of this specification, in which:

Figure 1 is a central vertical section through a combined washer and extractor embodying the invention;

Fig. 2 is a horizontal section taken on the line indicated at 2—2 in Fig. 1;

Fig. 3 is a fragmentary sectional view showing a modified form of agitator and connecting sleeve;

Fig. 4 is a fragmentary vertical section on an enlarged scale showing the mounting of the agitator and clothes receptacle, together with the means for operating the agitator during the washing operation and for rotating the receptacle and agitator simultaneously for extracting liquid from the clothes; and

Fig. 5 is a fragmentary side elevation of the inner housing that forms a part of the yieldably mounted carrying frame, showing the actuator for the clutch and brake mechanism by means of which the receptacle may be clutched to the drive shaft or to the supporting frame.

As shown in the accompanying drawings, the machine is housed within an outer rectangular housing 1 which has a rectangular angle iron base frame 2. The housing is supported at its four corners by means of legs 3 independently adjustable to plumb the rotational axis of the machine. The housing has a top 4 that includes a removable lid 5 that closes a central opening. Within the top 4 and underlying the margin of the central opening there is an annular splash shield 6 to prevent liquid being thrown through the opening during the washing operation.

A ledge 7 extends around the interior of the housing 1 intermediate the top and bottom thereof and provides a support for a liquid collecting trough 8 which collects liquid thrown from the clothes during the extracting operation and delivers the same to a suitable drain pipe 9. The outer wall 10 of the drain trough 8 extends to

the top of the housing and is provided with a rubber tip 11 at its upper end for engagement with the underside of the cover 4 to provide a liquid seal.

A rectangular angle iron frame 12 is supported on the base frame 2 with its corners midway between the corners of the frame 2 as shown in Fig. 2. At each corner of the frame 12 there is supported a shallow circular metal cup 13 each cup being adapted to receive the suction cup base 14 of an elastic rubber post 15 the upper ends of which are received in sockets 16 attached to the base of a cylindrical inner housing 17. The housing 17 has an inturned flange 18 at the top thereof and the flange 18 supports a series of shallow circular cups 19 that receive the suction cup bases 20 of elastic rubber posts 21 whose upper ends are received in sockets 22 attached to the under side of a flat plate 23 positioned a short distance below the drain trough 8. The plate 23 has a downwardly projecting flange 24 surrounding a central opening therein within which a vertically disposed cylindrical sleeve 25 is secured. The sleeve 25 extends downwardly from the plate 23 which is braced by means of a conical sheet metal member 26 having a flange 27 at its upper end secured to the plate 23 adjacent the periphery thereof and a flange 28 at its lower end secured to the lower end of the sleeve 25.

The yieldably supported frame formed by the plate 23, sleeves 25 and bracing member 26 receives a tubular bearing member 29 that fits within the vertical sleeve 25, that has an outwardly projecting flange 30 at its upper end that seats upon the plate 23 and that is secured to the plate by suitable means such as bolts 31. The bearing member 29 is centrally disposed and provides a support for a tubular shaft 32 that is journaled in bearing sleeves 33 at the upper and lower ends of the member 29. A space is provided between the bearing sleeves 33 within the member 29 to receive lubricant and suitable sealing rings 34 are mounted within the member 29 exteriorly of the sleeves 33.

A hub 35 is attached to the upper end of the shaft 32 and is positioned by a collar 36 that is clamped between the hub 35 and a shoulder on the shaft 32 and that engages with the upper bearing sleeve 33. The hub 35 serves to support a receptacle 37 for the clothes and cleaning liquid, the receptacle being formed to provide an annular trough-shaped bottom 38 and a substantially upright peripheral wall 39 that is circular in horizontal cross-section. The receptacle 37 has an annular top section 40 that is curved inwardly and provided with an inner marginal edge 41 that overlies the annular shield 6 so that liquid thrown against the interior of the section 40 will be discharged upon the annular shield 6 and directed back into the receptacle. Surrounding the upright wall 39 of the receptacle 37 there is a balancing chamber 42 of the character disclosed in my copending application Serial No. 17,844 filed March 30, 1848, now abandoned.

The lower portion of the top section 40 has openings 43 normally closed by a rubber band 107 serving as a valve through which liquid forced upwardly along the peripheral wall of the receptacle by centrifugal force during the extracting operation may flow into the balancing chamber 42 which is provided with suitable drain openings 44 through which liquid escapes into the trough 8.

The balancing device 42 in the illustrated embodiment includes a two piece shell having an imperforate peripheral wall 100 and inwardly directed top and bottom flanges 101 and 102, forming an annular chamber. Suitable baffles are provided to prevent surging and the like while permitting controlled and restricted flow of liquid circumferentially within the chamber. As shown, ribs 103 and 104 are arranged vertically along the inner surface of the wall 100, the ribs 103 alternating with the ribs 104

about the chamber. The ribs **103**, one of which is shown at the left in Fig. 1, extend radially inward at the bottom along the flange **102**, and stop short of the top flange **101**. The alternate ribs **104**, one of which is shown at the right in Fig. 1, extend radially inward along the top flange **101** and stop short of the bottom flange **102**. The spaces between the upper ends of the ribs **103** and the flange **101** and between the lower edge of the ribs **104** and the flange **102** provide a tortuous path through the annular chamber for the circumferential flow of liquid. An inner shell **105** formed with openings **106** is mounted on the balancing unit and engages the inner edges of the ribs **103** and **104**.

A supporting member **45** is rotatably mounted coaxially with the shaft **32** and above the same in ball bearings **46** mounted in the hub **35**. The upper portion of the supporting member **45** is formed to receive a ball bearing **47** that is positioned to support a short shaft **48** at a small inclination to the vertical. The shaft **48** has a flange **49** at its lower end and a collar **50** which engage the top and bottom edges of the inner race of the bearing **47** and secure the shaft **48** against endwise movement in the member **45**.

A cap **51** closes the bearing receiving portion of the member **45** and has a central opening through which the shaft **48** extends, the cap **51** being secured to the member **45** by suitable means such as bolts **52**. The shaft **48** has a reduced upper end **53** that receives a pair of hub plates **54** and **55** provided with peripheral flanges **56** and **57** and a clamping plate **58** having a peripheral flange **59**. The plates **54**, **55** and **58** are clamped to the shoulder at the lower end of the reduced portion **53** by means of a nut **60**. A flexible agitator disc **61** which may be made of fabric reinforced moulded rubber is vulcanized between the flanges **56** and **57** of the hub plates **54** and **55** and the upper end of a flexible rubber sleeve **62** is clamped between the flanges **57** and **59** of the plates **56** and **58**. The lower end of the sleeve **62** is of a diameter corresponding to that of the peripheral portion of the hub **35** and is clamped to the hub **35** by means of a clamping ring **63** which also serves to clamp the receptacle **37** to the peripheral portion of the hub, the ring **63** being secured to the hub **35** by suitable means such as bolts **64**. The nut may be covered by an upwardly tapering cap **65** secured to the plate **54** by suitable means such as a bolt **66**.

The agitator disc **61** may be provided with upwardly and downwardly projecting vanes **67** and **68**. During the washing operation a wobbling motion is imparted to the agitator disc **61** by rotation of the support **45** while the receptacle **37** is held against turning, the disc **61** being held against turning about its own axis by means of the flexible sleeve **62**. Rotation of the supporting member **45** moves the shaft **48** in a conical path causing a circumferentially progressing tilting movement of the agitator disc **61**.

The flexible sleeve **62** has a fluid tight connection with the agitator disc and with the hub of the clothes receptacle so that it serves as a portion of the inner wall of the annular trough of the receptacle, and as a housing for the supporting member **45**.

Other forms of agitator discs and connecting sleeves may be employed. As shown in Fig. 3 of the drawings the agitator may be in the form of a flat metal disc **61***a* clamped to the shaft **48***a* by a nut **60***a*, the disc **61***a* being connected to the clothes receptacle by means of a flexible rubber sleeve **62***a* that has its upper end vulcanized or bonded to the underside of the disc **61***a* adjacent its periphery and that has its lower end secured with a clamping ring **63***a* to the hub by bolts **64***a*.

Rigidly attached to the conical member **26** of the yieldable receptacle supporting frame there is a downwardly extending substantially cylindrical housing member **69**. The housing member **69** is secured to the conical member **26** by suitable means such as bolts **70**. The housing member **69** encloses the portions of the bearing

member **29** and the tubular shaft **32** that project below the lower end of the sleeve **25** and also a portion of the driving mechanism.

Within the tubular shaft **32** there is mounted a central drive shaft **71** that is supported by a ball bearing **72** mounted in a collar **73** attached to the lower end of the shaft **32**, the upper end of the shaft **71** being keyed to the supporting member **45**. The shaft **71** projects below the bearing **72** and has a pulley **74** attached to its lower end. The shaft **71** is driven by means of an electric motor **75** that is secured to the lower end of the housing member **69** in axial alignment with the shaft **71**. The shaft of the motor **75** has a pulley **76** within the housing member **69** and a pair of pulleys **77** and **78** are mounted on a horizontal shaft **79** journaled in brackets **80** secured to the housing member **69** and projecting outwardly therefrom. A belt **81** extends over the pulleys **74**, **76**, **77** and **78** for driving the shaft **71** from the motor, the belt extending through an opening **82** in the housing member **69** in passing from the pulleys **74** and **76** to the pulleys **77** and **78**.

A flexible sheet metal spider **83** is clamped between the collar **73** and a collar **84** on the shaft **32** and an annular friction clutch disc **85** is attached to the outer end of the arms of the spider **83**. The resilient spider **83** exerts a downward thrust on the friction disc **85**, pressing it against a flat friction clutch face **86** on the upper side of the pulley **74**, thereby providing a releasable driving connection between the shaft **71** and the tubular receptacle supporting shaft **32** by means of which the two shafts may be caused to rotate in unison. The clutch disc **85** is of a radial width greater than the width of the clutch face **86** of the pulley **74** and the outer portion of the disc **85** overlies an annular friction brake disc **87** that is mounted for vertical movement and held against turning movement within the housing member **69**. The brake disc **87** is normally supported on ledges **88** provided upon the interior of the housing member **69** and positioned to support the disc **87** clear of the disc **85** a short distance below the same.

Means is provided for moving the brake disc **87** vertically into engagement with the clutch disc **85** and to exert an upward thrust on the disc **85** to move it upwardly out of engagement with the clutch face **86** of the pulley **74** to disengage the shaft **32** and receptacle **37** from the shaft **71** and to hold the receptacle against rotation. The friction disc **87** is actuated by means of a bail-shaped lever **89** the ends of which are connected to opposite sides of the housing member **69** by pivots **90**. Inwardly of the pivoted ends thereof the lever **89** has inwardly projecting pins **91** that are received in lugs **92** attached to diametrically opposite portions of the disc **87**. The disc **87** is pivotally suspended by means of the diametrically opposite pins **91** and is normally supported in horizontal position by the ledges **88**. When the lever **89** is moved upwardly the brake disc **87** is lifted from the ledges **88** and brought into engagement with the disc **85**, exerting an upward thrust thereon that lifts the clutch disc **85** out of engagement with the friction clutch face **86** of the pulley **74**.

During operation of either of the disclosed embodiments of the machine the shaft **71** is continuously driven at uniform speed by the motor **75**. During the washing operation the lever **89** is held in its raised position by suitable means such as a solenoid **93** having a vertically movable armature **94** pivotally connected to the lever **89**. When the lever **89** is held in its uppermost position the clothes receptacle is held against rotation by the brake disc **87** and a progressive tilting movement is imparted to the agitator due to the inclination of the axis of the agitator with respect to the vertical shaft **71**.

As the tilting motion of the agitator progresses about the container, the clothes and water in the path of the downward movement of the agiator are subjected to compressive forces between the agitator and the bottom of

the container, having radial and tangential components, causing this portion of the mass of clothes and water to flow radially outward and circumferentially in the direction of rotation of the shaft **71**. At the same time, the clothes and water at an opposite point, where the agitator is tilting upwardly, are subjected to suction forces having radial and tangential components, causing this portion of the mass of clothes and water to flow radially inwardly and circumferentially in the direction of rotation of the shaft **71**.

The ribs **99** intercept and retard the circumferential flow of the mass of clothes and water, so that the clothes and water do not circulate at the speed of rotation of the shaft **71**. As disclosed and claimed in my copending application Serial No. 757,773 filed June 28, 1947, now Patent No. 2,672,744, dated Mar. 23, 1944, the ribs **99** are inclined so that their outer and upper ends are advanced in the direction of rotation with respect to their inner ends. Thus the circumferential flow causes the clothes and water to move outwardly along the bottom of the container and upwardly along the side wall, producing a roll-over action that distributes the clothes and prevents tangling. The upwardly projecting hub cap **65** also aids in preventing tangling by preventing the clothes from going over the center of the agitator.

The relative speeds of roll-over and circumferential rotation are selected by determining, for a particular machine, the angle of inclination of the ribs **99** which produces the best results.

Since the mass of clothes and water is prevented, by the ribs **99**, from rotating at the speed of rotation of the shaft **71**, each portion of the mass is subjected alternately to the inward and outward radial forces produced by the motion of the agitator.

To change from the washing to the extracting operation it is only necessary to deenergize the solenoid **93** and permit the brake disc **87** to drop into engagement with the ledges **88**, thereby permitting the clutch disc **85** to be forced downwardly by the spider **83** into engagement with the pulley **74** to cause the shaft **32** and clothes receptacle supported thereby to be driven through the disc **85** and spider **83**.

It should be noted that the agitator, the clothes receptacle and the driving mechanism for the clothes receptacle and agitator are mounted as a unit by means of vertically and laterally yieldable supports on a subframe which in turn is mounted by means of vertically and laterally yieldable supports on the base of the machine, the two sets of vertically and laterally yieldable supports being axially spaced. This arrangement greatly reduces the critical speed of rotation so that when the clutch disc **85** is forced into engagement with the pulley **74** the clothes receptacle is quickly accelerated through its critical speed.

The rubber band **107** prevents the washing liquid from being splashed out through the discharge openings **43** during the washing operation and is given sufficient tension to remain closed against the pressure of the liquid as the clothes container is accelerated from rest to the region of its critical speed. Above the critical speed of rotation of the container the band **107** is forced away from the openings **43** by the pressure of the liquid and centrifugal force allowing the liquid to be discharged into the balancing chamber **42**. Any unbalance that may exist in the clothes receptacle or that may be created by the initial discharge of water in the extracting operation tends to cause the out of balance weight to approach the axis of rotation when the clothes container is rotated at speeds exceeding its critical speed. This action tends to increase the radius of the side of the container opposite the unbalanced weight so that liquid discharged through the openings **43** tends to accumulate in the annular channel **42** on the side opposite the out of balance weight and thus tends to restore the balance of the receptacle. The liquid is held against the imperforate peripheral wall **100** between the top and bottom flanges **101** and **102** by centrifugal force and may also enter the annular channel formed by the strip **105** through openings **106**. When the balancing device is filled by liquid at a particular point the excess liquid is discharged past the top and bottom flanges **101** and **102** into the tub **8**.

Means are also provided for limiting the acceleration or the speed of rotation of the clothes receptacle in the event there should be an out of balance condition exceeding the capacity of the balancing device **42**. To this end two chains **95** and **96** are attached at their upper ends to inner and outer portions of the bottom of the trough **8** and extend downwardly through a small bell-shaped opening **97** in the plate **23** that is located substantially midway between the points of attachment of the chains **95** and **96** to the trough **8**. The chains **95** and **96** normally hang vertically from the opening **97** and are attached to an extension **98** of the lever **89**. Excessive lateral movement of the supporting frame with respect to the fixed housing applies tension to one or the other of the chains **95** and **96**, causing the lever **89** to be lifted intermittently to momentarily release the clutch disc **85** from the pulley **74** so that rotation is retarded or further acceleration is prevented, so that excessive vibration is prevented.

It is to be understood that variations and modifications of the specific devices herein shown and described may be made without departing from the scope of the invention.

I claim:

1. In a washing machine, a receptacle formed to provide an annular channel for clothes and washing liquid and having an upright peripheral wall, a supporting member mounted to rotate about a vertical axis centrally disposed with respect to said wall, a flexible rubber agitator disc within the receptacle and mounted at its center on said supporting member to turn with respect thereto about an inclined axis, means for holding said disc against rotation, and driving means for imparting continuous rotation to said supporting member to wobble the axis of said disc, said disc being vertically yieldable adjacent its periphery.

2. In a washing machine, a receptacle formed to provide an annular channel for clothes and washing liquid and having an upright peripheral wall, a supporting member mounted to rotate about a vertical axis centrally disposed with respect to said wall, a flexible rubber agitator disc within the receptacle and mounted at its center on said supporting member to turn with respect thereto about an inclined axis, said disc having upwardly and downwardly projecting vanes, means for holding said disc against rotation, and driving means for imparting continuous rotation to said supporting member to wobble the axis of said disc.

3. In a washing machine, a receptacle formed to provide an annular channel for clothes and washing liquid and having an upright peripheral wall, a supporting member mounted to rotate about a vertical axis centrally disposed with respect to said wall, a flexible rubber agitator disc within the receptacle and mounted on said supporting member to turn with respect thereto about an inclined axis, means for holding said disc against rotation, driving means for continuously rotating said supporting member and imparting wobbling movement to the axis of said disc, thereby imparting wobbling movement to said disc to cause the clothes and liquid to travel circumferentially in said channel, and vanes carried by said receptacle for imparting a rolling motion to said clothes as they move circumferentially.

References Cited in the file of this patent

UNITED STATES PATENTS

1,619,637 Schroeder ---------- Mar. 1, 1927

(Other references on following page)