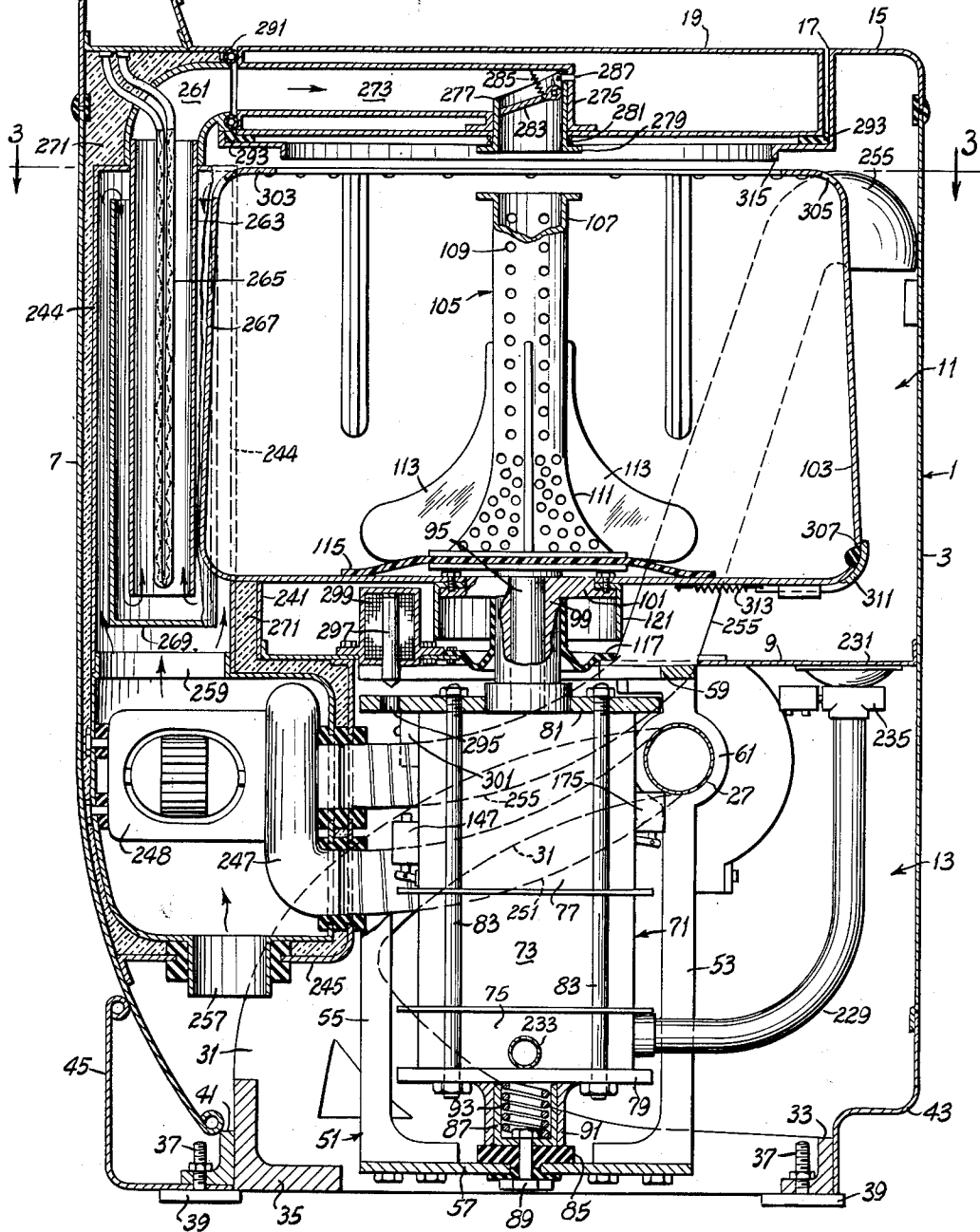


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4 Sheets-Sheet 1

FIG. 1.



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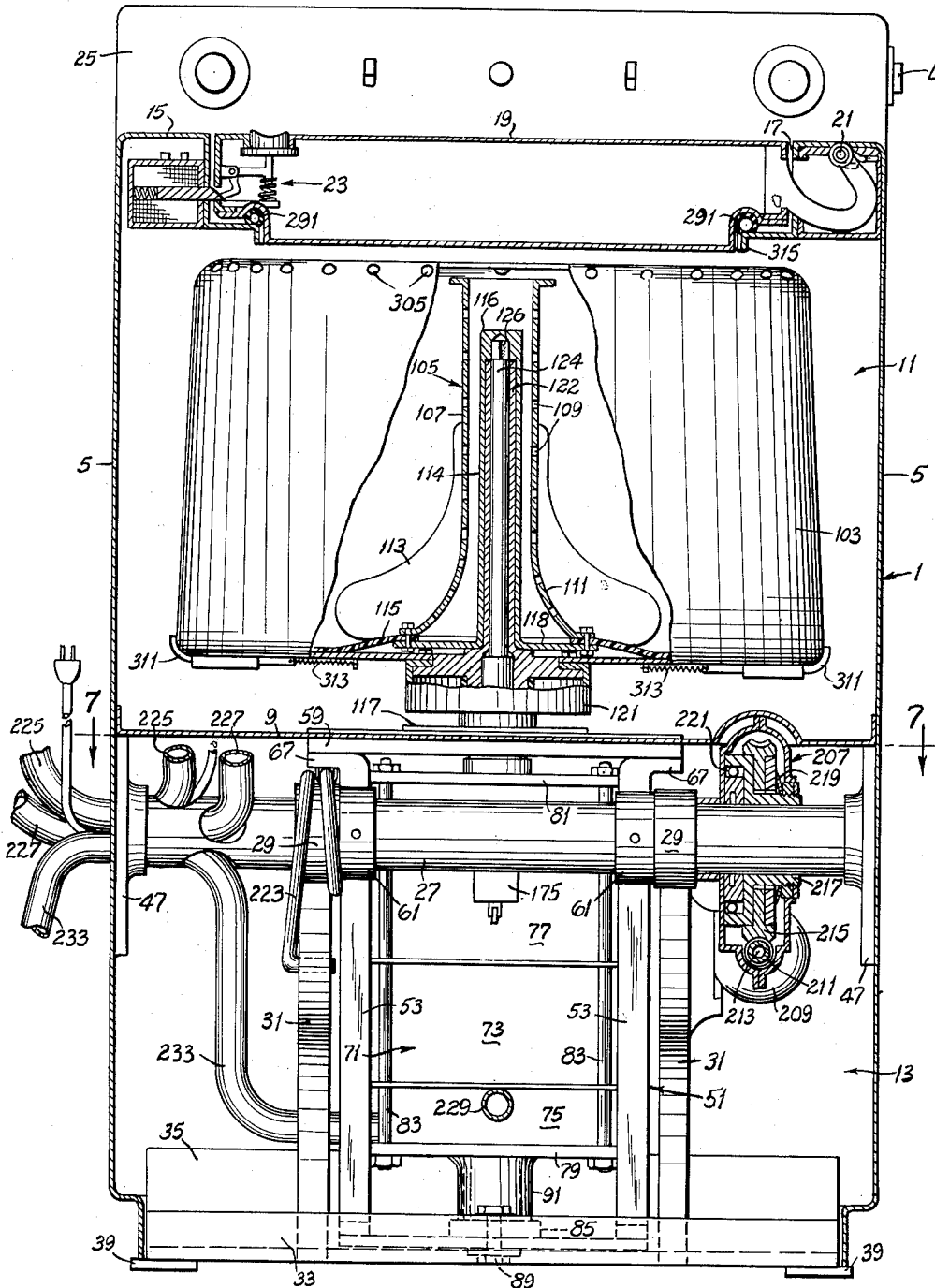


FIG. 2.

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2,737,799

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4 Sheets-Sheet 3

FIG. 3.

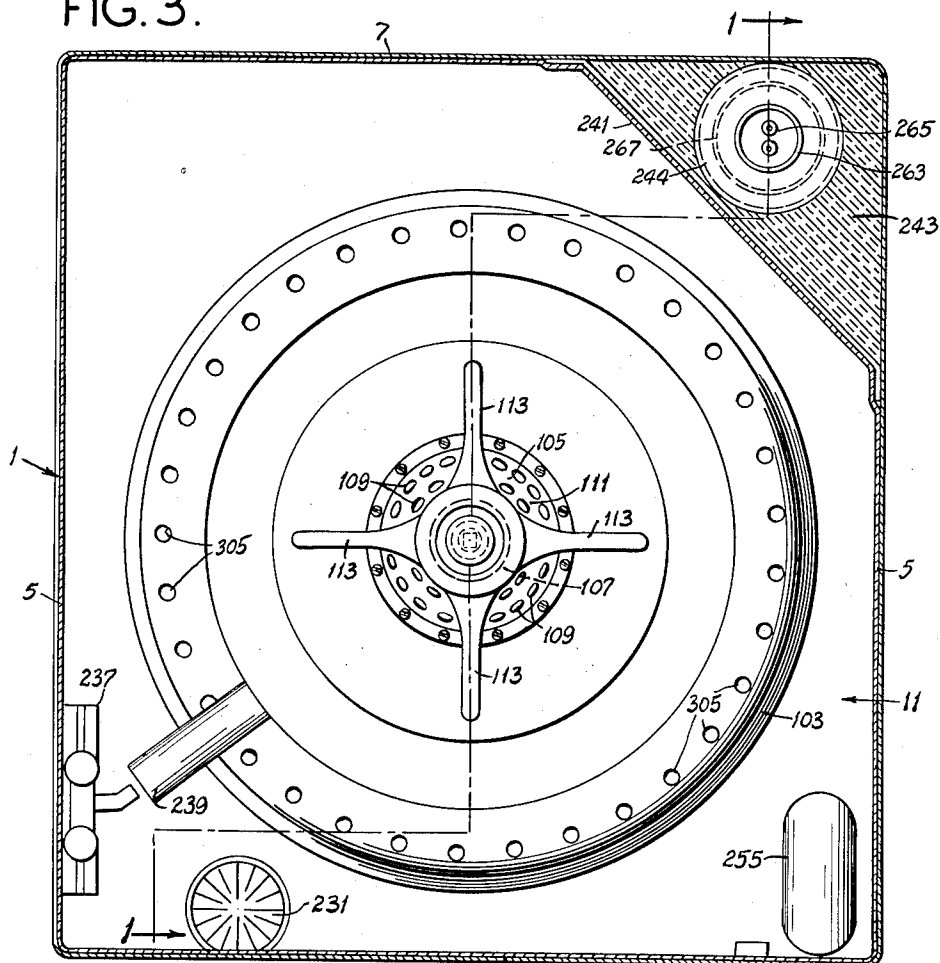
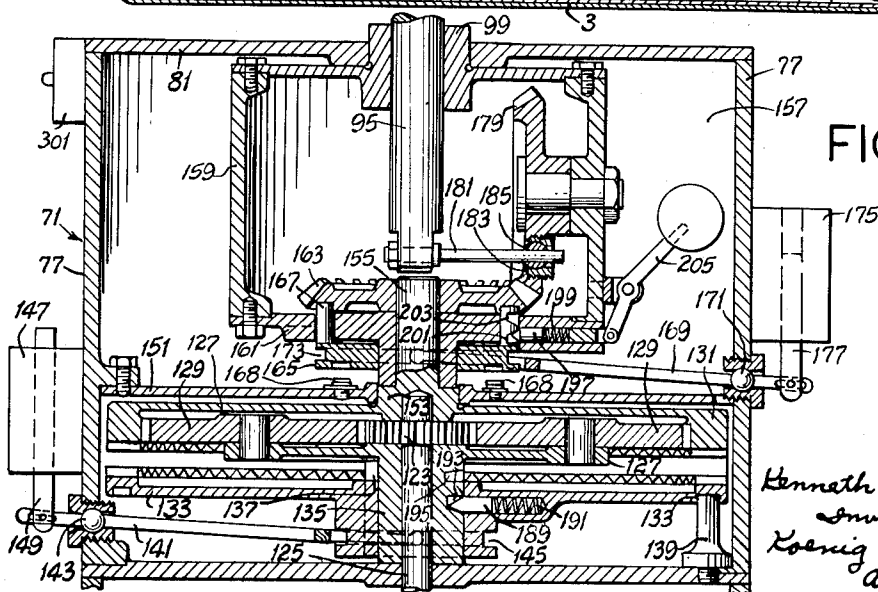


FIG. 4.



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LAUNDRY APPARATUS

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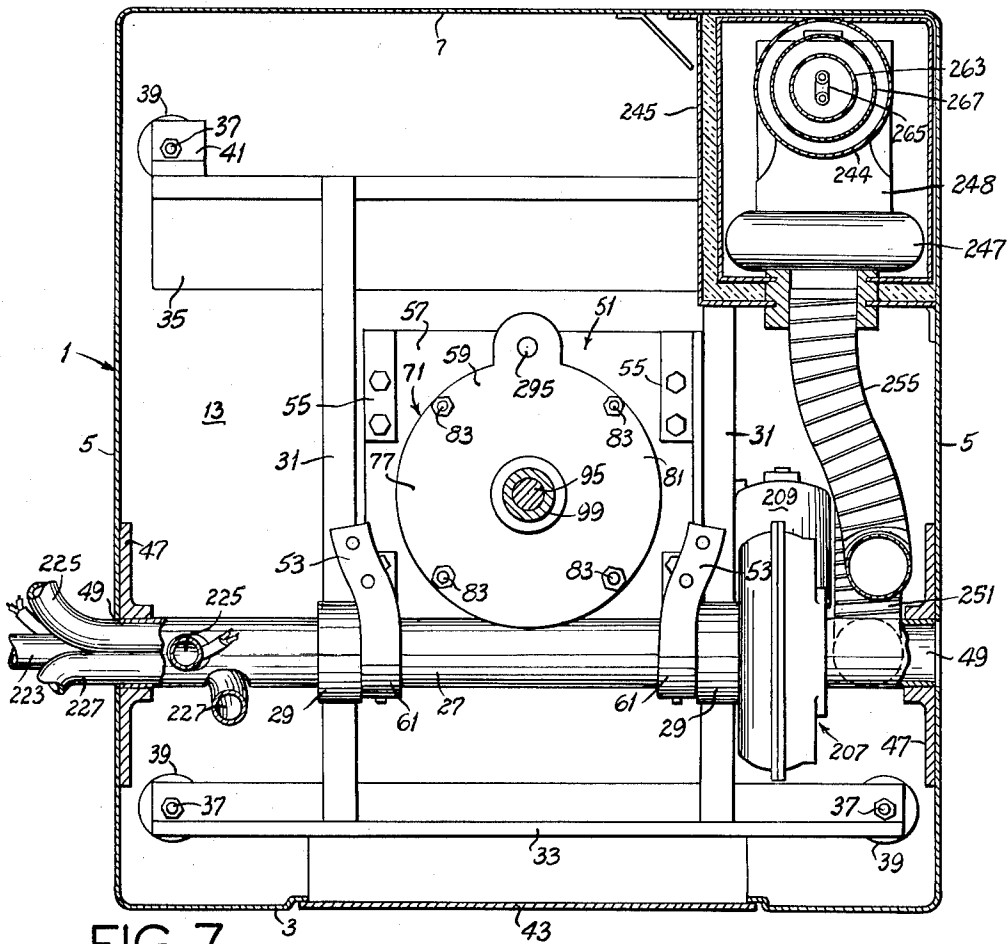
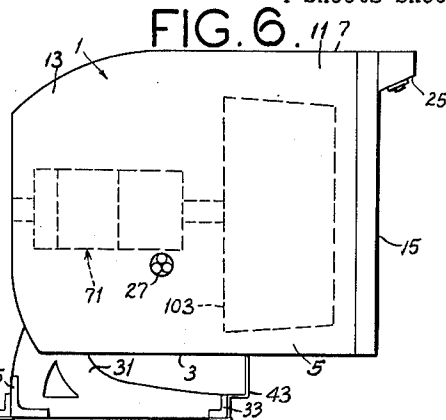


FIG. 7.

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LAUNDRY APPARATUS

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Application November 20, 1952, Serial No. 321,598

22 Claims. (Cl. 68—20)

This invention relates to laundry apparatus, and more particularly to a combination washing and drying machine.

Among the several objects of the invention may be noted the provision of laundry apparatus, particularly for home use, which may be controlled automatically to wash, rinse, spin dry and completely dry a batch of laundry in sequence without attention from the user; the provision of apparatus of this class in which washing is effected by the action of a vertical-axis agitator, this being a most desirable type of washing action, and in which drying is effected by tumbling action coupled with flow of hot air over the laundered articles, this being a most desirable type of drying action; the provision of apparatus of this class in which humid lint-carrying air resulting from the drying operation may be vented in such a way that the lint is carried out by the apparatus but prevented from entering the laundry room; the provision of apparatus of this class which has an improved type of tub providing for dynamic balancing when spin-drying and enabling the use of a larger tub within a given size of cabinet; the provision in apparatus of this class of an improved agitator which prevents laundry in the tub from jamming under the agitator and which reduces friction between the laundry and the tub bottom to reduce the wearing action on the laundry; and the provision of apparatus of the class described which is capable of drying a batch of laundry in a relatively short time and which is safe to use and compact in construction for its capacity. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the structures hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

Fig. 1 is a vertical front-to-rear section of a laundry apparatus of my invention, taken substantially on line 1—1 of Fig. 3;

Fig. 2 is a vertical side-to-side section of the apparatus, with parts broken away and shown in section;

Fig. 3 is a horizontal section taken substantially on line 3—3 of Fig. 1;

Fig. 4 is a view in section of a transmission of the apparatus;

Figs. 5 and 6 are small-scale side elevations illustrating two different positions of the apparatus; and,

Fig. 7 is a horizontal section taken substantially on line 7—7 of Fig. 2.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring to the drawings, a laundry apparatus constructed in accordance with my invention is shown to comprise a cabinet 1, which is rectangular in plan (see Figs. 3 and 7), having a front wall 3, side walls 5, and a rear wall 7. A partition 9 divides the cabinet into

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an upper laundry chamber or tub compartment 11 and a lower mechanism chamber 13. In the top 15 of the cabinet is an access opening 17 for the laundry chamber 11. This access opening is closed by a lid 19 which is hinged at 21 (Fig. 2) toward one side of the cabinet and which may be held closed by latch means designated 23. The lid is of a special construction, to be fully described later. At the rear of the top of the cabinet is a control panel 25.

The entire cabinet 1 is carried by a horizontal hollow shaft 27, which is enclosed in the mechanism chamber 13 and extends from side-to-side of the cabinet in such manner that the cabinet may swing between the vertical position shown in Figs. 1, 2 and 5 and the forwardly extending horizontal position shown in Fig. 6. The shaft 27 is journaled in bearings 29 at the upper ends of spaced pedestals 31. The pedestals are connected together toward the front of the apparatus by an angle iron 33 and toward the rear by a larger angle iron 35. For levelling the apparatus, levelling screws 37 having floor pads 39 are provided in the angle iron 33 and in angle members 41 secured to angle iron 35.

The shaft 27 is located toward the front of the cabinet and at such height that the apparatus may be mounted with the rear cabinet wall 7 closely adjacent a wall of the laundry room, while permitting the cabinet to be swung to horizontal position (compare Figs. 5 and 6). In order to attain a complete cabinet appearance when the cabinet is vertical, fixed front and rear panel sections 43 and 45 are provided secured to the angle irons 33 and 35, respectively. The lower portion of the rear wall 7 of the cabinet is inwardly curved on an arc centered in the shaft axis, as illustrated best in Figs. 1, 5 and 6, to clear the panel 45. The shaft is fixed at its ends to the side walls 5 of the cabinet by means of collars 47 (Figs. 2 and 7), and the side walls have openings 49 in line with the shaft.

Fixed to the shaft 27 between the pedestals 31 is a cage 51 consisting of front corner bars 53, rear corner bars 55, a base plate 57 and a top ring 59. The shaft is received in collars 61 formed integrally with the front bars 53. When the cabinet 1 is vertical, the cage 51 is vertical and is positioned toward the rear of the shaft (Fig. 1), and when the cabinet 1 is horizontal the cage 51 is horizontal and positioned above the shaft. The base plate 57 is fixed to the lower ends of the bars 53 and 55 and the top ring 59 is fixed to the upper ends of the bars 53 and 55. The top ring 59 supports the partition 9.

The cage 51 carries a combination motor-pump-transmission unit generally designated 71. This comprises an electric motor 73 with a pump 75 at one end of the motor and driven thereby, and a gear box 77 at the other end of the motor and powered thereby. The motor, pump and gear box are held in assembly between a bottom plate 79 and a top plate 81 tied together by bolts 83, with the pump at the bottom plate and the gear box at the top plate. The unit 71 is located in the cage 51 with its bottom plate 79 toward the cage base plate 57. A block of rubber 85 is fixed on the plate 57. On the rubber block is a cup 87. A bolt 89 holds the cup against the block, extending through a central opening in the block. The bottom plate 79 of unit 71 has a central projecting sleeve 91 slidable on the cup. A compression spring 93 in the cup reacts from the bottom of the cup to bias the unit 71 in the direction away from the plate 57. The unit 71 may be withdrawn through the ring 59.

An agitator shaft 95 extends from the gear box 77 through an opening in partition 9 into the tub compartment 11. Surrounding the shaft 95 is an independently rotary quill 99 which also extends from the gear box

into the chamber 11. The quill 99 at its upper end in chamber 11 has a flange 101 to which is fixed a tub 103. This tub is of special construction, to be fully described later. On the upper end of the agitator shaft 95 in the tub is mounted a double walled agitator 105. This agitator, in accordance with my invention, consists of a hollow sleeve 107 forming the outer wall of the agitator, perforated throughout its length as indicated at 109, flared outward at its lower end as indicated at 111, and provided with a number of radial vanes 113. The majority of perforations 109 are toward the bottom of 107. The hollow agitator is open at its upper end. Extending centrally within the sleeve 107 is an inner sleeve 114 forming the inner wall of the agitator which is closed at its upper end as indicated at 116 above the normal level of water in the tub. Sleeve 114 has a flange 118 at its lower end by means of which it is fastened to the bottom of sleeve 107. A skirt 115 of flexible sheet plastic material has its inner margin clamped between the flange 118 and the bottom of sleeve 107. The outer margin of the skirt engages the bottom of the tub. This skirt prevents laundry in the tub from jamming under the agitator and reduces friction between the laundry and the bottom of the tub. A rubber diaphragm 117 closes the opening for the quill and shaft in partition 9, while permitting both gyration and axial movement of the entire assembly comprising unit 71, quill 99 and shaft 97, the tub 103 and the agitator 105. On the bottom of the tub is an air trap 121. The quill 99 has a tubular extension 122 in sleeve 114 reaching to its upper end 116. The shaft 95 has an extension 124 in member 122 keyed at its upper end in 116 as indicated at 126.

The gear box 77 houses special gearing for effecting oscillation and reciprocation of the agitator with the tub stationary to wash a batch of laundry in the tub, high speed spinning of the tub (and agitator) for draining the tub and for damp drying, and relatively low speed rotation of the tub (and agitator) for a final drying operation. As shown in Fig. 4, the special gearing in the box 77 includes a reverted planetary gear train including a pinion 123 fixed on the upper end of the motor shaft 125, the latter extending from the motor 73 into the box. A planet carrier 127 is rotary on the motor shaft and carries planet gears 129 in mesh with pinion 123. A ring gear 131 meshes with the planet gears 129.

A clutch member 133 is slidable on the hub 135 of the planet carrier and is splined thereto as indicated at 137. The clutch member has a lower position in which it engages a fixed locking element 139 on the bottom of the gear box for locking the clutch member and the planet carrier against rotation. It has a raised position in which it locks the ring gear 131 and planet carrier 127 together for conjoint rotation. Raising and lowering of the clutch member is effected by means of a shifter 141 which is pivoted at 143 in the wall of the gear box with its inner end extending into an annular groove 145 in the clutch member. A solenoid 147 mounted on the wall of the gear box has its plunger 149 connected to the outer end of the shifter 141 for operating it.

The gear box 77 has a partition 151 above the ring gear 131. The ring gear has a hub 153 rotary in an opening in the partition, and from this hub a shaft 155 extends into the gear box chamber 157 above the partition. A cage 159 has a lower hub 161 journaled on shaft 155. The quill 99 extends from the upper end of the cage 159 through an opening in the top of the gear box. Fixed on the upper end of the shaft 155 within the cage 159 is a bevel gear 163. Between the bottom of the cage 159 and the partition 151 is a clutch ring 165 surrounding the hub 153 having clutch elements 167 extending upward through openings in the bottom of the cage. The clutch ring is shiftable between a raised position wherein clutch elements 167 engage the bevel gear 163 for locking the cage 159 to this gear, and a

lowered position wherein the ring engages locking elements 168 on partition 151 for locking the cage 159 against rotation. Shifting is effected by means of a shifter 169 pivoted at 171 in the wall of the gear box with its inner end extending into an annular groove 173 in the ring. A solenoid 175 mounted on the wall of the gear box has its plunger 177 connected to the outer end of the shifter for operating it.

A bevel gear 179 is carried by the side of the cage 159 in mesh with bevel gear 163. The agitator shaft 95 extends downward out of the quill 99 into the cage and at its lower end has a crank arm 181. Arm 181 extends slidably through an opening in a ball joint 185 held in a socket in the bevel gear 179 by a threaded retainer 183. The ball joint 185 swivels in the bevel gear.

For washing, the clutch ring 165 is lowered to lock the cage 159 against rotation and the clutch member 133 is lowered to lock the planet carrier 127 against rotation. This results in a drive via pinion 123 and planet gears 129 to the ring gear 131, with consequent speed reduction, for relatively low speed rotation of the ring gear, the shaft 155, bevel gear 163 and bevel gear 179. Rotation of the bevel gear 179 results in oscillation and reciprocation of the agitator shaft 95 and the agitator 105. Since the cage 159 is locked, the quill 99 and tub 103 are stationary.

For high speed rotation of the tub (and agitator) for draining and spin-drying, the clutch ring 165 is raised to lock the cage 159 to the bevel gear 163, and the clutch member 133 is raised to lock the planet carrier 127 to the ring gear 131. This results in a direct high speed drive from the motor shaft 125 to shaft 155, bevel gear 163, cage 159, quill 99 and the hub 103. Bevel gear 179 spins around with the cage 159, but does not rotate on its own axis. Accordingly, the agitator shaft 95 and the agitator 105 spin at the same speed as the tub, but the agitator does not reciprocate.

For low speed rotation of the tub (and agitator) for final drying, the clutch ring 165 is maintained raised to lock the cage 159 to the bevel gear 163, but clutch member 133 is lowered to lock the planet carrier 127 against rotation. This results in low speed rotation of the ring gear 131, the shaft 155, bevel gear 163, cage 159, quill 99 and the tub 103. Again, bevel gear 179 spins around with the cage 159, but does not rotate on its own axis, so that while the agitator is rotated at the same speed as the tub, it does not reciprocate.

For biasing the clutch member 133 to its lowered and raised positions, I provide in the clutch member a wedge 189 biased toward the hub of the clutch member by a spring 191. When the clutch member is lowered, the wedge engages in a lower annular groove 193 in the hub, the groove being shaped so that the biased wedge cams the clutch member downward. When the clutch member is raised, the wedge engages in an upper annular groove 195 in the hub, this groove being so shaped that the biased wedge cams the clutch member upward.

For biasing the clutch ring 165 to its lowered and raised positions, I provide in the cage 159 a wedge 197 biased toward one of clutch elements 167 by a spring 199. When the ring is raised, the wedge engages in a lower groove 201 in the clutch element 167, the groove being so shaped that the biased wedge cams the ring upward. When the ring is lowered, the biased wedge engages in an upper groove 203 in the clutch element 167, this groove being so shaped that the wedge cams the ring downward. The bias on the wedge 197 may be increased when the cage 159 is spinning by using centrifugal means as indicated at 205.

For tilting the cabinet 1, I provide an electric motor-driven worm gear tilting mechanism, generally designated 207. The motor 209 for driving this mechanism is mounted on one of the pedestals 31. A worm 211 on the motor shaft 213 meshes with a worm gear 215. This worm gear is rotary on a sleeve 217 which in turn is

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rotary on the shaft 27. It drives the sleeve through a friction clutch 219. The sleeve drives the shaft 27 through a one-way clutch 221. With this arrangement, the cabinet may be tilted forward by hand independently of the worm gear mechanism, this being permitted by the one-way clutch which overruns on forward tilting, and the friction clutch allows for manual rearward tilting and slipping in case of accidental jamming when tilting. Counterbalancing of the cabinet 1 in either direction is obtained by means of a spring 223.

The hot and cold water hose lines 225 and 227 for filling the tub lead into the cabinet through the left end of the hollow shaft 27. A drain hose 229 leads from a drain 231 in the partition 9 to the inlet of the pump 75, and an outlet hose 233 leads from the pump outlet out through the left end of the hollow shaft 27. At 235 is shown a solenoid-controlled drain valve. The hot and cold water hose lines lead to a mixer 237 which supplies water at the desired temperature to a trough 239 to flow into the tub (Fig. 3).

The right rear corner of the laundry chamber 11 as viewed in Fig. 3 is partitioned off by means of a diagonal partition 241 to form a heater chamber 243. In this chamber is provided a tubular heater casing 244, and at the lower end of this chamber is provided an insulated housing 245 for a centrifugal blower 247 and an electric motor 249 for driving the blower. Housing 245 is insulated not only to retain heat but also for sound insulation purposes. To the blower outlet is connected a hose 251 which leads to the hollow shaft 27 adjacent the right end of the shaft. To the blower inlet is connected a hose 255 which leads from the chamber 11. The housing 245 has an air intake 257 and an outlet 259 leading into the casing 244. The end of the hose 255 in chamber 11 is located toward what becomes the bottom of the chamber 11 when the cabinet is horizontal and in position to receive lint thrown out from the tub.

At the upper end of the heater casing 244 is a duct 261 which is open to the lid opening 17 in the top of the cabinet. Extending down into the casing 244 from this passage is a baffle tube 263. In the tube is an electrical resistance heating element 265. Surrounding the tube is a baffle cylinder 267 which is closed at its bottom as indicated at 269. Thermal insulation is provided as indicated at 271.

In the lid of the cabinet is a duct 273 which, when the lid is closed, is in communication with the duct 261 (Fig. 1). The duct 273 extends to the center of the lid, and there has a right-angle end portion 275 in alignment with the agitator 95. Slidable in the duct end portion 275 is a fitting 277 having an upturned flange 279 at its lower end. A spring 281 reacts from the bottom of the lid against this flange to bias the fitting toward the agitator. In the fitting is a butterfly valve 283 normally biased in the direction away from the agitator to a position closing the fitting by a spring 285. The valve carries a detent 287 engageable in an opening in the wall of duct end portion 275 to latch the fitting in raised position against the bias of spring 281. Packing such as is indicated at 291 and 293 is provided to ensure air-tight sealing of the lid.

When the cabinet is tilted from vertical to horizontal position, and the weight on spring 93 is relieved, this spring 93 pushes the unit 71, the tub 103 and the agitator 95 toward the lid. To prevent the entire assembly of unit 71, the tub and the agitator from moving off center as the cabinet is tilted (noting that this entire assembly as a floating mount), I provide an opening 295 in the plate 81 which receives the plunger 297 of a solenoid 299 mounted on the partition 9. The solenoid is energized so that the plunger 297 enters the opening 295 before the cabinet is tilted. The plunger is also utilized to operate a control switch 301 for the motor 209 mounted on the gear box 77. In order to keep the entire assembly of unit 71, the tub and the agitator in position for entry of the plunger 297 in opening 295, I may use, if necessary, a pair

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of springs (not shown) connected to two diametrically opposite bolts 83 for holding the assembly generally centered.

As previously noted, the tub 103 is of special construction, being of smaller diameter at the top than at the bottom. It has an upturned flange 303 at the top. It is imperforate except for a series of holes 305 around its top and a number of holes 307 in its side wall adjacent its bottom. The holes 307 are closed by centrifugally acting valves 311 biased inward by springs 313. The lid opening in the top of the cabinet is bounded by a down-turned flange 315 which is received in the tub when the tub moves toward the lid.

Operation is as follows:

With the cabinet 1 in vertical position, the lid 19 is opened, the batch of laundry placed in the tub 103, and the lid closed and latched. In Fig. 2, I show latch means 23 as a solenoid-controlled latch for electrically latching the lid closed with a push button for releasing the latch. The tub 103 is then filled with water from the mixer 237 as in a conventional automatic washing machine, and soap is added in the usual manner. With the gearing in gear box 77 set for washing action, as previously explained, the motor 73 is energized and the agitator 95 is thereby oscillated and reciprocated for washing the laundry. During the washing, the tub 103 is stationary.

At the termination of the washing period, the batch of laundry is rinsed in conventional manner by draining the tub, filling it with rinse water and again draining the tub, several such rinses usually being employed. The tub is drained by setting the gearing in gear box 77 for spinning the tub at high speed as previously explained. The water in the tub flows out over the rim of the tub and through the holes 305. Following the rinsing, the tub is spun at high speed for damp drying. Initially, during the spin drying, holes 307 remain closed by valves 309, and some water is trapped around the wall of the tub by reason of its upward convergence. This trapped water provides a dynamic balancing action until high enough speed is attained for the valves 309 to open by centrifugal action, whereupon the trapped water drains from the tub. The water flowing out of the tub drains out through the drain 231 and is pumped out by pump 75.

The electric heater 265 is turned on some time prior to the termination of the spin-drying operation so that the heater and parts 244, 263 and 267 are well heated by the time spin-drying ceases. Following the spin-drying, the gearing in gear box 77 is set for low-speed rotation of the tub 103 as previously explained. Solenoid 299 is energized to enter the plunger 297 in the hole 295 in plate 81. As the plunger enters the hole, it operates the switch 301, and motor 209 is energized to rotate the shaft 27 and thereby swing the entire cabinet 1 to horizontal position (Fig. 6). The motor is deenergized when the cabinet reaches horizontal position by a conventional limit switch which may be mounted on the cabinet as indicated at L.

As the cabinet swings to horizontal position, the weight on spring 93 is relieved, as previously explained, and the unit 71, the tub 103 and agitator 95 are moved by the spring toward the lid 19. This closes the gap between the rim of the tub and the flange 315 of the lid to prevent laundry in the tub from coming out of the tub. It also brings the upper end of the agitator nearer the lid. It also results in a condition such that the unit 71 can not come off the plunger 297 even though the solenoid 299 should accidentally be deenergized and the plunger retracted, noting that the plunger projects from the solenoid even when the solenoid is deenergized.

As the cabinet begins to tilt, the blower motor is energized. This draws a partial vacuum in the tub compartment 11, and causes the butterfly valve 283 to swing down and open. As the valve swings down, the detent 287 is released and fitting 277 is moved toward the agitator by spring 281 to the point where the flange 279 on the fitting

engages the end of the agitator. With the butterfly valve open, air flows through the intake 257, around the motor 248, through the space between the cylinder 267 and the casing 244, through the space between the tube 263 and the cylinder 267, then through the tube 263, duct 261, and duct 273 to the agitator 95. The air cools the motor, allowing a larger motor to be used to increase the vacuum, and is heated by the motor in addition to its being heated by the heater elements. With the cabinet 1 in horizontal position, and with the tub 103 accordingly rotating on substantially a horizontal axis, the laundry in the tub is tumbled, and the hot air flows into the space between sleeves 107 and 114 out through the perforations 109 in sleeve 107 thereby to dry the clothes. The humid, lint-laden air resulting from the drying action flows out of the tub 103 via holes 305, then passes out through hose 255, the blower 247, hose 251, and the hollow shaft 27. The blower induces a strong circulation of air. A bag for collecting the lint may be connected to the end of the shaft where the air exists, or a hose leading to a window or an outside vent may be used to control heat and humidity as well as lint.

The drying operation continues until the desired degree of dryness is obtained. This may be automatically determined as, for example, by a time switch, a thermostatic switch, or a humidostatic switch (not shown). Finally, the dry laundry is removed, and the cabinet pushed back to vertical position.

It will be understood that the sequence of operations as above described will be electrically controlled. The electrical control system is not shown, since it does not constitute a part of the invention herein described, and utilizes standard controls.

I have found that fastest final drying is obtained if the tub is rotated at a speed of about 60 R. P. M., varying to some extent with the type of laundry in the tub, the moisture content, and the tub diameter. At this speed, the laundry in the tub takes on the form of a floating ring around the hollow agitator, and the hot air flows out of the agitator into the center of the floating ring. Fast drying also results from there being a partial vacuum in the tub compartment, and from the preheating of the parts 244, 263 and 267, these parts forming a heat reservoir, and also due to utilization of heat from the blower motor.

The apparatus is electrically safe, the heater 265 being isolated from the water and moist laundry in the tub compartment. Here it is to be noted that during the washing, rinsing and spin-drying, the butterfly valve 283 is closed to prevent entry of water into the duct 273. Also, due to the heat reservoir action of parts 244, 263 and 267, the heater 265 may draw a relatively low and safe electrical load.

The cabinet 1 may be tilted to an angle of about 45° for special ease in loading and unloading and, for a small batch of laundry, may be operated for washing by tumble action when in such a tilted position.

The special tub shape and centrifugally operating valves 311 provide a dynamic balancing action when spin-drying and allow a larger size tub to be used within a given cabinet. The dynamic balancing action is particularly desirable in that it allows the apparatus to by-pass certain critical vibration speeds when spin-drying, and the larger size tub is particularly desirable in view of the use of the apparatus for both washing and drying.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description are shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. Laundry apparatus comprising a support, an ex-

terior cabinet having a top opening and pivotally mounted on the support to swing between a vertical and a horizontal position, a lid for the opening, and a tub in the cabinet rotary on an axis which is generally fixed relative to the cabinet and which extends heightwise of the cabinet.

2. Laundry apparatus as set forth in claim 1, further comprising an agitator in the tub.

3. Laundry apparatus comprising a support, an exterior cabinet having a top opening and pivotally mounted on the support to swing between a vertical and a horizontal position, a lid for the opening, a tub in the cabinet rotary on an axis which is generally fixed relative to the cabinet and which extends heightwise of the cabinet so that the tub is vertically upright when the cabinet is in vertical position and generally horizontal when the cabinet is in horizontal position, means in the cabinet for rotating the tub when horizontal, and means for causing a flow of heated air in the tub when horizontal.

4. Laundry apparatus comprising a support, an exterior cabinet having a top opening and pivotally mounted on the support to swing between a vertical and a horizontal position, a lid for the opening, a tub in the cabinet rotary on an axis which is generally fixed relative to the cabinet and which extends heightwise of the cabinet so that the tub is vertically upright when the cabinet is in vertical position and generally horizontal when the cabinet is in horizontal position, a hollow perforated agitator in the tub adapted for oscillation while the tub remains stationary, means in the cabinet for operating the agitator for washing when the tub is vertically upright, for spinning the tub for spin-drying when the tub is vertically upright and for rotating the tub for final drying when the tub is horizontal, and means in the cabinet for causing a flow of heated air into the agitator and thence out into the tub through the perforations in the agitator.

5. Laundry apparatus as set forth in claim 4 wherein the means for causing the flow of heated air comprises a conduit in part in the cabinet and in part in the lid, the part in the lid being communicable with the agitator, a heater in the conduit, and means for exhausting air from the cabinet whereby a flow of air is induced through the conduit and over the heater to the agitator.

6. Laundry apparatus comprising a support, a hollow shaft carried by the support for rotation on a horizontal axis, an exterior cabinet carried by and enclosing the shaft and being swingable with the shaft between a vertical and a horizontal position, a tub compartment toward the top of the cabinet, an open-top watertight tub in the compartment, water supply lines leading into the compartment through one end of the hollow shaft and extending upward in the compartment to a point above the top of the tub for filling the tub through its open top, and drain means leading out of the compartment including a line leading out through said end of the hollow shaft.

7. Laundry apparatus as set forth in claim 6, further comprising means for causing a flow of heated air in the tub including a blower for withdrawing air from the compartment having its outlet connected to the hollow shaft.

8. Laundry apparatus comprising a support, a cabinet having a top opening pivotally mounted on the support to swing between an upright vertical position and a forwardly extending horizontal position, a lid for the opening, a partition in the cabinet dividing it into an upper tub compartment and a lower chamber, a motor and a transmission mounted in the lower chamber, a quill extending from the transmission into the tub compartment through an opening in the partition, a shaft extending from the transmission in the quill, a tub fixed to the upper end of the quill in the tub compartment, an agitator on the upper end of the shaft in the tub, a flexible

diaphragm closing the opening in the partition around the quill, a spring biasing the motor, transmission, tub and agitator assembly toward the lid, said assembly being moved toward the lid by the spring when the cabinet swings to horizontal position and the weight on the spring is relieved.

9. Laundry apparatus as set forth in claim 8, further including means for holding the said assembly in centered position when the cabinet is swung to horizontal position.

10. Laundry apparatus as set forth in claim 8, wherein the agitator is hollow and perforated, and further including a conduit in part in the cabinet and in part in the lid, the part in the lid being in communication with the agitator when the said assembly moves toward the lid, a heater in the conduit, and means for exhausting air from the tub compartment whereby a flow of air is induced through the conduit and over the heater to the agitator.

11. Laundry apparatus as set forth in claim 10, further including a valve in the conduit adapted to open in response to exhausting of air from the tub compartment.

12. Laundry apparatus comprising a cabinet having an opening, a lid for closing the opening, a tub in the cabinet, a hollow perforated agitator in the tub, an air duct in the lid opening at one end to the end of the hollow agitator, and means in the cabinet for causing a flow of heated air through the duct into the agitator and thence out through the perforations in the agitator.

13. In laundry apparatus, a tub, a shaft extending into the tub through its bottom and adopted for oscillation while the tub remains stationary, an agitator on the shaft in the tub, and oscillable with the shaft, and a skirt of flexible sheet material at the bottom of the agitator and secured to the agitator for oscillation therewith having its margin slidably engaging the bottom of the tub for preventing laundry in the tub from jamming under the agitator and for reducing friction between the laundry and the bottom of the tub.

14. Laundry apparatus as set forth in claim 1, wherein the pivotal mounting for the cabinet is located toward the front of the cabinet.

15. Laundry apparatus as set forth in claim 14 wherein the transmission includes a fixed member and a member shiftable on the fixed member, one of said members having a pair of spaced grooves and the other a detent biased toward the grooves, said grooves and detent being formed so that the shiftable member is biased in one direction when the detent is in one groove and in the opposite direction when the detent is in the other groove.

16. Laundry apparatus comprising a cabinet having a top opening, a lid for closing the opening, a tub mounted in the cabinet adapted for rotation on a generally vertical axis and having a top opening for loading it with laundry and removing laundry therefrom through the top opening of the cabinet when the lid is open, a hollow perforated agitator in the tub, an air duct in the lid opening to the upper end of the agitator, and means in the cabinet for causing a flow of heated air through the duct into the agitator and thence out through the perforations in the agitator.

17. Laundry apparatus as set forth in claim 16 wherein the agitator is perforated throughout its length, with the majority of the perforations toward its bottom.

18. Laundry apparatus comprising a support, a cabinet having a top opening pivotally mounted on the support to swing between an upright vertical position and a horizontal position, a tub mounted in the cabinet for movement toward and away from the top of the cabinet and occupying a position away from the top of the cabinet when the cabinet is in vertical position, and means for moving the tub toward the top of the cabinet when the cabinet is swung to horizontal position.

19. Laundry apparatus as set forth in claim 18, further including means for holding the tub in centered position when the cabinet is swung to horizontal position.

20. Laundry apparatus as set forth in claim 18, further comprising a hollow perforated agitator in the tub and movable with the tub toward and away from the top of the cabinet, and a conduit in part in the cabinet and in part in the lid, the part in the lid being in communication with the agitator when it moves with the tub toward the top of the cabinet, a heater in the conduit, and means for inducing a flow of air through the conduit and over the heater to the agitator.

21. Laundry apparatus as set forth in claim 20, further including a valve in the conduit adapted to open in response to induction of the flow of air.

22. Laundry apparatus comprising a support, an open-top watertight rotary tub mounted on the support to swing between a vertical upright position and a horizontal position, an agitator in the tub adapted for oscillation while the tub remains stationary, means swingable with the tub for oscillating the agitator while the tub is in vertical position and stationary, for spinning the tub for damp drying when the tub is in vertical position, and for rotating the tub for final drying when the tub is in horizontal position, means for retaining laundry in the tub when the tub is in horizontal position, and means for directing a flow of heated air to the center of the tub when in horizontal position for the final drying.

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