

April 14, 1959

B. L. BRUCKEN

2,881,609

COMBINED CLOTHES WASHING MACHINE AND DRYER

Filed Nov. 16, 1953

10 Sheets-Sheet 1

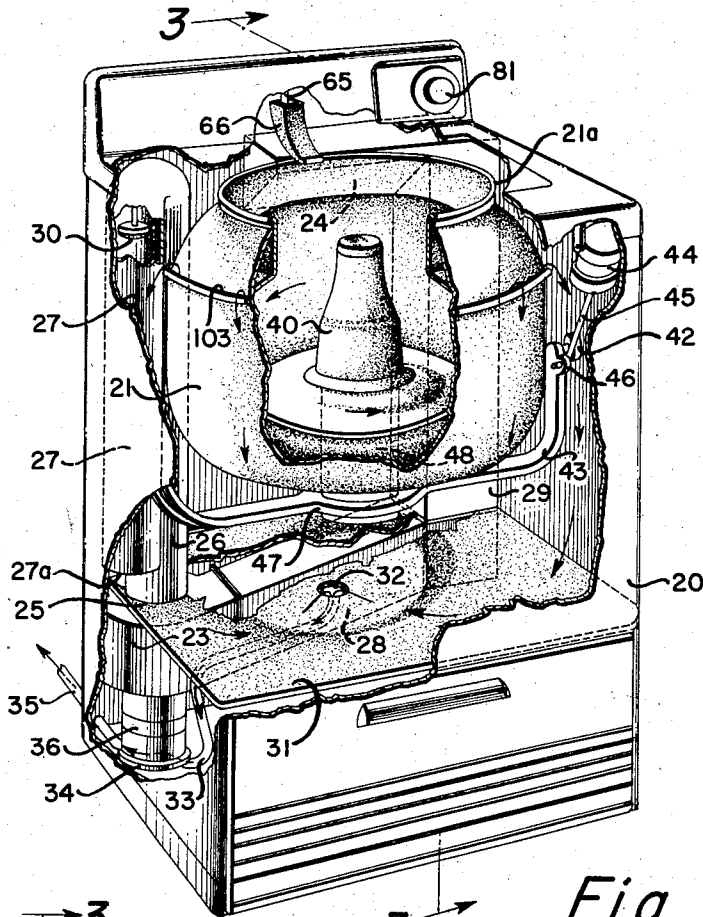
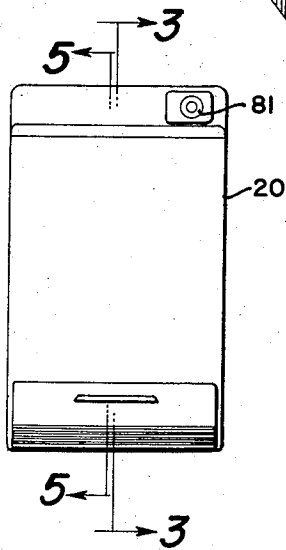


Fig. 2



→ --- Water Flow (Spin)

Fig. 1

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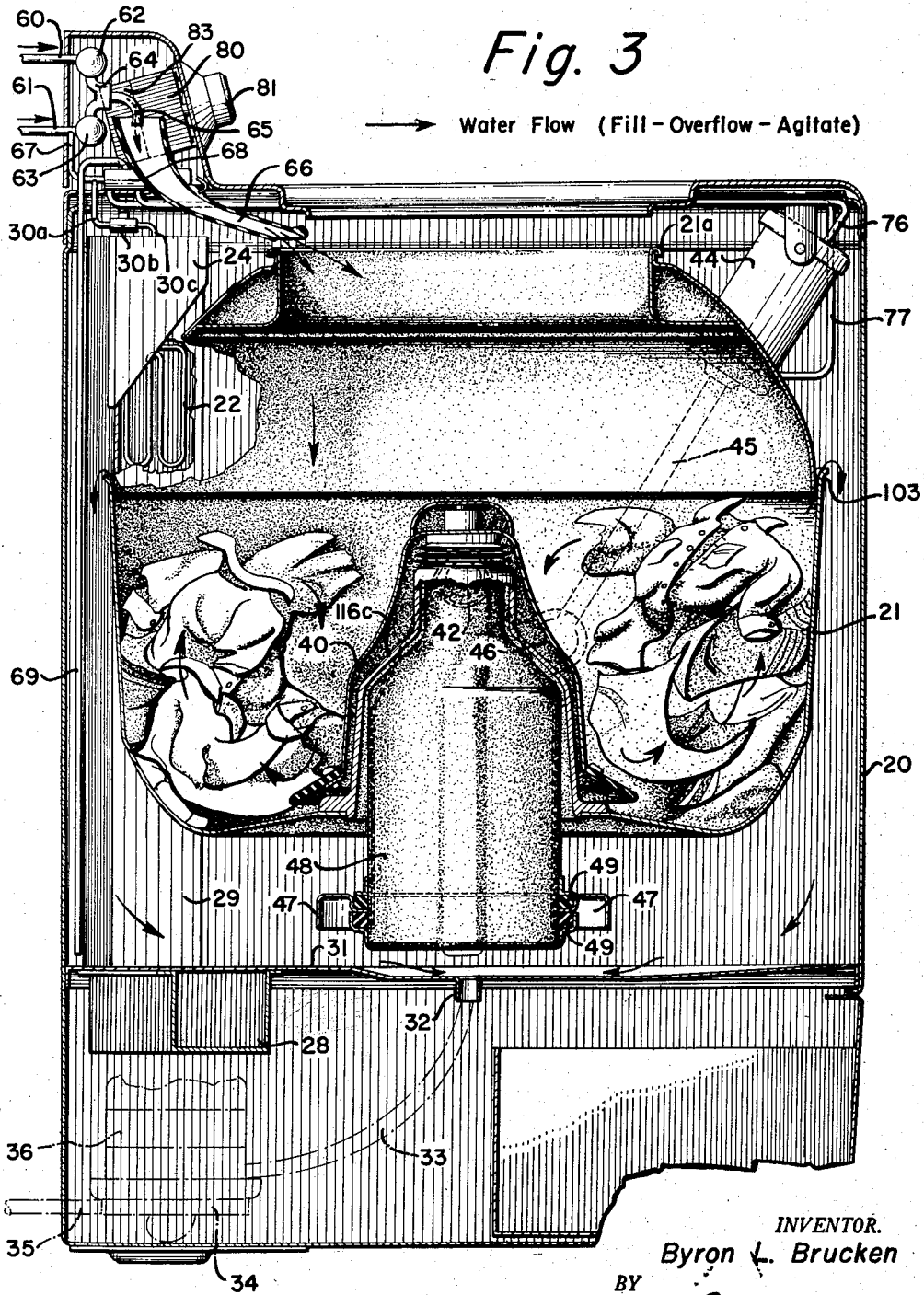
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10 Sheets-Sheet 2



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10 Sheets-Sheet 5

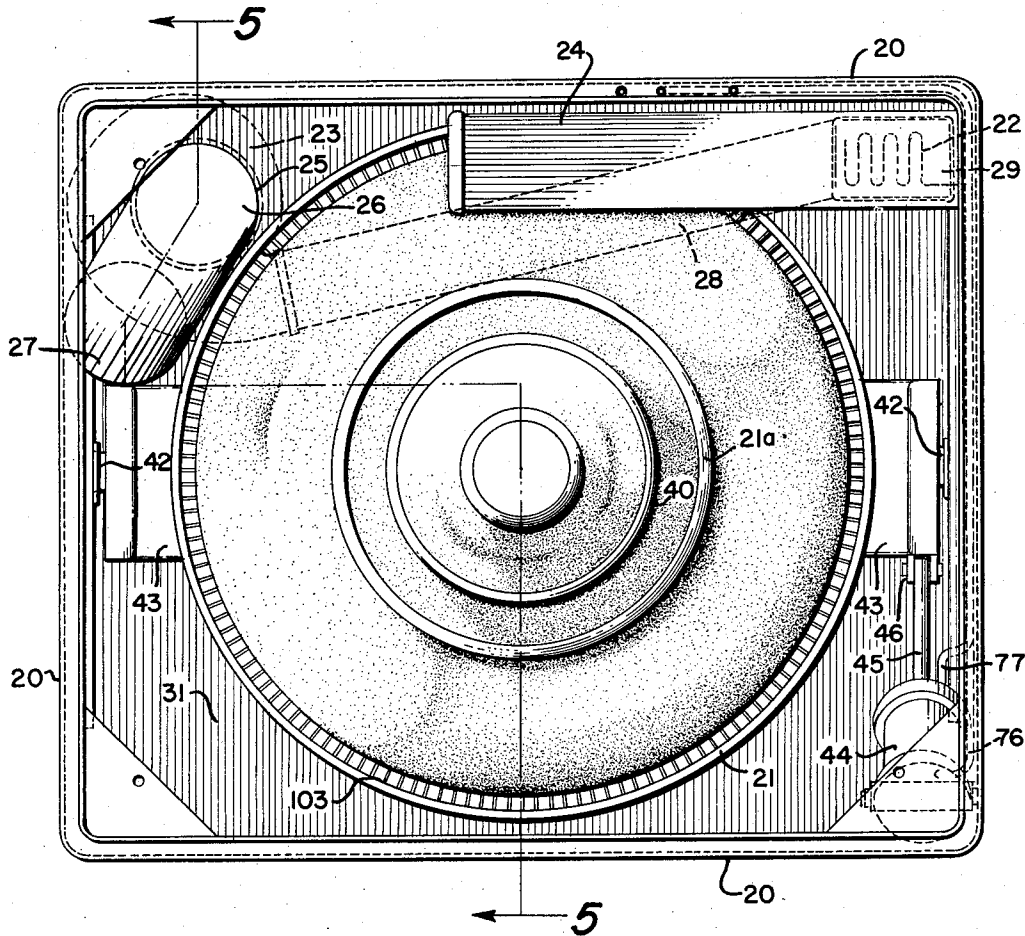


Fig. 6

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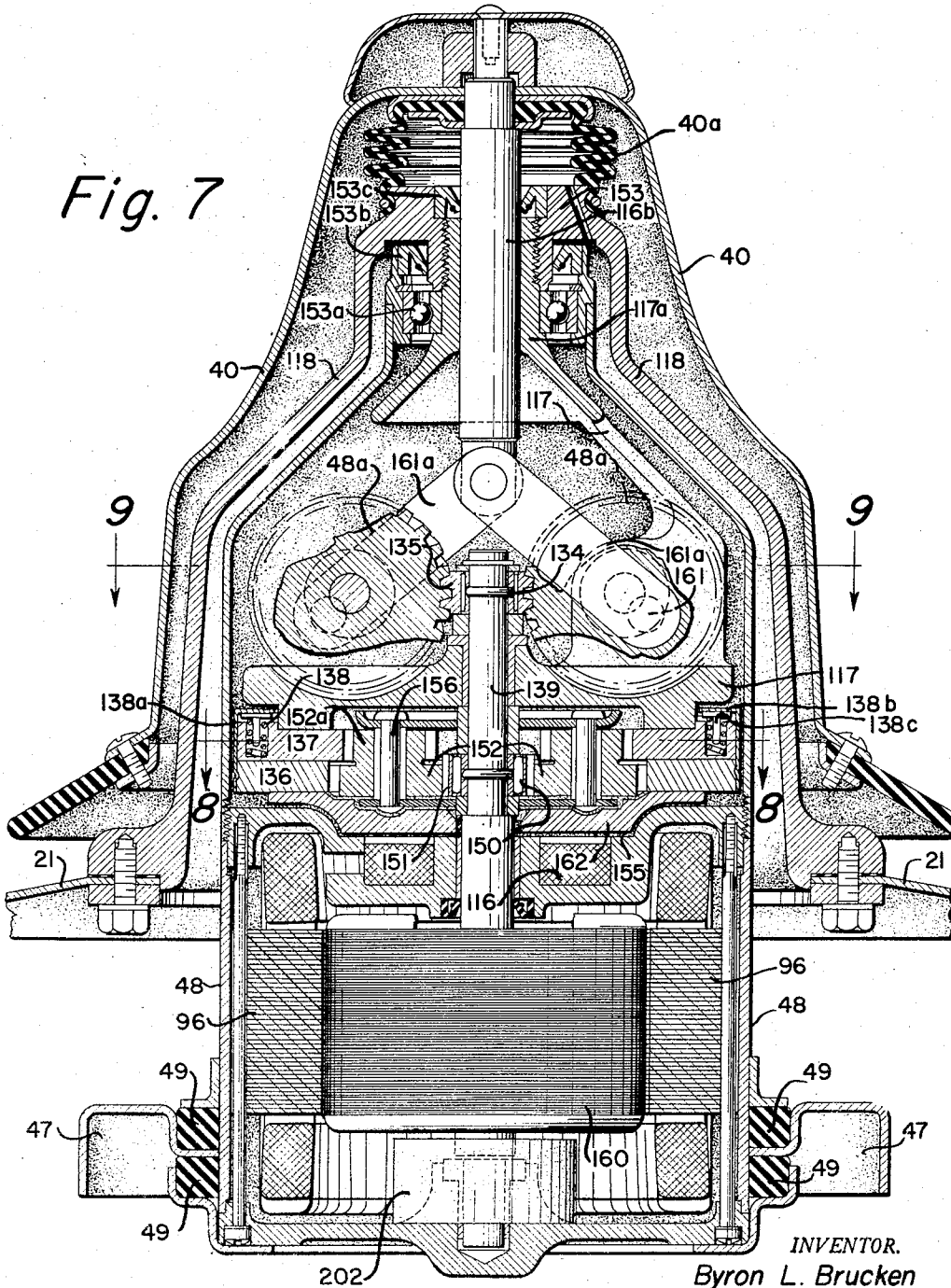
2,881,609

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10 Sheets—Sheet 6

Fig. 7



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2,881,609

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10 Sheets-Sheet 7

Fig. 8

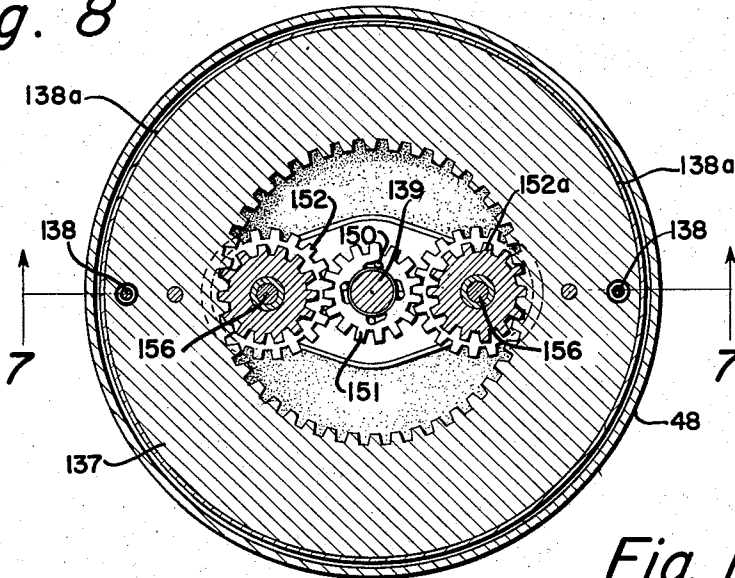
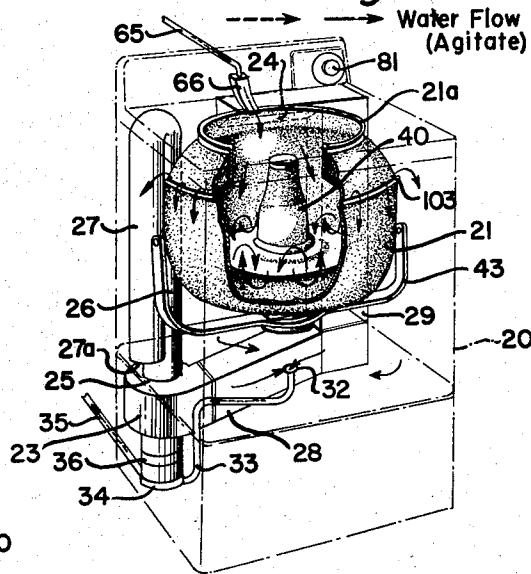


Fig. 11



.....> Condenser Water Flow
-----> Air Flow

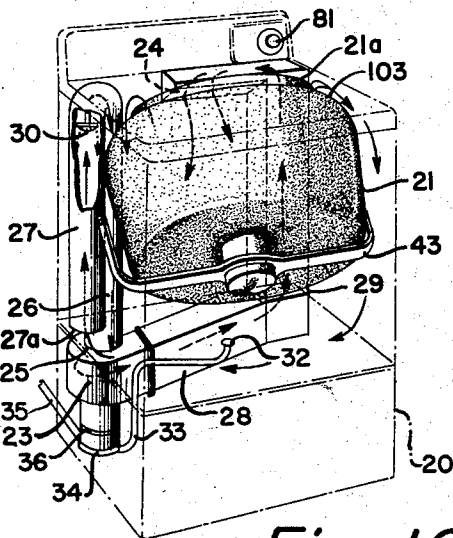


Fig. 10

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10 Sheets-Sheet 8

Fig. 9

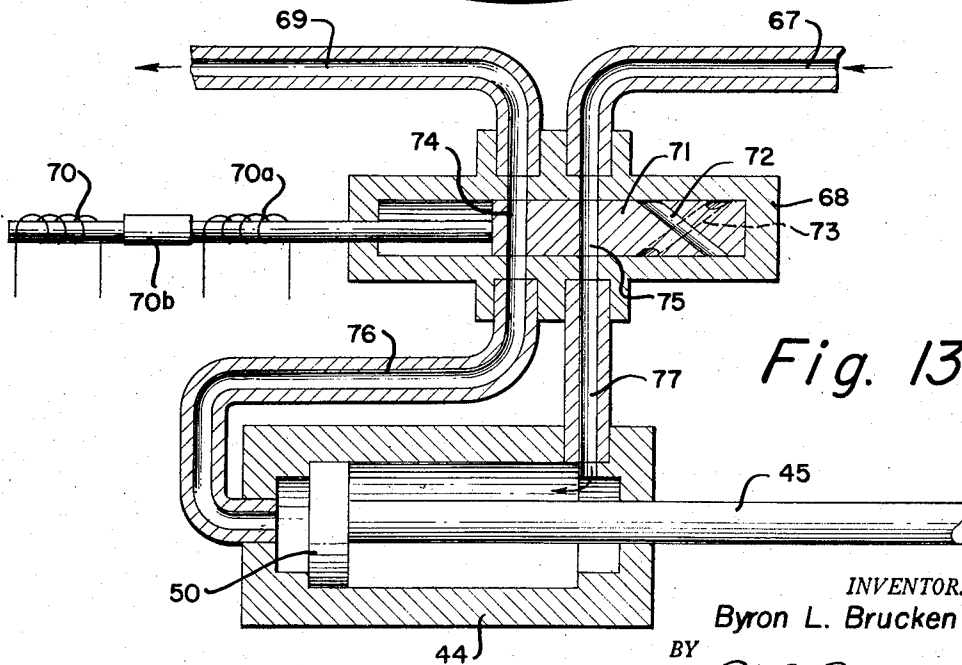
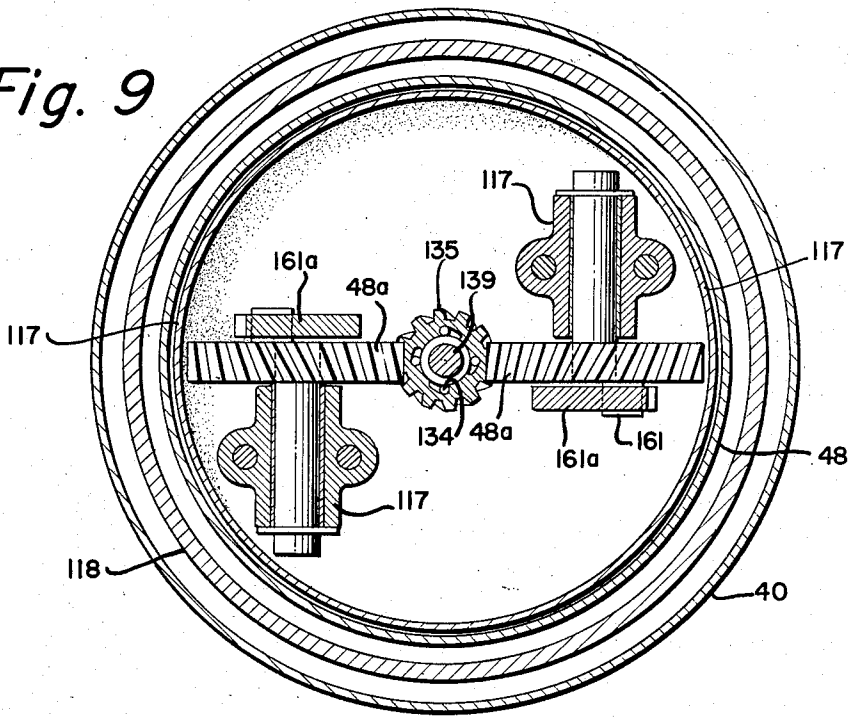


Fig. 13

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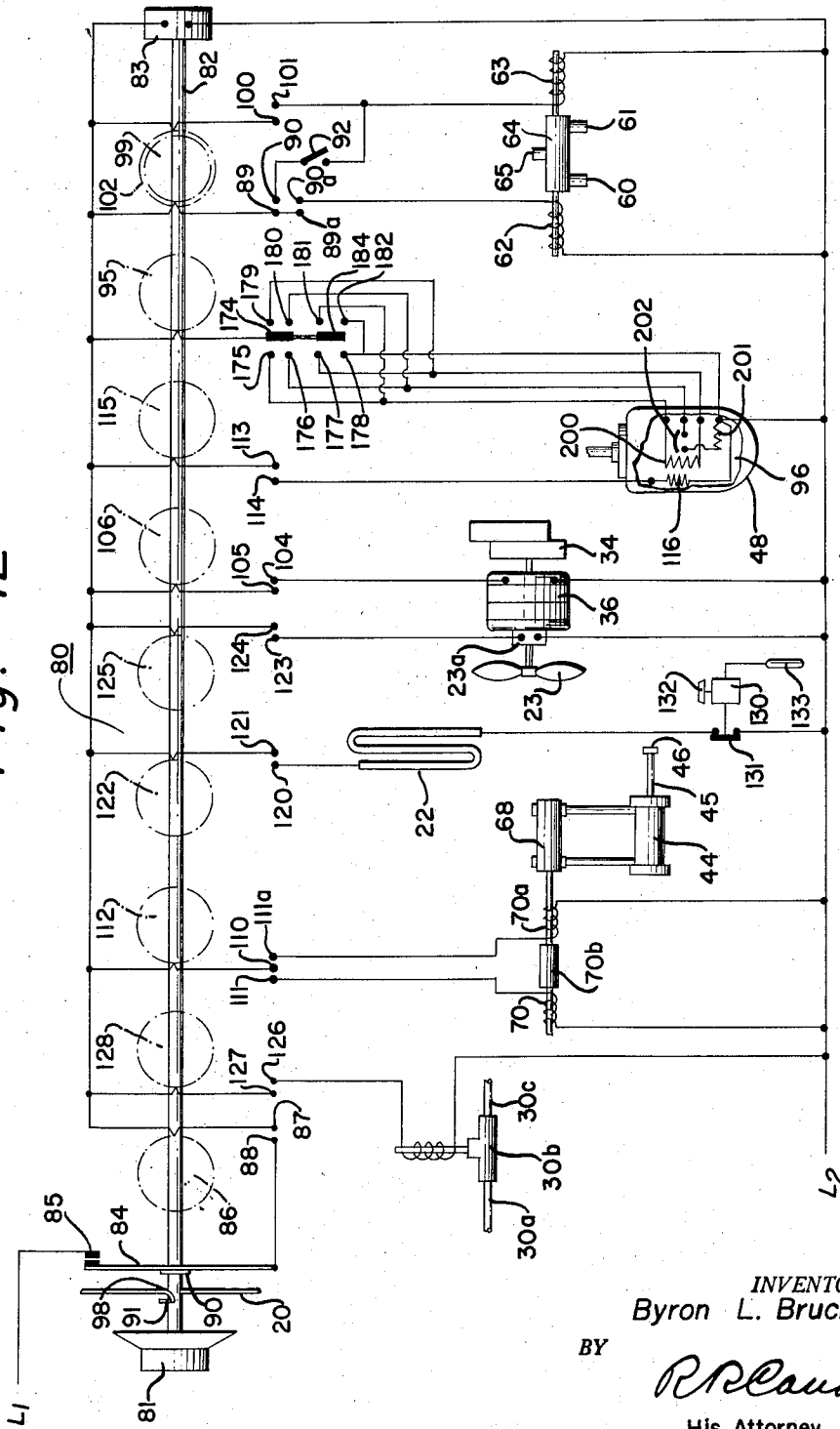
2,881,609

COMBINED CLOTHES WASHING MACHINE AND DRYER

Filed Nov. 16, 1953

10 Sheets-Sheet 9

Fig. 12



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10 Sheets-Sheet 10

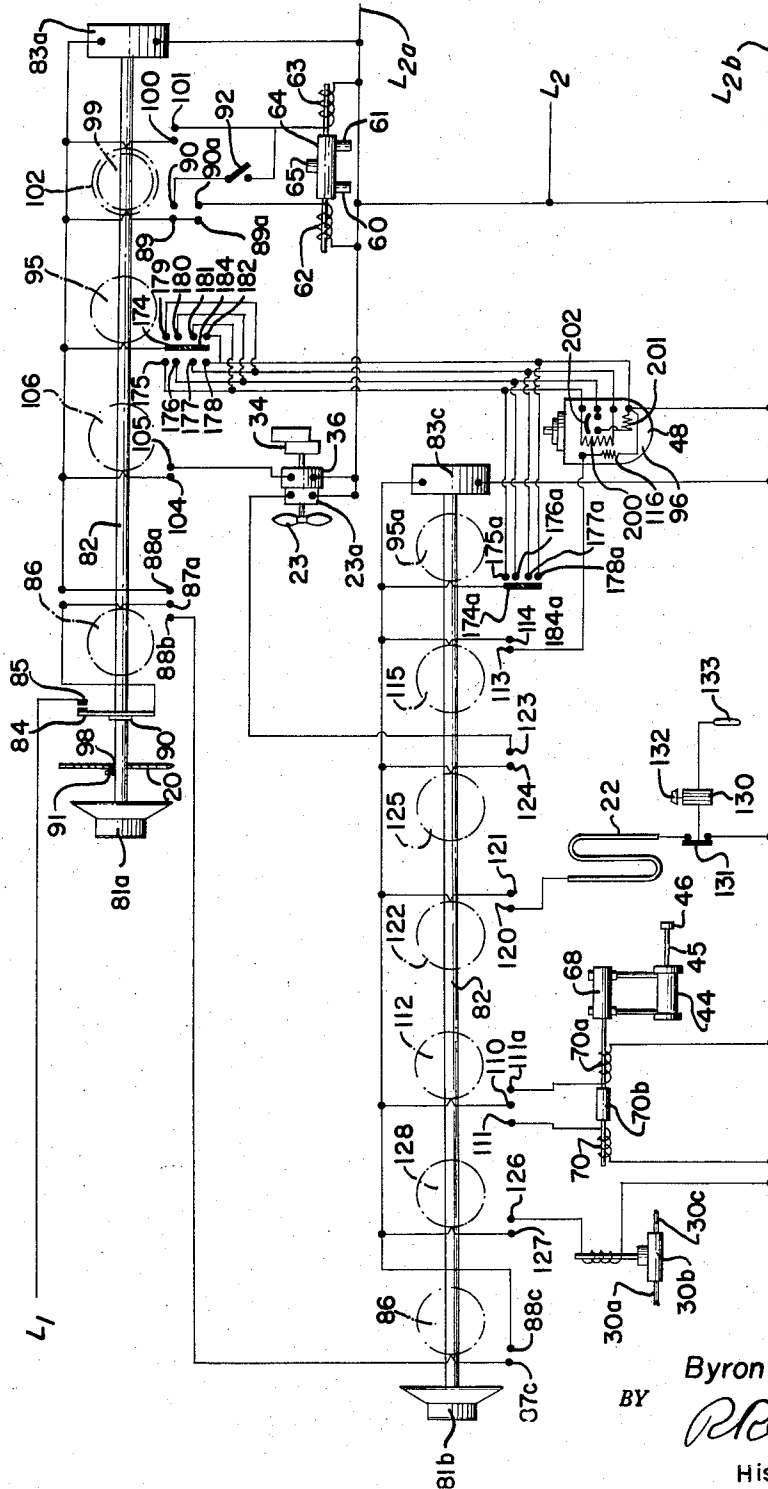


Fig. 14

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1

2,881,609

COMBINED CLOTHES WASHING MACHINE AND DRYER

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Application November 16, 1953, Serial No. 392,222

1 Claim. (Cl. 68—19)

This invention relates to domestic appliances and more particularly to a combined clothes washing machine and dryer.

An object of this invention is to provide a combined washer and dryer in which a rotatable tub is movable from a vertical position for washing to a non-vertical position for drying.

Another object of this invention is to provide a top loading combined washer and dryer.

Another object of this invention is to provide an improved combined washer and dryer with air heating and blowing means having an air discharge in alignment with the tub of the washer when it has been moved to its non-vertical position.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of the invention is clearly shown.

In the drawings:

Figure 1 is a front elevation of the cabinet for the combined washer and dryer.

Figure 2 is a view in perspective and partly in cross-section of said washer and dryer.

Figure 3 is a vertical cross-section taken substantially along the lines 3—3 of Figures 1 and 2.

Figure 4 is a view similar to Figure 3 but showing the tub in its non-vertical position.

Figure 5 is a vertical cross-sectional view taken somewhat along the line 5—5 of Figure 6. In addition, the tub is shown dotted in its non-vertical position, for drying.

Figure 6 is a top plan view of Figure 5, with the top panel removed.

Figure 7 is a vertical cross-sectional view of the driving mechanism for the agitator and tub, taken along line 7—7 of Figure 8.

Figures 8 and 9 are horizontal cross-sectional views taken along the lines 8—8 and 9—9 of Figure 7.

Figure 10 is a phantom view similar to Figure 2, on a reduced scale and showing more detail concerning the air flow and condenser water flow, and with the tub in tilted position.

Figure 11 is a phantom view similar to Figure 2, on a reduced scale and showing in more detail the filling and agitation features of the machine.

Figure 12 is a diagrammatic view showing the timer and elements governed thereby.

Figure 13 is a diagrammatic representation of the mechanism for moving the tub from a vertical to a non-vertical position.

Figure 14 shows two timers for controlling the washing and drying operations independently or automatically in sequence.

Cabinet 20 contains a rotatable tub 21 movable from a vertical position, as shown in Figures 2, 3, 5, etc., to a non-vertical position as shown in Figures 4, 10, etc.

Clothes are washed in the tub 21 while it is in its vertical position. They are also wrung centrifugally by

2

spinning the tub at high speed while it is still in its vertical position. Thereafter, the tub is tilted to its non-vertical position and rotated at low, clothes tumbling speed while warm air is blown into the tub.

Air heating means 22 and air blowing means 23 discharges warm air at 24 in alignment with the mouth of the tub when the tub is in its non-vertical position. The blowing means 23 receives air at 25 from the down flow tube 26. The tube 26 receives air from the air up-flow condenser 27, which has an air intake at 27a inside the cabinet 20 but outside the tub 21, and adjacent the floor 31. This air flows upwardly through the condenser tube 27 where the moisture in the air is condensed, thence down through the down flow tube 26 to the blower 23 and from thence through another conduit 28 to a riser 29 where it is heated by heater 22, and then to the air discharge conduit 24. The warm dry air is discharged into the tilted tub where it picks up the moisture from the clothes. The moistened air then flows mostly over the rim 21a of the tub and returns to the air intake 27a to repeat the cycle.

Moisture carried by the air and removed from the clothes is condensed from the air by the cold water spray 30 at the top of the condenser tube 27. The dried air is rewarmed and recirculated to continue to dry the clothes to the desired degree of clothes dryness.

The water sprayed and condensed in 27 drops through the condenser air intake 27a to the floor 31, from whence it flows to the water drain 32 (Figures 5 and 10). The water then flows through conduit 33 to pump 34 which discharges into a hose 35, which may be connected to a stationary tub or drain. Conveniently, the blower 23 and pump 34 may be driven by the motor 36.

If desired, the blower 23 may be driven from the motor 36 through the medium of electrically operated clutch 23a, although such clutch may be omitted for manufacturing economy.

An oscillatable agitator 40 is placed within the tub 21, and preferably is vertically reciprocable therein, by mechanism more fully described elsewhere.

The tub 21 is mounted within the casing 20 on horizontal trunnions 42 which support a swinging yoke 43. The yoke is actuated by the plunger-cylinder construction 44, through the medium of the connecting rod 45 and crank 46. Movement of the piston 50, within cylinder construction 44 moves the connecting rod 45.

The yoke 43 has a ring 47 at its lowermost central part. This ring 47 resiliently supports the mechanism housing 48 by means of resilient rings 49. The housing 48 contains the tub and agitator driving mechanism more fully shown in Figures 7 and 8.

The mechanism is capable of reciprocating the agitator vertically at the proper speed through the medium of shaft 116b, through gear reduction 48a while the rotor 160 of motor 96 runs with its nearest part to the left, as viewed in Figure 7, and clockwise in Figures 8 and 9. The tub is spun at high speed by cage 117, and tub supporting cone 118 while the motor 96 runs with its nearest part to the right, as viewed in Figure 7, and counterclockwise in Figures 8 and 9. The tub 21 rotates at slow, clothes tumbling speed when it is in its non-vertical position because of a change of gear drive in housing 48. Further description of the mechanism in housing 48 appears elsewhere.

The agitator 40 is flexibly water-sealed with respect to tub cone support 118 by means of flexible bellows 40a.

Water for washing the clothes is introduced through the hot water pipe 60 (Figure 3) and cold water pipe 61, which discharge respectively through the solenoid valves 62 and 63 into the mixer and constant flow control 64, which discharges through the faucet 65 into the flexible

nozzle 66 directed into the mouth of the tub 21, when the tub is in its vertical position.

To rock the tub from vertical to non-vertical position, the cold water pipe 61 (Figures 3 and 13) is also connected to the pipe 67 leading to the pilot valve 68 which directs the water selectively to opposite sides of the piston 50 within the cylinder 44 and from whence it discharges through the pipe 69 to the floor 31 and drain 32. The pilot valve 68 (Figure 13) may be controlled by solenoids 70 and 70a which pull magnet armature 70b in opposite directions to actuate the plunger 71 for selectively directing the water to opposite sides of the piston 50. The plunger 71 has passages 72, 73, 74 and 75 which connect the pipes 76 and 77 at suitable times to feed to and discharge water from both sides of piston 50 to rock tub 21 from its vertical to its non-vertical position and vice versa. The cold water pipe 61 is also connected to condenser supply pipe 30a leading to condenser valve 30b which controls the flow of water through extension 30c to condenser spray 30.

The mechanism in housing 48 is constructed and operates as follows:

For agitation, the motor rotor 160 runs to the left in Figure 7 or clockwise in Figures 8 and 9. The motor shaft 139 becomes free-running with respect to one way, roller type clutch 150 and clutches at one way, roller type clutch 134 to rotate spiral gear 135 and spiral gears 48a. Gears 48a, in turn, reciprocate the shaft 116b through the medium of cranks 161 and connecting links 161a.

For fast tub rotation, to wring the clothes while the tub is in a vertical position, motor rotor 160 runs to the right in Figure 7 and counterclockwise in Figures 8 and 9. At this time, clutch solenoid 116 remains de-energized and solenoid armature 162 is not pulled down. Solenoid armature 162 fixedly carries gear plate 136, and since the solenoid is not energized, the compression springs 138 pull the gear plate 136, through the medium of connectors 138a, upwardly against the gear plate 137 and frictionally hold the gear plates together. Gear plate 137 is attached to the cage 117. Therefore, rotary power flows at the same speed from the motor shaft 139 through one way, roller type clutch 150, gears 151 and 152 to gear plates 136 and 137, cage 117, tub support 118 and tub 21.

Details of the connection between cage 117 and tub support 118 include a cone-shaped upper extension 117a of cage 117, which threadedly engages upper neck 153 of the tub support 118. The cage 117 and upper extension 117a are rotatably supported within housing 48 by ball bearing 153a. Liquid seals 153b and 153c are provided to prevent undesired flow of lubricant and/or water.

For slow rotation of the tub, while it is in a non-vertical position, to dry the clothes, clutch solenoid 116 is energized and pulls armature 162 into stationary frictional engagement with stationary surface 155, and this in turn holds gear plate 136 away from gear plate 137 and holds plate 136 stationary and allows plate 137 to rotate. The motor rotor 160 is rotated to the right in Figure 7 and counterclockwise in Figures 8 and 9. Rotary power flows from motor shaft 139 through clutch 150 and rotates gear 151. Since plate 136 is stationary, gear 151 rotates planetary gears 152 and 152a to rotate gear plate 137 and cage 117 at a desired slower speed by well-known planetary action. Cage 117 rotates tub 21 at such slower speed for the drying operation heretofore explained.

The motor includes a running winding 200, a starting winding 201, and a centrifugal switch 202 for disconnecting the starting winding when the motor speed reaches a predetermined value. These elements of the motor may be of the usual construction, now well known.

The mechanism in housing 48, per se, is made the subject of the patent for Domestic Appliance 2,801,549,

issued Aug. 6, 1957, to which reference may be made if necessary for further information.

The timer 80 (Figure 12) controls elements of my combined washer and dryer to cause them to operate automatically in proper sequence. The time knob 81 is used for indicating the amount of travel of the timer, and for manually setting the timer shaft 82. The knob may have "start" and "stop" and intermediate indications on it. The shaft 82 is driven by the timer motor 83 preferably in a quick step by step partial rotation in a manner somewhat similar to that described in the patents to K. O. Sisson 2,520,695, August 29, 1950, and/or 2,549,025, April 17, 1951. The shaft 82 may be selectively set manually by the knob 81 while either in its retracted position shown in Figure 12 or in its pushed in position, as described in the Sisson patents. When knob 81 is pushed in (toward the right in Figure 12) contact 84 closes on 85. If knob 81 is at "start" or any other operating intermediate position the timer motor cam 86 closes 87 on 88 to energize timer motor 83 throughout from "start" position to "stop" position, when contacts 87 and 88 are automatically opened to stop all operations. Spring 90 corresponds to 85a of Sisson 2,520,695, and pin 91 is provided to cause the knob to be automatically pushed out as it is manually rotated beyond the "stop" position and past cam 98 toward the "start" position, so that the machine will not start until the knob is deliberately pushed in by the user.

The operation is as follows:

To wash a load of clothes, the user inserts the clothes and detergent in the tub and moves the knob 81 to "start" (or to a shortened initial agitation period as described in Sisson 2,549,025) and pushes the knob 81 in (toward the right in Figure 12). This closes 84, 85 and 87, 88, as previously described, to energize timer motor 83.

The initial fill is controlled by closing 89, 90 and 89a, 90a, to energize hot solenoid valve 62 the correct period of time for a hot fill (or both 62 and 63 if manual "mix" switch 92 is closed). Thereafter 89, 90 and 89a, 90a are opened. The first pulsation or agitation is produced by the closing of contact 174 with contacts 179 and 180 by means of cam 95, and by the closing of contact 184 with contacts 181 and 182 which rotates the motor 96 in casing 48 in the correct direction to reciprocate the agitator 40 vertically for the correct period of time.

To whirl the tub at high speed, while vertical, for wringing the clothes, the timer contact 174 closes on 175 and 176 while contact 184 closes on 177 and 178 to rotate motor 96 in the other direction to rotate tub 21 and agitator 40 at high speed for the correct period of time.

A tepid or mix rinse is produced by the timer automatically by repeating the previous fill, agitation and spin operations without detergent under the control of the timer. A cold rinse (with or without a previous tepid rinse) is obtained by closing 100, 101 by cam 102 for the proper length of time to fill the tub. Cams 99 and 102 are indicated concentrically because they correspond to similar parts in the Sisson Patent 2,549,025.

If it is desired to have the machine agitate and spin the cold rinse "without overflow," the timer is designed so that 100, 101 are opened before agitation is produced. If "overflow rinse" is desired, then the timer is designed so that 100, 101 remain closed during this rinse agitation. Thereafter, the last rinse spin is obtained, after the fill and agitation have been turned off, by closing the proper circuits of motor 96 as previously described, after which the circuits of motor 96 are opened.

The water spun from the clothes in the foregoing operations is discharged from the tub during the spin over the rim 103 from which it hits the side walls of cabinet 20 and flows down to floor 31, through outlet 32, pipe 33, pump 34 and discharge hose 35. Operation of the

5

pump is accomplished by the closing of 104, 105 by cam 106 which drives pump and fan motor 36.

To dry the load of clothes referred to in the two preceding paragraphs, the timer is permitted to continue to turn and closes 110, 111a by cam 112 to tilt the tub 21 to non-vertical position by energizing solenoid 70a and causing piston 50 to move to the position shown in Figure 13. Thereafter, a slow turning of tub 21 is produced to tumble the clothes in the tub, warm air is blown into the tub to evaporate the moisture from the clothes, the evaporated moisture is condensed by cold water sprayed at 30, and the water is discharged at 35. To accomplish this the timer closes contact 174 on 175, 176 and contact 184 on 177, 178 by cam 95 to rotate motor 96 in the same direction as in spin; closes contacts 113, 114 by cam 115 to energize solenoid 116 to produce slow rotation of tub 21; closes contacts 120, 121 by cam 122 to energize heater 22; closes contacts 104, 105 by cam 106 to energize fan and pump motor 36; closes contacts 123, 124 by cam 125 to energize blower solenoid clutch 23a, if such a clutch is used; closes contacts 126, 127 by cam 128 to energize condenser water valve 30b. This operation continues for a sufficient time to dry the clothes. Thereafter, 110 and 111 are closed to rock the tub to vertical position. The timer then opens all contacts except 84, 85 and 87, 88 and thereafter opens 87, 88 at the "stop" position automatically to stop all operations of the washer-dryer and of the timer itself.

If desired, the heater 22 may be controlled by a thermostat 130, controlling switch 131, and being manually adjustable as to temperature setting by knob 132, and having a thermostatic bulb 133 in the machine wherever desired.

If the user wishes to wash clothes without drying them, the timer is stopped after the final spin. If the user wishes to dry clothes without washing them in this machine, he places the timer in a position just before the tilting of the tub, places the clothes in the tub and then pushes the knob 81 in (to the right in Figure 12). The drying operation will take place, starting with the tilting of the tub, as previously described.

If it is desired to have two knobs so that the washing operations can be automatically stopped without using the drying operations, and the drying operation can be started without a washing operation, the timer construction shown in Figure 14 may be used. Wherever the same numerals are used as in Figure 12, it is intended to indicate that substantially the same operation is controlled in the same manner. Wherever a different numeral is used, or a suffix is used which is not used in Figure 12, it is intended to indicate that such part has been added or modified as the case may be.

Knob 81a controls a timer mainly for washing, while knob 81b controls a timer mainly for drying. Knob 81a has "start," "stop" and intermediate wash indications on it. Knob 81b has "start," "stop" and intermediate drying indications on it. If desired, 81a may be suitably indicated as the washing control knob and 81b as the drying control knob. Knobs 81a and 81b may or may not be provided with springs and cams corresponding to 90, 98 of Figure 12, as desired. The following description will assume that knobs 81a and 81b will be pushed in whenever necessary.

If knob 81a is placed at "start" and knob 81b is at "stop" only washing will be performed. If knob 81a is placed at "stop" while knob 81b is placed at "start" only drying will be performed. If both knobs 81a and 81b are placed at "start," then washing will be performed first followed by a drying operation.

To wash without drying, knob 81a is placed at "start" and pushed in, while knob 81b is placed at "stop." Current flows through the wash timer from L₁, 85, 84, 87a,

6

88a then to the timer motor 83a and L_{2a} and L₂. The contacts controlled by cams 106, 95, 99 and 102 operate as in Figure 12 and the parts controlled thereby are connected to the power lines L₁, L₂ in proper sequence for washing. The washer-dryer operates the same as described with respect to the wash portion of Figure 12. When knob 81a reaches "stop" 87a opens from 88a and closes on 88b. This stops the wash timer motor 83a and sends L₁ current to the dryer timer. If knob 81b is at "stop," 87c is open from 88c and no drying operations can take place. The machine is completely stopped.

To dry without washing, wet clothes are placed in the tub. Knob 81a is placed at "stop" and pushed in, and knob 81b is placed at "start" and pushed in. Contacts 87c and 88c are closed so current flows from L₁ through 85, 84, 87a, 88b, 87c, 88c, timer motor 83c, L_{2b} and L₂. As motor 83c begins to run, cam 112 tilts the tub 21 and the drying operations described with respect to the drying steps in Figure 12 proceed to the end, including the rocking of the tub to vertical position, at which time knob 81b reaches "stop" and all operations cease. Cam 95a operates the running winding 200 and the starting winding 201 the same as was done by cam 95 of the timer in Figure 12 for slow rotation of tub 21 by closing contact 174a on 175a and 176a, and contact 184a on 177a and 178a.

To wash and dry with the timers of Figure 13, both knobs 81a and 81b are placed at "start" with the clothes and detergent in the tub. Contacts 87a, 88a are closed so current can only be supplied to the wash timer which then causes all the washing operations to take place as above described, after which knob 81a reaches "stop." This connects 88b and 87a to energize and start the drying timer (which is at "start") and the drying operations which continue until knob 81b reaches "stop" when all operations cease.

While the form of embodiment of the invention as herein disclosed constitutes a preferred form, it is to be understood that other forms might be adopted as may come within the scope of the claim which follows.

What is claimed is as follows:

In combination, a washer and dryer comprising: a fixed cabinet; a bulkhead in said cabinet having a drain opening and defining a chamber thereabove; an imperforate rotatable tub in said chamber having an open end; an agitator in said tub, said tub being movable from a vertical position to a non-vertical position; a pair of substantially vertically extending pipes in fixed relationship to said cabinet connected at their tops, said pair including a first pipe having a lower end in communication with the chamber adjacent said cabinet and a second pipe extending through said bulkhead; a third pipe having an open discharge end communicating with the open end of said tub when said tub is in a non-vertical position and connected with said second pipe; a blower associated with said pipes for recirculating air from said chamber through said pipes and into said tub, heating means for heating said recirculating air, and means for introducing a cooling fluid into said first pipe in counterflow relationship to said air for condensing moisture from the air; said moisture being removed from said cabinet by said drain opening.

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