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FABRIC LAUNDERING MACHINE

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This invention relates to laundering machines, and particularly to a laundering machine which performs a washing and a complete drying cycle.

The continued development of components has added various features and introduced different structures which have advanced the machine to a commercial stage. The construction permits the use of a cabinet only 36” high, 30” to 33” wide, and 26½” deep. The cabinet encloses a complete laundry capable of washing, rinsing, wet-drying and completely drying the fabrics and optionally contains an ironer by which the dried fabrics may be ironed.

The receptacle for the fabrics is mounted coaxially within a tub, the axis of which is tilted upwardly at the front at an angle of approximately 5°. Since the machine completely dries the fabrics and since the volumetric capacity of the receptacle for drying must be approximately twice that of washing, the mounting of the tub and receptacle at an angle is important. There are eight reasons why the tilting of the tub rearward substantially improves the operation of the machine. First, the rear half of the receptacle is employed for the washing operation providing the desired volumetric capacity for the cabinet and the fabrics. Second, a substantial savings in water occurs while obtaining the desired depth of water in the rear half of the receptacle for the washing operation. Third, the effect of the jet spray is substantially improved since the water is sprayed into the tub in a parabolic path and will more nearly approach the fabric in a path nearer the tub area. Fourth, the distribution of the receptacle when changing into the spin operation is substantially improved because of the thicker annulus thereof when confined to the rear half of the receptacle. Fifth, the overhang weight on the receptacle bearing is substantially reduced since the fabrics are closer to the bearing and heaviest when saturated with water. Sixth, the vibration isolation system is substantially improved by the improved static and dynamic balance, the former due to the better distribution of the fabrics and the latter because of the center of mass of the distributed fabrics being disposed substantially on the center of mass of the suspended tub and receptacle. Seventh, the washability is substantially improved because of the increase in the interfacial scrubbing action within the fabrics themselves and the scrubbing action occurring on the back face of the receptacle. Eight, contributing is better because the radial thickness of the fabric annulus is greater when concentrated in the back half of the receptacle. The drying of the fabrics is substantially improved because (a) as they get drier they expand into the full volume of the receptacle, and (b) the cooling water and condensate flow on the inner tub face to the rear of the tub out of the receptacle path of the air, thereby substantially reducing any possibility of re-entrainment of the condensate and the water being employed to produce the condenser effect. A further important advantage is the room provided at the top of the front wall of the tub above the door opening for the heat accumulator which is supported thereon.

After the washing operation is performed in the rear half of the receptacle and after the water is centrifugally extracted from the fabrics, the drying of the fabrics will occur within the entire area of the receptacle. As the fabrics become dry, they expand and move to extend within the forward part of the receptacle and at the time the fabrics are dry they will be striking on the door area of the machine. By employing a servo mechanism adjacent the door area, this striking of the fabrics against the mechanism will cause the mechanism to operate and thereby terminate the operation of the machine at the time the fabrics are dry.

When the machine is operated on a 115 volt line, a thermal accumulating device is employed embodying both a storage means and a heating means, either of the electric or the gas type. The device is heated through the entire cycle of washing and drying the fabrics except for the period when the motor is excessively loaded requiring additional wattage above the normal running wattage, during which time the electric heating means is de-energized for the short demand period. Therefore, during the laundering cycle prior to the evaporative drying cycle, heat is being stored in the thermal accumulating device.

A closed air recirculatory system is employed for drying the fabrics in the drying cycle. Preferably a damper is provided in the air recirculatory system which is open during the final centrifuging period for initially heating the fabrics, receptacle and tub prior to the drying operation. Heating at this period is important since the increased heat on the fabrics decreases the kinematic viscosity of the water contained therein which accounts for the additional water mechanically removed from the fabrics toward the end of the centrifuging period. It also raises the saturation to approximately 100% and increases static pressure in the system which breaks down the pneumatic sticking of the fabrics to the wall. As a result, the final drying cycle is started with the recirculatory air at a high temperature and moisture level. Upon termination of the extraction period by whatever means employed, the blower for circulating the air in the closed recirculatory system is then operated and a flow of water is provided for the condenser. The condenser is so located that only a portion of the recirculatory air is contacted thereby for the purpose of drying the fabrics at a high temperature and a high moisture content level.

To condense water from air, the temperature of the air must be lowered to the dew point, and by operating on a small portion of the air only a small quantity of sensible heat is lost while lowering the small portion of air to the dew point, after which the dehumidification will take place without any further loss of sensible heat. Because of the low loss of sensible heat, the delivered air from the blower and heater will be retained at a high level, substantially constant for the 230 volt circuit when employed, or will be maintained high with a slower progressive rate of reduction when the heat storage element is employed on the 115 volt circuit. When either the 230 or 115 volt circuit is employed, it is desirable to employ extremely high temperatures at the beginning of the drying cycle when the fabrics are thoroughly saturated with water and reduce the temperature thereafter so that when the fabrics are no longer saturated they cannot be damaged by the heated recirculated air. When the 230 volt arrangement, the lowering becomes progressive as the fabrics become drier since the input heat to the heat storage element will not equal the heat being delivered therefrom to the air, and at the end of the drying cycle the fabrics may be removed without any cooling time added to the cycle. When the 230 volt arrangement is employed and a part of the heating element of the delivered heat is reduced before the fabrics become dry near the end of the drying cycle, still the temperature of the fabrics will be at such a high degree
that a cooling period will be required of several minutes without any input of heat at the end of the drying cycle so that the fabrics can be handled thereafter.

When drying with either arrangement, a predetermined set time may be employed to terminate the operation. Such a period of time will be judged by the operator and satisfactory results can be obtained, when using a period of time for terminating the drying cycle, from the experience had by the operator from several operations of the machine. It was found, when drying with the 230 volt arrangement, that the drying temperature curve was substantially flat throughout most of the drying period, and at the end thereof, when substantially all of the moisture has been removed from the fabrics, the temperature rapidly rises. This point, known as the T.C.O. point (thermal cutoff point) may be employed as the point of termination of the drying cycle of operation. When drying with the 115 volt arrangement, the temperature is constantly dropping throughout the entire drying cycle, until at the end thereof, when substantially all of the moisture has been removed from the fabrics, the temperature starts to rise. This point, known as the R.T.C. point (reverse thermal cutoff point), may be employed as the termination point of the drying cycle of the 115 volt arrangement. This can be used to eliminate the drying timer and become effective near the end of the operation of the washer timer which can be again operated at the end of the drying cycle by the R.T.C. or the T.C.O. systems to terminate the operation and set up the timer for a subsequent operation. This temperature terminal may be included in the timer which is employed for controlling the cycles of washing and drying the fabrics. When in the drying cycle, the timer may be set off at a fifteen or twenty minute point of operation for ironer dry condition of the fabrics to be picked up by the thermostatic control mechanism for the air temperature, and after the rise of temperature occurs in either the T.C.O. or the R.T.C. system, as pointed out above, when substantially all of the moisture has been removed from the fabrics, the timer is again cut in for the 115 volt arrangement to terminate the operation, and for the 230 volt arrangement to have a cooling period added to the drying cycle by the timer mechanism before the timer mechanism terminates the operation.

A suspension system is employed embodying four springs disposed in tension for supporting a pair of cross members at the bottom of the tub. The cross members have the side-pressed pads which engage smooth plates or surfaces at the front and rear of the machine. This simple suspension mechanism at the lower half of the tub permits the tub to vibrate relative to the cabinet without vibrating the cabinet any noticeable amount. A weight is provided on the cabinet in the nature of an iron which is located therewithin enclosed by a door so that the cabinet actually houses a complete laundering machine, including the washer, dried, and the ironer. This additional weight on the cabinet has the advantage of further eliminating the vibration thereof when the tub and servo elements mounted thereon oscillate during the extracting period.

In view of the fact that a soak cycle may be employed initially prior to the wash cycle of operation and additional water is introduced between the soak and washing cycles, a novel soap dispensing device is employed having a closed container upon which the soap is initially placed prior to the beginning of the operation. After the soak cycle, when the drain is closed and water is introduced within the fabrics and receptacle, the closure element of the device opens, the water being extracted washes over the closure element, and the soap is carried into the washing water, thereby cleaning the closure element and mouth of the device and preventing the accumulation of soap thereon.

A blower is mounted upon a conduit formed on the upper right-hand side of the tub in which a condenser is supported and over which a lint screen is provided in continuation of the peripheral wall of the tub. As the air is drawn upwardly through the screen to the blower, the lint will be deposited on the screen in an upward direction, with the screen mounted out of engagement with the water during the washing cycle. The lint remains on the screen after the drying operation and during the next washing cycle so that it is not washed back into the new load of fabrics during the subsequent washing cycle. However, during the centrifuging cycle of the subsequent washing cycle, the water is thrown over the screen in a downward direction so that the lint is washed from the screen and into the drain without contacting the fabrics being washed. Thus, the lint is collected on the screen by an upward flow during the drying cycle and is washed therefrom by a downward flow after the subsequent washing cycle. By this arrangement, the lint screen is always clean before the drying cycle and is washed into the drain without engaging a new load of fabrics being washed in the subsequent washing cycle and without the necessity of using a removable screen.

Certain fabrics adhere to the inner wall of the receptacle after the extracting operation, preventing them from dropping and tumbling during the drying cycle. This is usually caused, when one of these three things occur: the wedging due to the configuration of the tub and baffle; the pneumatic holding of the fabrics against the smooth peripheral wall; and the adhesion because the calcite-in-methyl cellulose contents of the detergents which might be employed. This latter is an antigraying agent employed to prevent redeposition of the dirt on the fabrics. The reason that it has adhesive quality is because the jell point is too high for washing water temperatures, and, as a result, this also causes the sticking of the fabrics on the peripheral wall. It was found that this action of adhering to the wall varies with the type of fabrics which are being operated upon.

Several things have been done to reduce and overcome this adhesion of the fabrics to the peripheral wall of the tub at the end of the centrifuging cycle of operation. First, the wedging action caused by the baffles when the following faces thereof are radial has been overcome through the changing of the location of the faces to be in divergent relation to the radius. Second, the introduction of the extremely high temperature air toward the end of the centrifuging cycle forms a sterilizing cycle and produces high static pressure within the tub which reduce and substantially overcome the pneumatic sticking, and third, by extracting a substantial amount of water from the fabrics prior to the final centrifuging operation. Such initial extraction is accomplished by accelerating the cycle for a very short period of time, in the nature of a couple of seconds, to raise the speed thereof to approximately 250 r.p.m., from which speed it immediately decelerates to normal washing speed. The receptacle is again accelerated and this time, since a substantial amount of water was extracted from the fabrics in the prior accelerating cycle, the second acceleration for a very short period of time, in the nature of a couple of seconds, raises the speed of the receptacle to substantially 350 r.p.m. so that additional water will be extracted from the fabrics, after which the receptacle will coast back down to the normal washing speed. Additional periods of acceleration may be employed if desired; thereafter the final extracting cycle of the receptacle at high spin speed occurs. The initial extraction of water before the spin is also beneficial in reducing the load on the motor. After the centrifuging cycle it was found that the fabrics no longer adhere to the inner wall of the receptacle and will immediately break therefrom and begin to tumble at drying speed.

The introduction of hot water at the final rinse cycle before the spin cycle is substantially beneficial in raising the temperature of the fabrics and tub, which is further raised, as pointed out above, by the introduction of heat either near the end of the centrifuging cycle or immediately-
ly after the first accelerating spin which removes a substantial amount of water which is not heated. Thus, the pre-moistening of the fabrics and drained from the tub. Second, the extracted water washes the lint from the screen which was implanted therein during the prior drying cycle and conducts it to the drain. Third, after the drain is closed and fresh water is introduced into the fabric tub, the extracted water washes the soap into the water and cleans the closure element and mouth of the bellows onto which the soap was stored during the soaking cycle. Fourth, if twenty-five pounds of water are retained within a six-pound load of fabric, eleven or twelve pounds of the water are extracted by the two initial acceleration spins. It is to be understood that any number of the initial spins may be applied within the cycle but two of such spins reduce the weight of the water within the fabric to approximately one-half. The final centrifuging spin at high speed removes all but approximately three to five pounds of water in the six-pound load. Especially is this true when heat is initially introduced to the tub after the first acceleration spin. Thus, with the water content of the fabrics reduced to a minimum, with the receptacle and fabrics heated at a higher temperature than normally would occur, and the drying at a high temperature moisture content level, the drying cycle is reduced to substantially one-half or even less over systems which do not employ the features above mentioned. It is to be understood that a centrifugal device may be employed to cut off the motor after the receptacle has been energized to accelerate to some specific predetermined speed rather than depending upon a time interval, as the speed attained when relying on time will depend upon the contained load.

Accordingly, the main objects of the invention are: to provide a laundering machine which produces a complete cycle of washing and completely drying fabrics efficiently in a minimum amount of time; to provide a laundering machine with a tub and receptacle which are tilted at the top rearwardly to have only the rear half of the volume of the receptacle utilized during the washing cycle and the entire volume of the receptacle available during the drying cycle; to provide a machine which washes, rinses, wet-dries and completely dries fabrics which applies heat thereto during the final rinse and after the first acceleration spin to decrease the kinematic viscosity of the water in the fabrics in the closed air recirculatory system so as to dry at a high temperature and moisture content level, and, in general, to provide a laundering machine which is simple in construction and economical of operation both in the use of water for washing, rinsing and condensing and in the use of heat for drying both by the time and method of application.

Other objects and features of novelty of the invention will be specifically pointed out or will become apparent when referring, for a better understanding of the invention, to the following description taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a perspective view of a laundering machine embodying features of the present invention;
FIG. 2 is an enlarged, broken sectional view of the machine illustrated in FIG. 1, taken on the line 2—2 thereof;
FIG. 3 is an enlarged, sectional view of the structure illustrated in FIG. 2, taken on the line 3—3 thereof;
FIG. 4 is a broken, sectional view of the structure illustrated in FIG. 3, taken on the line 4—4 thereof;
FIG. 5 is an enlarged, sectional view of the structure illustrated in FIG. 4, taken on the line 5—5 thereof;
FIG. 6 is a broken, sectional view of the structure illustrated in FIG. 2, taken on the line 6—6 thereof;
FIG. 7 is an enlarged, sectional view of the structure illustrated in FIG. 6, taken on the line 7—7 thereof;
FIG. 8 is a broken view of the structure illustrated in FIG. 7, showing additional structure applied thereto;
FIG. 9 is a sectional view of the structure illustrated in FIG. 8, taken on the line 9—9 thereof;
FIG. 10 is an enlarged, sectional view of the structure illustrated in FIG. 6, taken on the line 10—10 thereof;
FIG. 11 is a sectional view of the structure illustrated in FIG. 10, taken on the line 11—11 thereof;
FIG. 12 is a sectional view of the structure illustrated in FIG. 10, taken on the line 12—12 thereof;
FIG. 13 is a broken view of the structure illustrated in FIG. 10, showing a mechanism added thereto;
FIG. 14 is a plan view of structure which is similar to that illustrated in FIG. 2, showing a modified form of supporting mechanism;
FIG. 15 is an enlarged, sectional view of the structure illustrated in FIG. 14, taken on the line 15—15 thereof;
FIG. 16 is an enlarged, broken sectional view of the structure illustrated in FIG. 14, taken on the line 16—16 thereof;
FIG. 17 is an enlarged, broken sectional view of the structure illustrated in FIG. 4, taken on the line 17—17 thereof;
FIG. 18 is a sectional view of the structure illustrated in FIG. 17, taken on the line 18—18 thereof;
FIG. 19 is a view of a chart illustrating the method of removing moisture from the circulated air;
FIG. 20 is an enlarged, broken sectional view of the structure illustrated in FIG. 2, taken on the line 20—20 thereof;
FIG. 21 is a sectional view of the structure illustrated in FIG. 4, taken on the line 21—21 thereof;
FIG. 22 is an end view of the structure illustrated in FIG. 21, as viewed from line 22—22 thereof;
FIG. 23 is a sectional view of the structure illustrated in FIG. 21, taken on the line 23—23 thereof;
FIG. 24 is a broken sectional view of the structure illustrated in FIG. 23, taken on the line 24—24 thereof;
FIG. 25 is a diagrammatic view of the tub and receptacle illustrating a washing cycle of operation;
FIG. 26 is a view of the structure illustrated in FIG. 25, showing a drying cycle of operation;
FIG. 27 is a front view taken on the line 28—28 thereof;
FIG. 28 is an enlarged, broken sectional view of the structure illustrated in FIG. 27, taken on the line 29—29 thereof;
FIG. 29 is a drying cycle chart comparing the drying time for the different arrangements of the machine;
FIG. 30 is a view in elevation of a control panel for regulating the cycle of operation of the machine;
FIG. 31 is a view of structure, similar to that illustrated in FIG. 30, showing another form thereof;
FIG. 32 is a view of structure, similar to that illustrated in FIG. 30, showing a further form thereof;
FIG. 33 is a view of structure similar to that illustrated in FIG. 30, showing a still further form thereof;
FIG. 34 is a plan view of structure which is adjusted by the setting of the dials on the panels of FIGS. 30 to 33 inclusive;
FIG. 35 is a view of a contact element for terminating the drying cycle;
FIG. 36 is a sectional view of the structure illustrated in FIG. 35, taken on the line 36—36 thereof;
FIG. 37 is a rear view of the top portion of the machine showing the controls mounted therein;
FIG. 38 is a reduced side view of the structure illustrated in FIG. 37;
FIG. 39 is a broken front view of the structure illustrated in FIG. 37, showing the control dials for the machine;
FIG. 40 is a rear view of the machine, showing a belt drive therefor;
FIG. 41 is a front perspective view of the bolt drives illustrated in FIG. 40; FIG. 42 is a perspective view of the motor, pulleys and clutches illustrated in FIG. 41; FIG. 43 is a perspective view of the pump and the clutch drive therefor illustrated in FIG. 41; FIG. 44 is a view of a pulley illustrated in FIG. 40, with a pulley connected thereto in overrunning relation therewith; FIG. 45 is a sectional view of a thermal storage element similar to that illustrated in FIG. 4; FIG. 46 is an enlarged, sectional view of the structure illustrated in FIG. 45, taken on the line 45-48 thereof; FIG. 47 is a sectional view of structure, similar to that illustrated in FIG. 45, operating by a gas heating device; FIG. 48 is an enlarged, sectional view of the structure illustrated in FIG. 47, taken on the line 48-49 thereof; FIG. 49 is an enlarged, sectional view of the structure illustrated in FIG. 47, taken on the line 49-49 thereof; FIG. 50 is an operation chart showing the sequence of operation in the machine; FIG. 51 is a wiring diagram of the machine when employing the thermal storage means illustrated in FIG. 5, and FIG. 52 is a wiring diagram, similar to that illustrated in FIG. 51, employed with the thermal storage element illustrated in FIG. 45.

Referring more particularly to FIGURES 1 to 13 inclusive, the laundering machine of the present invention embodies a cabinet 40 having a front panel 41 containing a door 42 in the center and a door 43 at the upper left-hand corner. A door 44 is illustrated at the upper right-hand corner which permits access to the oil level protective devices when employed in the system. The front panel is supported on a rectangular frame on which side panels 45 and 46 are secured rearwardly of the front panel 41 and on which a top panel 47 is secured. The panel 47 has an upwardly offset portion 48 at the rear on which a dial control panel 49 is mounted. Within the compact area of the cabinet, a complete laundry is provided, embodying a tub and a receptacle within which the fabrics are washed and completely dried and an ironer by which the damp fabrics may be ironed.

The Suspension System

Uprights 51 at the front and uprights 53 at the rear, forming the corner posts of the frame, support brackets 53 and 54 on which tension springs 55 are suspended, being adjustable thereon by nuts 56 threaded on bolts 57. The springs have hooks 58 on the lower ends which extend through apertures in brackets 59 secured to forward and rearwardly extending tubular elements 61. The tubular elements are attached to the bottom of a tub 62 by stampings 63 and 64, the stamping 64 being secured directly to the tub while the stamping 63 is secured to a sump 65 at the bottom left-hand side of the machine. The entire tub is supported upon the two spaced tubular elements 61 which extend from the front to the rear of the cabinet. It will be noted that the tubular elements 61 are mounted at an angle to the axis of the tub so that when the tubular elements are disposed in a horizontal plane the tub 62 will be tilted rearwardly at the top to have the central axis thereof disposed at substantially a 5° angle to the horizontal.

As illustrated in FIG. 7, each end of the tubular elements 61 is enlarged at 66 for the reception of a sleeve 67 which is secured therein. Each end of the central aperture 68 of the sleeve 67 has a bearing 69 therein which supports a shaft 71. A flanged disk 72 is mounted on the protruding end of the shaft 71 and a friction washer 73 is mounted on the forward face thereof encompassed by the flanged edge. The structural elements 51 and 53 of the frame have laterally extending channel plates 74 mounted thereacross as part of the frame, on which polished plates 75, made of stainless steel or the like, are secured, aligned with the ends of the tubular element 61 and disposed normal thereto. A recess 76 is provided on the forward end of the sleeve 67 forming a shoulder 77 against which a coil spring 78 abuts when the forward end engages the rear side of the flanged washer 72. With this arrangement, a predetermined outward pressure is applied at each end of the tubular element 61 against the friction washers 73 which restricts the lateral movement of the washers over the plates 75 when the tub gyrates during its operation.

The tub 62 contains a rotor 79 having a shaft 80 thereon which is mounted in a bearing supported by spacers 82 on the rear wall 83 of the tub in a manner as illustrated in the above mentioned applications. The shaft 80 supports a pulley 84 which is driven by a belt 85 from a pulley 86 on a shaft of a transmission 87 which is mounted directly upon a motor 88. The tub has a flange against which the peripheral edge of the rear wall 83 abuts and is secured in sealed position by the U-shaped band 89 having a sealing gasket therein, all as described in the above-mentioned copending applications.

The peripheral wall 91 of the tub has a conduit 92 in unit relation therewith extending over an opening 93 therein which is enclosed by a lint screen 94. As illustrated in FIG. 3, the conduit 92 is of narrow width relative to the depth of the tub. The top of the conduit supports a blower 95 which is preferably of the centrifugal type having an inlet on the bottom in communication with the top of the conduit and having a cylindrical-shaped outlet 96.

A thermal accumulating device or exchanger 97 is mounted on the front face 98 of the tub above the door opening 99 thereof. The accumulator, as illustrated in FIG. 5, embodies heavy plates 101 which may be cast iron or of similar metal construction having fins 102 on the outer sides thereof and having an electric heating unit 103 disposed therebetween. The plates 101 in the heating unit 103 are supported within a conduit 104 by bolts 105. The conduit 104 is mounted within a metal sheath 106 having internal thermal reflecting walls by plates 108 which have point engagement with the top and sides of the sheath, thereby maintaining the conductivity between the sheath and conduit to a minimum.

An elbow 109 has a cylindrical end joined to the blower outlet 96 and a rectangular end joined to the conduit 104. The adjacent ends of the plates 101 have tapered extensions 111 from which a curved vane 112 extends into the elbow 109 to produce an equal division of the air past the fins 102 of the plates. The opposite end of the conduit 104 is extended downwardly at 113 to be joined to a rectangular elbow 114 which is supported by the sheath 106 through welded flanges 115 thereof. The rear side of the elbow 114 has an opening aligned with an opening 116 located adjacent to the central opening 99 of the tub for the admission of air into the tub and receptacle.

The cylindrical portion of the elbow 109 has a damper 117 pivoted therein on a shaft 118 on which a pinion 119 is secured. The teeth of the pinion are engaged by the teeth of a rack 121 which is longitudinally movable to forward and retracted positions by a spring biased solenoid 122, the gear, rack and pinion being disposed on the outside of the elbow.

A pulley 123 is connected to a shaft 124 of the blower 95 through a clutch 125 which is operated by a solenoid 126 to engage and disengaged positions. A pump 127 of the positive displacement type is mounted on the tub between the motor and the blower. A pulley 128 and a pulley 129 are mounted upon the shaft of the pump, each having a clutch of the overrunning type which is effective in opposite directions of rotation of the motor for engaging the shaft and driving the pump in a single direction. The forward end of the overrunning clutch of the motor 88 has a pair of pulleys 131 and 132 thereon. A belt 133 connects the pulley 132 to the pulley 129, while a belt 134 con-
nests the pulley 131 to the pulley 125 of the blower. The rear face of the belt rides in the pulley 128 and the belt is twisted 90° in view of the 90° relationship of the pulleys 125 and 131.

Drive Mechanism

The rear face of the motor shaft 88 has the transmission mechanism 87 therein which is illustrated more specifically in FIGS. 10, 11 and 12. The motor frame 135 contains a housing formed by the flange 136 through which the motorshaft 81 extends, being supported in a bearing 130. A pinion 137 is secured to the shaft by a key 138 and disposed in mesh with the teeth of a gear 139 mounted on a sub shaft 141 on the needle bearings 140. An extension of the gear 139 on the needle bearing 140 forms a pinion 142 disposed in mesh with an idler pinion 143 on a stub shaft 144. The teeth of the pinion 143 mesh with the teeth of a gear 145, the hub 146 of which extends over the shaft 81. The hub 146 supports one end of a sleeve 148 on a series of roller bearings 147. The hub is mounted on roller bearings 150 and is retained against a thrust washer 149 by a sleeve 151 which bears against a thrust washer 152. The sleeve 151 is maintained on the end of the shaft by a pin 153. A ball bearing 154 is supported between the sleeves 151 and 148 at the outer ends thereof.

A pair of overrunning clutches 155 and 156, which engage to drive in the same direction, are mounted between the hub 146 and sleeve 145 and between sleeves 151 and sleeve 148. The clutches may be of any type but are herein illustrated as embodying a garter spring 162 and a plurality of spirals 166, the spirals on the clutch 155 being effective in the same direction as the spirals on the clutch 156. The sleeve 148 supports the pulley 86 which is mounted on a fixed relation therewith. A cover 157 the shape of the flange 136 is secured to the flange by a plurality of screws 158, with a gasket 159 provided therebetween. Dowel pins 161 accurately align the cover with the flange and a seal 162 prevents leaking of lubricant within the housing from between the sleeve 148 and the cover. A fill plug 163 and a drain plug 164 are screwed into threaded apertures in the flange 136.

When the shaft 81 is driven in a clockwise direction, as viewed from the left-hand end, the pinion 137 drives the gear 139 which in turn drives the pinion 143 from the pinion 142 which drives the gear 145 in a reverse direction, that is to say, counterclockwise. The gear train substantially reduces the rotation of the gear 145 from the motor speed of 1725 r.p.m. With this arrangement, when the shaft 81 is rotated in one direction, the clutch 155 will lock the shaft through the sleeve 151 and sleeve 148 to drive the pulley 86 in the direction in which the motor shaft is driven. During this direct driving of the pulley 86, the clutch 156 is ineffective, permitting the operation of the gear train 137, 139, 142, 143 and 145 without interfering with the direct drive of the pulley. When the shaft 81 is reversed, the clutch 156 becomes ineffective and the clutch 155 connects the drive through the gear train from the hub 146 of the pulley 145 to the sleeve 148, to thereby drive the pulley 86 in the same direction as it was driven directly by the shaft but at a substantially lower speed, driving the receptacle at approximately 48 r.p.m. When the pulley 86 is driven directly by the shaft 81, the receptacle is rotated at approximately 520 r.p.m. Therefore, when the motor is in one direction the receptacle 79 is driven at slow speed for washing and drying, and when reversed the receptacle is operated at high speed in the same direction of rotation for extracting.

Centrifugal Switch

It will be noted in FIG. 13 that the cylindrical end 167 of the pulley 86 supports a hub 168 having a fly ball mechanism 169 thereon, the ends of the arms of which engage an axially movable cup 171. An arm 172 supported on the cover 157 has a contact 173 thereon connected from a contact 174 carried on a spring arm 175 secured to the arm 172 and insulated therefrom. When the speed of the pulley 86 reaches a predetermined amount, the cup 171 will be retracted within the hub 168 by the fly ball mechanism 169 sufficiently to open the contacts 173 and 174, to thereby open a circuit through the conductors 176, for a purpose which will be explained hereinafter.

Water Control

The pump has a suction line 177 which is connected to a T-elbow fitting 178 at the bottom of the tub, as illustrated in FIGS. 2 and 6. The elbow end is attached through a flexible tube 179 to the sump 65 which contains a solenoid operated valve 180. The T branch 181 is connected to a vertically disposed tube 182 which communicates with a diaphragm actuated switch 193. As the water flows into the tub and rises in the tube 182, the increase of air pressure therein against one side of the diaphragm causes contacts on the other side thereof to open a circuit through conductors 184 to a solenoid operated mixing valve 191. In this manner, the height of water within the tub is controlled, the flow being interrupted when the circuit through the conductors 184 is open. A flexible outlet conduit 185 from the pump 127 may be directed to drain, the conduit 185 being joined to a nipple 186 supported in a rear panel 187 of the cabinet.

A hot water conduit 188 and a cold water conduit 189, which are preferably hose connections, are joined to the mixing valve 191, the introduction of the hot and cold water being controlled by valves actuated by solenoids 192 and 193. The hot or mixed water is conducted through a flexible tube 194 to a reversely bent tube 195 that functions as a vacuum breaker for directing water downwardly to a funnel 196 which has a flexible tube 197 attached thereto. The tube 197 is joined to a metal tube 198, as illustrated in FIG. 4, which extends through the front face 98 of the tub. As illustrated in FIGS. 17 and 18, the tub has the open end 199 directed outwardly and downwardly so as to direct a spray of water through the front opening of the receptacle and across the interior thereof to the lower rear wall portion.

Condenser

An additional solenoid operated valve 201 connects the cold water supply to a U-shaped tube 202 which directs water downwardly into a funnel 203 from which it passes through a conduit 204 to a spray tube 205 in the conduit 92 (see FIG. 24). When water is directed from the U-shaped tube 202 into the funnel 203 through the conduit 204, it will be sprayed from the spray conduit 205 against the wall 206 of the conduit 92 to reduce the temperature thereof and form a condensing wall for the air being drawn through the conduit 92 into the blower 95.

Soap Dispenser

When employing a 115 volt circuit, it is desirable, at least on the first operation when the machine is cold, to begin the operation with a soaking cycle of approximately ten minutes before the washing cycle is initiated. This provides additional time for accumulating heat within the thermal storage element 97. Means may be provided for introducing soap or detergent into the tub at the beginning of the subsequent wash cycle since the soap or detergent placed within the receptacle at the beginning of the soak cycle was washed out with the soapy water at the end of the soak cycle. For this purpose the cabinet is provided with a door 207 in the top panel which is joined by a conical bellows 208 to an opening in the top of the peripheral wall 91 of the tub. A closure element 209 covers the mouth of the bellows, having an arm 211 pivoted to the peripheral wall 91 of the tub by a bracket 212. A solenoid 213 is connected to the arm 211.
and a spring 214 retains the element 209 in upward closed position, as illustrated in FIG. 20. The plate is preferably arched upward at 215 to extend slightly within the lower opening or mouth of the bellows 208. Soap or detergent is introduced through the opening enclosed by the cover 207 in the top panel 47 of the cabinet which will fall upon the arched portion 215 of the closure element 209 and will be retained therein during the soaking cycle. The soaking cycle is completed by a centrifuging operation with the drain open; while extracting, the drain is closed and freshwater is sprayed into the fabrics and tub. During the introduction of freshwater at the time of centrifuging with the drain closed, the solenoid 213 is energized through conductors 216 to cause the armature 217 to move downwardly against the tension of the spring 214, to thereby move the closure element 209 downwardly and permit the soap to be washed therefrom by the freshwater being extracted from the fabrics. This not only washes the soap from the element 209 but also from the mouth of the bellows 208 to maintain them free from an accumulation of soap thereon. The solenoid 213 may be energized each time the water is extracted from the fabrics so as to have the element 209 move downwardly in the path of the extracted water to provide assurance that all of the soap or detergent will be washed therefrom and from the bellows.

Lint Screen

The use of the soak and wash cycles increases substantially the washability of the fabrics which is aided by the high drop due to the large receptacle diameter and the scrubbing action on the rear face of the tub and that between the fabrics. The use of the lint screen 94 over the opening in the tub enclosed by the conduit 92 provides a unique arrangement of having lint drawn upwardly with the air and collected on the screen by an upward movement of the lint fibers. The lint is retained on the screen throughout the drying cycle and also through the subsequent soaking cycle to the first centrifuging cycle during the subsequent operation of the machine. In such an arrangement, the lint is washed from the screen only when the drain is opened by the water extracted during the centrifuging operation which is thrown across the screen in a downward direction opposite to that in which the lint was laid upon the screen. This assures the immediate washing of the lint from the screen into the drain, thereby eliminating any chance of the lint being washed from the screen into the wastewater and the fabrics being laundered.

Modified Damper Means

It will be noted in FIGS. 8 and 9 that a shaft 219 may be substituted for shafts 91 at the ends 66 of the tubular elements 61, being longer to receive three friction shoes 221 which are moved outwardly in frictional engagement with the inner wall of the tubular elements 61 by springs 222 disposed therebetween. Slots 223 are provided on each side of the shoes 221 in which split spring washers 224 are secured. In this manner the shoes are secured to the shafts 219 and the engagement of the outer faces thereof under predetermined pressure with the inner faces of the tubular elements 61, providing a resistance against the axial movement of the shafts 219 and thereby providing a resistance to the axial movement of the tub in the Z-plane, that is, to say forwards and rearwards within the cabinet. As indicated above, the static unbalance produces vibration also laterally in the horizontal or X plane and in the vertical Y plane and is damped by the friction pads 73.

Tilted Tub

The tub as illustrated in FIGS. 25 and 26 has the cubic capacity of a drier, which capacity is substantially twice that required for washing. In FIG. 25 the tub and receptacle are illustrated with fabrics 225 disposed therein when in wet condition. It will be noted that the main depth of water indicated by the broken line 226 is substantial at the rear of the tub as compared with that at the forward part of the tub, thereby providing the required depth of water at the rear for washing while substantially reducing the amount of water required to obtain such depth, thereby saving on the amount of water used for the soaking and washing cycles. This saving is obtained due to the tile filling of the axis of the tub approximately 55 from the horizontal. The fabrics when wet move to the rear of the receptacle and are washed in the rear half thereof. The concentration of the fabrics in this manner produces the interfacial rubbing therebetween, as well as the rubbing on the back wall of the receptacle. After the water is drained from the tub and circular water is passed through the tub and receptacle, the fabrics will become progressively drier and progressively move toward the front of the receptacle, utilizing all of the cubic contents for the drying operation if approximately the proper weight of fabric is being laundered within the receptacle.

In FIG. 27 the path of circulated air is illustrated, wherein the air from the blower 95 will be directed through the elbow 168 into the conduit 104 within the sheath 106 to be directed from the elbow 114 into the top portion of the tub and receptacle. The heated air will pass through the fabrics being tumble within the receptacle and will pick up moisture therefrom, after which it will be drawn into the conduit 92 and into the blower 95. It will be noted that all of the air will pass through the lint collecting screen 94 and that only a small portion 227 will pass over the cooled wall 206 of the conduit 92 and the water being sprayed therefrom from the tub 205. Thus, it will be noted that the volume of the air being drawn into the blower, only a fraction thereof will be acted upon by the cooled wall and the sprayed water to remove moisture therefrom. The reason for this will be evident when examining the quantum representation of dry air phenomenon as disclosed in the chart of FIG. 19.

The area bounded by A, B, C, and D represents sensible heat. The area A, E, F, and D represents the latent heat of vaporization. The area B, C, O represents all of the air being circulated. Thus, it will be noted that if all of the air represented by the area B, C, O is represented upon the condenser, all of the sensible heat will be dissipated before the dew point is reached, indicated by line A and D, and dehumidification, represented by the area A, E, F, and D, can occur. If a less amount of air, represented by area A, C, J, I is acted upon by the condenser, then the area G, H, D, and C represents the substantial reduction in sensible heat loss that occurs when the dehumidification essentially substantially the same amount of moisture represented by the area H, I, J, and D. The length C, G, J, I depends upon the temperature of the cooling water relative to the temperature of the air being circulated.

If a less amount of air, represented by the area K, C, N, M is acted upon by the condenser, then a still smaller loss of sensible heat, represented by the area K, L, D, and C will occur while dehumidifying substantially the same amount of moisture represented by area L, M, N, D. Therefore, to prevent the dissipation of sensible heat, it is imperative that only a small percentage of air is acted upon by the condenser. By conditioning only a small amount of the circulated air, the air will maintain most of its sensible heat and the temperature thereof will be retained at a high level which, in the 230 volt system, will be substantially constant throughout most of the drying cycle. Similarly, the air will also be high, with an optimum degree of saturation when drawn into the blower, and when passing beyond the heating means will have a maximum ability to take up moisture from within the receptacle and fabrics.
up air will be substantially dry relative to the amount of moisture in the air of the system. In such an arrangement, the condenser is eliminated since the small fraction of air which is added to the air of the system will have relatively little moisture content so that after mixing with the air of the system the proper degree of saturation will have been obtained. From the point of view of heat and time consumption, the drying with air at high temperature and moisture content has proved most efficient.

When, however, it is objectionable to introduce the air at high moisture content into a room, the closed recirculatory system is to be preferred. When, however, there is no objection to the use of the moist air in these systems or if conducted outside of the home into atmosphere, then the elimination of the condenser is advantageous. In such a system, not more than five percent (5%) of the air is conducted to atmosphere, leaving substantially 95% of recirculatory air maintained in the system at all times. This is the most efficient system that can be developed, the only objection thereto being the introduction of the moisture laden air into the room. A condenser could be employed through which the air would pass before being discharged so that the moisture content thereof is reduced to ambient. It is also to be understood that the condensers employed in the systems need not be of one type. The condenser could be of the air type or any other type known to be suitable, one employing a desiccant or the like, as disclosed in the above mentioned applications. The use of the water condenser, however, has the advantage that it does assist in the delimiting operation, picking up the lint particles not collected by the screen and carrying them to the drain.

It is to be understood that this substantially constant temperature of operation occurs only when a 230 volt circuit is employed, providing sufficient wattage to maintain the temperature constant. The use of the thermal storage element is necessary with the low wattage input from the 115 volt line so that extremely high temperatures will be had upon the initial introduction of heat into the receptacle and fabrics in the order of 600°F at the time that the fabrics contain the maximum amount of water. As the fabrics become drier, the temperature becomes lowered resulting in a decrease of temperature as the moisture content of the fabrics decreases. A similar effect may be obtained on a 230 volt circuit where a high watt heating element, such as one having a 6000 or 8000 watts rating, could be used initially when the fabrics are wet and a substantial amount, say one-half of the heating element, is cut out so as to produce the mount of heat at the end of the drying cycle as the fabrics become drier to prevent them from being damaged by the high heat.

Referring to FIGS. 26, 27 and 28, it will be noted that as the fabrics become dry they move to the front portion of the receptacle and fall against the door 42 in engagement with the glass window 228 provided therein. The window 228, as illustrated in FIGS. 27 and 28, has a switch unit 229 secured in an aperture 231 therein by an annular rubber element 232. A flexible element, such as a diaphragm 233, is also supported by the annular rubber element 232 and is positioned to be engaged by the fabric as they fall against the window when the fabrics have become dry. The movement of the diaphragm operates a limit switch 229 which interrupts the drying cycle. The diaphragm and switch form a servo mechanism for directly indicating the end of the drying cycle through the action of the fabrics which progressively move to the front of the machine as they dry.

A Substitute Suspension System

Referring to FIGS. 14, 15 and 16, a further form of suspension mechanism for the tub is illustrated, that wherein leaf springs 234 are substituted for the tubular elements 231 and the spring mechanisms in the ends thereof. The leaf springs are secured to bosses 230 and 235 at the bottom of the tub when placed within a channel therein by plates 236 supported by screws 237 which may or may not pass through the leaf springs. The ends 238 of the two leaf springs apply a force to the plates 75 at the front and rear corners of the cabinet frame, the same as the springs 78 of the tube 61. The four suspension spring 239-240 having an offset hooked end 241 at the bottom which extends over a pin 242 of a flanged disk 243 which supports a washer 73 of brake material. The ends 238 of the leaf springs have an aperture 244 therein through which the pin 242 extends, the pressure at the ends of the leaf springs urging the friction washers 73 against the polished plates 238 and retaining the pins in the apertures. The same resistance to vibration results from the use of the leaf springs as resulted from the use of the tubular elements 61 as above described. The ends 238 of the leaf springs provide the tension for resisting vibration in the X and Y modes, while the central arcuate portion will elongate and contract to provide dampening in the Z mode.

Ironer

As pointed out hereinafore, the door 43 of the cabinet 40 covers an ironer which may be pulled therefrom. The ironer embodies a cylinder 245 having a shoe 268 thereon. On the side 45 of the cabinet within the space enclosed by the door 43, a pair of dovetailed slide elements 247 is supported in parallel relation. A plate 248 has bosses 249 thereon having the pair of dovetails 251 extending therefrom and disposed within the dovetailed groove of the slides 247. The plate has a hub 252 mounted substantially in the center thereof and welded, pinned or otherwise secured in rigid relation to the plate. The opposite end of the hub 252 carries a plate 253 which is also fixed thereto by a peening or welding operation. The plate carries four rods 254 and four rollers 255. The outer ends of the rods support a spider 256 which supports a motor 257 and a gear reduction unit 258. The shaft 259 from the gear reduction unit is secured to a spider 261 which is attached to an ironer roll cylinder 245. The rear end of the ironer roll cylinder is contacted by four rollers 255 on which it rotates at slow speed when the motor is energized to drive the shaft 259. The shaft 262 of the motor supports a fan blade 263 for circulating air over the motor to keep it cool.

The plate 248 has a rod 264 secured thereon and disposed parallel to the axis of the ironing roll cylinder 245. The rod supports the ironing shoe 265 which is of arcuate shape to engage the padded cover 246 and cover approximately 90° of its cylindrical area. The shoe contains a heating element mounted therein in the conventional manner. A tubular element 266, secured by an arm 267 to the shoe 265, permits the rocking of the shoe on the rod. The tubular sleeve 266 has an arm 268 secured thereto and provided with a slot 269 near its outer end. It will be noted from FIGS. 23 and 24 that an actuating rod 271 is mounted on the inside of the cabinet, having an end 272 bent at right angles therewith. This end is retained in position to enter the slot 269 when the ironer is drawn forwardly out of the cabinet. The lower end of the rod 271 has a hook extending into an aperture 273 in a lever 274 which is pivoted by a bracket 275 to the bottom of the cabinet. A spring 276 urges the outer end of the lever and the rod 271 to its uppermost position. The outer end of the rod is bifurcated and has a foot treadle 277 secured thereto by a pivot 278. The treadle has an extending boss 279 which abuts an extending boss 281 on the end of the lever 274 when in operating position.

When in operating position, as illustrated in the figure, the foot treadle 277 is moved downwardly to be in extension of the lever 274 and to be in rigid relation thereto. When the lever is pushed down, the rod 271 is moved downwardly, moving the arm 269 downwardly therewith, thereby rotating the tubular sleeve 266 on the
rod 264 and moving the shoe 265 against the fabrics that have been placed on the padded cover 246 which is being driven in rotation counterclockwise toward the s hoe. A limit switch 507 is actuated by an arm 270 on the sleeve 269 to energize the motor 257 each time the shoe 265 is moved into engagement with the fabrics on the ironing roll. After the fabrics have all been ironed, the ironer may then be slid into the cabinet and hidden from view by closing the door 43.

FIG. 29 illustrates a chart showing the drying time cycles of different combination laundering machines. The curve 282 was obtained when operating a combination machine with a normal use of air in the conventional manner on 230 volts. Six and one-half (6.5) pounds of water remained in six pounds of fabrics after the centrifuging operation. This requires approximately forty-five minutes to remove during the subsequent drying cycle. Curve 283 illustrates the time cycle for drying on 230 volts when hot water was used for the final rinse and hot air was introduced to the cylinder and fabrics during the last half of the centrifuging operation. The heat of decreased the kinematic viscosity of the contained water, permitting additional water to be mechanically removed from the fabrics during the centrifuging operation, leaving approximately two and one-half (5.5) pounds of water in the same six pounds of fabric load. The drying operation started at a high temperature and moisture content level which more rapidly removed the water from the fabrics by evaporation, requiring about thirty-five minutes in the illustrated case. Curve 284 was produced when operating on a 115 volt circuit, with the heating device energized throughout the entire laundering operation. Due to the introduction of the extremely high heat at the last part of the centrifuging cycle, six pounds of fabrics were left with approximately 4.7 pounds of water therein after the centrifuging operation and this amount of water was removed from the fabrics in approximately thirty-six (36) minutes of the drying cycle.

It will thus be seen that the introduction of heat during the final rinse and centrifuging operation reduces the amount of water remaining in the fabrics after the extracting operation to be evaporated therefrom during the drying cycle. At the beginning of the drying cycle, the machine and fabrics are heated above normal so that the fabrics are dried at an optimum temperature and moisture level, as indicated above, to produce the most efficient drying in the shortest possible time.

These curves 282, 283 and 284 represent operation on the same fabric within the same receptacle at the same centrifugal speed of approximately 500 r.p.m. In view of the rugged suspension system which maintains the gyration at a minimum, the centrifuging speed can be elevated to approximately 625 r.p.m., which will reduce the water content in the centrifuged fabrics to approximately fifty percent (50%) retention, that is to say, in a six (6) pound load to approximately three (3) pounds or less, depending upon the temperature of the final rinse water and that of the air introduced into the fabrics and receptacle during and after the second accelerated spin. This reduction in the amount of water in the centrifuged fabrics reduces substantially the time required to dry the fabrics by the recirculatory air system. If the accumulator is employed with a 230 volt system, then the final drying time after centrifuging is reduced to approximately ten or fifteen minutes, completing the overall cycle of laudering to approximately forty-five (45) minutes.

**Temperature Control**

It was interesting to note that when employing the stored heat during the drying cycle the temperature of the circuit air continued to drop as the moisture content decreased. This dropping of the temperature continues until the fabrics are substantially dry, at which point the temperature of the air in the system rises. This provides a very accurate point for interrupting the operation of the machine and is known as the reverse temperature control. This is of extreme interest since it will occur irrespective of fabric loading, humidity, or initial water content of the fabrics at the start of the drying cycle. A timer is usually employed on the machine controlling the various operations through the soaking, washing, rinsing, wet-drying periods and at least a portion of the drying cycle. When the operator is satisfied to guess the time required to dry the fabrics, this timer may be set, say for a thirty-five (35) minute time period. If the reversed temperature control is to be employed, the timer is permitted to run for fifteen or twenty minutes during the drying cycle, after which it is stopped and the control opens a cover by the reverse temperature control device which is capable of completing a circuit at the time the fabrics are dried when the temperature of the circulated air reverses. At that time the timer is cut back into operation by the closed contacts of the R.T.C. device to terminate the operation of the machine and to reset itself for the subsequent laundering cycle.

Referring to FIGS. 35 and 36, a bimetallic element 335, having a contact 336 thereon, carries the contact downwardly as the temperature drops. An arm 337 having a contact 338 thereon is secured by a friction hinge 339 to the supporting block 341. An insulated loop element 342 is connected to the bimetallic arm and the arm 337, causing the arm to move downwardly with the bimetallic arm as the fall of temperature of the circulated air continues to drop. When the fabrics are dry, the temperature reverses its direction, thereby reversing the direction of movement of the bimetallic arm 335, causing the contact 336 to move upwardly and engage the contact 338 which is held in its lowestmost position by the friction of the hinge 339. The closing of the contacts completes a circuit which produces the termination of the operation of the machine, after which the bimetallic element and arm will return to their starting positions, with the contacts closed which will separate as soon as the air temperature lowers in the subsequent operation.

The R.T.C. system is usable on the accumulator type of machine regardless of voltage. The T.C.O. system is employed on machines not using the accumulator regardless of voltage. When employing T.C.O. system, the temperature will rise to a point where it will be maintained as a rate of evaporation occurs and will rise rapidly thereafter at the time the fabrics are substantially dry. If this rise is to be employed in terminating the operation of the machine, the timer is again set off after fifteen or twenty minutes of the drying cycle and the control is taken over by the thermostat which is actuated upon the final rise of temperature at the end of the drying cycle to close the contacts. This closes the circuits to the timer which will operate the machine in the absence of heat for a few minutes to cool the fabrics during the final cooling period. Thereafter, the timer will stop the machine and reset itself for a subsequent laundering operation.

**Control Panel**

In FIGS. 30, 31, 32 and 33, control panels are illustrated, having adjustable elements which may be set for controlling the cycle of operation of the machine. In FIG. 30 green and red bulb's eyes 285 and 286 are mounted at the left-hand end of the dial plate 287, one or the other of which is illuminated when the switch 285 is moved to hot, medium or warm. When moved to the hot position, the red bulb's-eye 286 is illuminated, warning the operator that the hot water and air are being employed. The switch 288 controls the manual control of the accumulator when on hot position and a lower temperature when on medium or warm positions. When the switch is moved to medium or warm position, the green bulb's-eye 285 will be illuminated, apprising the operator of the lower temperature. The dial plate has a slot 289 in which an index button 291 is slidable. The
pointed on the button indicates the number of minutes for the pre-wash and/or wash cycles, whatever is set up for the machine operation. The operation may occur at the beginning of the wash cycle which requires twelve minutes, or for any lesser amount of time. The rinse and spin cycles follow the wash cycle, after which the drying cycle occurs. An indicating button 292 operates in a slot 293 having a pointer which indicates the number of minutes for the drying cycle. The pointer indicates thirty-five minutes of drying time but longer or shorter time periods may be obtained through the setting of the button. When the button is set from the 0 position, the drying cycle is eliminated entirely from the laundering cycle and the accumulator, if employed, is not heated during the washing cycle of operation.

In FIG. 31 a plate 294 is illustrated having the bull's-eye 285 and 286 located beneath the indicating scale, the illuminating sources for which are energized by the operation of the switch 298 in the manner above referred to. An indicator 295 is operated by a knob 296 for movement in a slot 297 for setting the pre-wash and/or wash time and the finger 292 operating in a slot 293 controls the drying and the length of the drying time. A similar arrangement is illustrated in FIG. 32, with the exception that the dial plate 297 is of arcuate rather than of rectangular shape.

In FIG. 33 a further form of the dial plate 298 is illustrated, one of rectangular construction having a knob 299 by which the temperatures of the water and the air are set. A knob 301 controls the movement of an index wire 302 across a window 303 back of which the dial areas and numbers appear. On turning the knob 301, the index wire 302 may be set any position along the window up to the point of the drying cycle. A finger 304 operating in a slot 305 controls the length of the drying cycle or eliminates the drying operation. The knob 299 operates a shaft 306 having a sprocket wheel 307 thereon, as illustrated in FIG. 34. The knob 301 operates in a shaft 308 which has a sprocket wheel 309 thereon. A sprocket chain 311 interconnects the sprocket wheels 307 and 309. The inner end of the shaft 308 is journaled in a plate 313 which engages the clutch plate 313 for connection with a timer motor 314. A pair of cams 315 and 316 are mounted on the shaft 308 which control the operation of the switches 317 and 318. Positioning means 319 retain the shaft in a position of clutch plate engagement and disengagement. It will be noted that the drying cycle control 304 carries a switch 321 on the rod 322 to be actuated when engaged by a finger 323 carried by the sprocket chain 311 in alignment with the index wire 302. The rod 322 also carries a bridging contact 324 which bridges the bare conductors 325 to complete a circuit therethrough.

When the step finger 304 has moved to zero position, the bridging block 324 moves out of contact and interrupts a circuit through the bare conductors 325. When the conductors are interrupted in this manner, the machine completes the washing operation without going into the dry cycle. This occurs when the finger 333 engages the switch 331 and opens the contact thereof. A switch 326 in the main circuit is mounted on the motor 314 having an operating finger 327 which closes the circuit to the motor when actuated. When the clutch plate 312 is moved from the clutch plate 315, a disk 328 moves upwardly out of engagement with the projecting finger 329 and interrupts the circuit to the wash motor. When the knob is pushed inwardly to engage the teeth of the clutch plates 312 and 313, the disk 328 moves the finger 327 downwardly to complete the circuit to the machine. A slide bar 329 extends through an aperture in a block 331 which is secured on the rod 322 for preventing the rotation of the rod 322 when the interrupting the circuit to the wash motor. When the knob is turned counterclockwise to return the knob to approximately 35° and providing assurance that the knob will be returned to zero setting by the counterclockwise rotation thereof to return all of the elements to their initial positions. It is to be understood that the chain can be whole multiples of the scale length and of the circumference of the sprocket, so that the knob need not be reversed rotated to starting position but continued in the same direction by employing the next adjacent index wire 302 for marking indications on the dial. It will be noted in this arrangement that the scale may be moved instead of the index wire 302.

Referring to FIGS. 37, 38 and 39, a novel base panel 345 is provided on the top panel 47. This is of inverted V-shape having a front sloping panel 346 for the control dials and knobs and a sloping rear open area 347 in which the water conductors and electric cable may be disposed, permitting the machine to be set flush against a wall. A further novelty provided by this arrangement resides in the use of a sloping panel 348 adjacent to the panel 346 supported by the brace members 349 and the frame 50 to which they are secured. The panel 348 supports all of the control elements for operating the machine and simplifies the hose and wire connections. The solenoid operated hot and cold water valve 311 is mounted on the left-hand side of the panel as viewed from the rear. The solenoid operated condenser valve 201 is mounted adjacent thereto and a drying timer 351 and a washer timer 352 are mounted in the central portion of the panel 348. A switch 353 for the control of hot, medium or warm supply of water and air is mounted near the washing timer. A relay 354 and a relay 355 are mounted at the right-hand end of the panel 348, while the water level control device 183 is supported on the frame by a bracket 356. The drain conduit 186 extends to the right-hand bottom corner of the area 347. In this arrangement, all of the controls are open for service directly in rear of the back panel 346 of the top panel 47.

A switch actuated knob 357 is mounted on the lower right-hand face of the front panel 346 for operating the main switch 358 of the machine. The switch 353 is operated by a dial knob 359 on the left-hand side of the front panel. A drier timer dial 361 and a washing timer dial 362 are mounted near the central portion of the panel 346, having actuating knobs 363 and 364 respectively for operating the drier timer 351 and the washing timer 352. Above and between the dials 361 and 362 is a red bull's-eye 365 providing a warning light indicating that the accumulator of the machine is being energized.

In FIGS. 40 to 44 inclusive, a drive is illustrated. The motor 88 of the capacitor type has a pulley 366 fixed to the shaft and a pulley 367 secured thereto by a clutch 368 which engages when the spring arm 369 of a U-shaped member is moved toward the motor by a solenoid 371. A pulley 372 is secured to the opposite end of the shaft by a clutch 373 moved into engagement by the arm 374 on the opposite end of the member 370 when the arm 374 is moved by a solenoid 375 toward the motor. A stub shaft 367 supports a pulley 377 and a pulley 378 is also mounted on the stub shaft 376 secured thereto by an overrunning clutch 379. A drive pulley 381 is mounted on a shaft 382 which is secured to the rotor of the machine. A belt 383 extends over the pulleys 367, 378 and 381. A belt 384 extends over the pulleys 366 and 377. When the receptacle is to be operated at slow speed, the pulley 366 will be free running on the motor shaft, while the pulley 366 will drive the pulley 377 and through the clutch 379 which is engaged, will drive the pulley 381. This will produce the slow speed operation of the receptacle at approximately the 48 r.p.m. speed mentioned above. When, however, the solenoid 371 is energized and the clutch 368 is engaged, the pulley 366 on the motor shaft will drive the belt 383 over the pulley 378 to operate the pulley 381 and the receptacle at high speed. The belt 384 will continue to drive the pulley 377 but the clutch 379 will overrun and will not interfere with the drive of the pulley 381 by the belt 383.
A pulley 385 is fixed to the motor shaft on the end having the pulley 372 secured thereon by a clutch, which pulley is secured on the end of a twisted belt 386. This belt drives a pulley 387 which drives the pump 127 when the clutch 388 is engaged through the actuation of a solenoid 389. The belt is twisted to provide the proper direction of operation of the pump by the motor. A belt 380 is connected to the pulley 372 and the pulley 125 and since the axes of the pulleys are at right angles to each other the belt is twisted 90°. A control is provided for driving the pump through the provision of the clutch 388 on the pump pulley 387 and a control for the blower is provided by the provision of the clutch 373 on the pulley 372. Thus, by the use of the solenoid operated clutch 368, the overrunning clutch 379 and the two belts 383 and 384, the pulley 381 and receptacle may be driven at the low washing and drying speed and at centrifuging speed. By the use of the clutches 373 and 388, the pump 127 and blower 95 may be operated at any time independently of each other. With this arrangement, a single motor operates all of the driven elements of the machine.

Referring to FIGS. 45 and 46, the plates 102 of the thermal storage element 97 are provided with a heating element 390 which, besides the end leads, has an extra lead 391 thereon so that the full length of resisting strip may be employed or a reduced portion thereof utilized. This is desirable to provide a means for securing the resistance element to the supply circuit in accordance to its rating. When a circuit is employed which can provide 120 volts at 20 amperes, a portion of the length of the resistance element will be connected in the circuit by the use of the lead 391 and operated at 2400 watts. When, however, only 16 amperes can be drawn from a 115 volt line, then the full length of the resistance element is employed in the circuit and operated on approximately 1800 watts. Otherwise, the thermal storage element 97 is the same as that referred to hereinabove with regard to FIGS. 4 and 5.

Gas Heat
In FIGS. 47 to 49 a gas type of heater is provided between the plates 102, having a combustion chamber 392 in the lower portion of which a burner 393 is mounted having spaced burner apertures or nozzles 394 throughout the length thereof. A gas air mixing element 395 of conventional form is provided at the forward end of the burner to which the supply gas conduit is connected, the primary air to which may be regulated in the hook-up of the resistance element to the supply circuit in accordance to its rating. When a circuit is employed which can provide 120 volts at 20 amperes, a portion of the length of the resistance element will be connected in the circuit by the use of the lead 391 and operated at 2400 watts. When, however, only 16 amperes can be drawn from a 115 volt line, then the full length of the resistance element is employed in the circuit and operated on approximately 1800 watts. Otherwise, the thermal storage element 97 is the same as that referred to hereinabove with regard to FIGS. 4 and 5.

Electric Control
Referring to the wiring diagram of FIG. 51, the main line is indicated by numerals 400 and 401 from a 115 volt source. The timer dial knob 301 is pushed in to close the main switch 463 which energizes the timer timer circuit. The timer timer switch 462 has been properly positioned and closed, and provided further that the "on" off" ironer switch is in its "off" position produced by the closing of the contacts 502 and 503. The closing of the contacts 405 energizes the motor 404 of the timer. At the same time, contacts 406 are closed by the timer circuit energizing the starting and running winding 407 and 408 of the motor 88. During the energization of the starting winding 407, the relay 409 is energized by having its coil in series with the starting winding, to thereby cut out the heating coil 411 of the heat accumulator 97. When speed is reached and the motor is operating by the running winding 408, a centrifugal switch of the motor switches out the winding 407, thereby energizing the coil of the relay 409, permitting the heating coil 411 of the accumulator to be energized. At the same time, the solenoid winding 412 is energized to open the valve to the hot water to introduce hot water into the tub if the control contacts 413 are closed. If the hot, medium and warm selector knob 359 has been moved to indicate medium, contacts 414 are closed and the winding 412 of the hot water 415 and the winding 412 of the cold water solenoids 412 and 415, respectively. The rotor continues to operate at 18 r.p.m. entirely through the washing cycle. If either the drain valve or pump controls the draining of the water from the tub, the solenoid 422 will operate the drain valve or actuate the pump when the timer contacts 423 are closed to thereby remove the water from the tub. Thereafter, timer contacts 424 and/or 425 are closed to provide a flow of water which will spray into the tub onto the fabrics being tumbled therein for a predetermined number of cycles and length of time, it being understood that the type of timer used in the subject device achieves the acquired speed of making and breaking the electric circuits by impelling the cam switch shaft one quick "impulse" every forty-five seconds. After the spray rinse is completed, the solenoid 422 is de-energized so that water can contact with the tub and the hot water solenoid 412 is energized through the closing of the contacts 424 and a deep hot rinse will then occur for a desired period. Thereafter, contacts 424 are opened, de-energizing the hot water solenoid 412, cutting off the supply of water to the fabrics and the contacts 423 are closed to conduct the collected water to drain.

The polarity switch 426 is reversed through the energization of the coil 427 of the polarity relay 354 through the closing of the contacts 428 which also energizes the plugging relay coil 429 which shuts the centrifugal starting switch 431 to reverse the direction of operation of the motor. The contacts 428 are closed for a period of approximately two seconds so that the receptacle will accelerate to a speed of approximately 250 r.p.m. depending upon the load contained therein. This accelerated spin removes approximately eight (8) pounds of water for a six (6) pound load containing approximately twenty-five (25) pounds of water after the washing cycle. The receptacle is accelerated in this manner for approximately two seconds, after which it will coast down to tumbling speed. This process is repeated one or more times at higher speeds depending upon the reduced weight of water in the fabrics. Additional water is mechanically extracted from the fabrics by the additional accelerated spins before the centrifuging cycle occurs. Thereupon, the switch 428 makes contact with contact 432 energizing the polarity relay coil 427 for a full impulse so that when the plugging relay 429 is again energized the receptacle will then go into its
full spin speed for a desired number of impulses. Near the end of the cycle, when two or three impulses remain, the timer contacts 435 are closed to energize the coil of the solenoid 122 which operates the damper 117 to open position so that air can be drawn into the tub due to the high speed rotation of the receptacle. This admits air at a high temperature to the tub onto the fabrics which are retained by the centrifugal force on the peripheral wall thereof. Contact 428 then moves to neutral position and contacts 437 are opened, de-energizing the motor 88 so that it will coast down and stop, permitting the fabrics to further spin and wash through the receptacle. Following this, the drying cycle occurs through the closing of the contacts 438 which energizes the clutch solenoid 125 to connect the drive to the blower 95 and to energize the solenoid 201 of the condenser water valve which admits a flow of water to the condenser tube 285. The closing of the contacts 438 also energizes the motor 441 of the drier timer. In this same impulse the motor 88 is re-energized through the closing of the contact 406 and the receptacle is again operated at tumble speed, at approximately 48 r.p.m.

It is to be understood that before the centrifugalizing and drying cycle commences, the contact 423 was closed to maintain the drain valve 180 in open position throughout the entire length of the cycles.

The contacts 437 which control the accelerated spin are closed for two seconds and open for forty-three (43) seconds, actuated by a cam in the washer timer. Depending upon the cam which operates the contacts 402 from the length of time set by the operator, these contacts will be open at the end of the set drying cycle, de-energizing the entire circuit. Contacts 173 and 174 of the centrifugal governor 168 open the circuit for the accelerated spin when the governor has reached speed. The governor is employed instead of time being utilized for controlling the acceleration impulse of the receptacle. The governor takes the place of the switch 437 which times the impulse for the impulse accelerated spin. The R.T.C. or the T.C.O. control can be made effective by bridging the contacts 402 when they open after a predetermined set time, shorter than the drying time. The contacts 405 when open are shunted by a circuit containing contacts 442 which are open by the R.T.C. or the T.C.O. control when indicating the end of the drying cycle. When the R.T.C. or the T.C.O. contacts 442 close, the wash cycle is terminated, and up to this point, the contacts 403 which disconnects all of the circuits and sets up the time for the next laundering operation. In this scheme, the drier timer motor runs for a longer length of time than it will taken to open the contacts 442.

Referring to FIGS. 39, 50 and 52, an operating cycle is illustrated, laid in with a second wiring diagram for the belt type of transmission. It will be noted from FIGS. 39 and 50 that a substantial area is provided on the dial 362 for the "off" position of the machine. The timer is advanced by its motor in impulses of 45 seconds and is provided with cam activated contacts indicated by numerals 1 to 6. A band 15° or three impulses wide, indicated by the area 470, has the pointer of the knob 364 extended therein to start the machine operation through the closing of the contacts 6-478. When the pointer is in the area the heating element is energized and the final spin cycle is set to the number of spins set by the timer motor. The contacts 364 will close a circuit to the washing timer motor 404 through the switch 479 and move the pointer of the knob 364 from the area 470 into an area 471 in which the washing cycle occurs, at which time contacts 6-480 are closed. The area 472 on the chart FIG. 50 indicates maximum heat being applied to the heating element of the thermal storage device 97, and when the timer motor is energized it will be noted that the continuation of this area is shown reduced in width to indicate the lower wattage rating of 1800 or 2400 watts. In addition, 1500 or 1800 watts were originally used so as to have additional wattage available for operating the motors and the relays. At the time of setting the knob 364 with the pointer at the area S, the knob 359 is set for hot, medium or warm water which is delivered to the tub during the fill portion of the washing cycle through the mixing valve. The switch 353, controlled by the knob 359, is also provided with contacts connected in a circuit containing a 600" thermostat 461 which is in series with a 300° thermostat 462. The thermostat 462 has a short circuit 463 thereabout in which contacts 464 are provided. The contacts 464 are closed when the knob 359 has its pointer directed to the hot water position, and the thermostat 461 will permit the temperature of the heat storage device to rise to 60°. If the knob is turned to medium or warm, then the contacts 464 open and the thermostat 462 will open at approximately 300°, limiting the temperature rise of the heating element to approximately 300°. Hot water at selected temperature, indicated by the band 474, will be introduced into the tub through the closing of the contacts 2-484. The timer motor, indicated by the band 475, will be in operation, as noted above, and the motor 88 starts its operation, as indicated by the band 476, through the energized contacts 6-480. The water will continue to be delivered into the tub until the contacts of the diaphragm operated switch 183 are disengaged, whereupon the water will be at proper level and the flow thereof will terminate. The washing cycle continues for approximately twelve (12) minutes, after which the drain valve is opened or the pump is operated, indicated by the band 477, through the closing of the contacts 485, energizing the clutch solenoid 389. Warm water, indicated by a band 486, is then introduced into the tub through the closing of the contacts 2-487 for a short period of time when the contacts will open. Thereafter, while the water is being drained, the accelerated spin occurs, indicated by the band 488, through the operation of the contacts 3-489, energizing the solenoid for driving the pulley 367 and receptacle at high speeds for approximately a two-second interval. The contacts immediately after the receptacle decelerates until it is again driven at washing speed, which accelerated spin requires approximately two minutes. Thereafter, while the drain valve is still open, a complete centrifugal spin, indicated by the band 491, occurs by closing the contacts 1-492. During the deceleration of the spin, hot water is introduced into the tub by closing contacts 2-484, indicated by the band 493, during which the drain valve is closed or the pump operation interrupted by the opening of the contacts 485, and the flow continues for a period of three (3) impulses to produce a deep water rinse. After the hot water flow is terminated, the switch 485 is again closed to open the drain valve or operate the pump, as the case may be. Thereafter, a second band 48 indicates the accelerated spin of the receptacle, and it is to be understood that the bands indicate a plurality of spins, two or more, so as to remove a substantial amount of the water before the next cycle. After the accelerated spins, indicated by the second band 488, contacts 1-492 again close for producing the final spin operation of approximately nine (9) impulses of the timer, indicated by the band 494, and the extraction of water from the fabrics. The band 495 indicates time at which the damper 122 is open due to the closing of the contacts 3-496, which energizes the damper solenoid 122. A dotted extension 497 of the band 495 indicates that the damper may be opened after the first accelerated spin when a substantial amount of water has been removed from the fabrics so that heat may be applied to the re-
ceptacle fabrics during the second or more accelerated spins, without wasting heat on the extracted water during the first accelerated spin. At the end of the accelerated spins, the motor is de-energized by opening the contacts 6-400 for a period, permitting the receptacle to come down to stop position, which causes the fabrics to fall and break from the wall of the receptacle, after which contacts 6-400 are again closed and the motor again operated. At this time, contacts 1-499 are closed, energizing the solenoid 201 for starting the flow of the condenser water, energizing the motor 314 for starting the drier timer and the solenoid 126 for clutching the blower, thereby setting up the drying cycle of operation. Thereafter, the receptacle continues to rotate at tumbling speed and the air is circulated at high temperature due to the accumulated heat and the additional heat being supplied from the heating element. As indicated hereinabove, this heat, when high temperature air is employed, will be approximately 350° F., which will not harm the fabrics since they contain a substantial amount of water.

The temperature of the circulated air will progressively lower as the moisture content of the fabrics becomes lower so that at the time the fabrics are dry the temperature will have dropped below an amount which would be harmful to the fabrics.

As pointed out above, the operation may be terminated by time set on the drier dial 361 or may be terminated by the R.T.C. or the T.C.O. cycles, as indicated above. In any instance, after the drying of the fabrics, the dial knob 364 will be advanced to "off" position, cutting out all of the circuits and permitting the fabrics to be removed if the accumulator is employed. If a high wattage circuit of 230 volts is utilized, a cooling time with the heater off is usually added so that when the operation is completed the fabrics may be removed from the machine. The switch dial 357 of the panel has an "off" and "on" position controlling the contacts 499 and 500, disconnecting both of the lines leading to the machine. A dial 364, which may be moved inwardly to start the operation, closes contacts 501 in one line of the circuit. When the dial reaches "off" position, it moves outwardly, interrupting the contacts 501, thereby de-energizing all of the circuits of the system.

Referring again to FIG. 51, the ironer has a circuit which is energized by a contact 502 when moved from a contact 503 which de-energizes the circuits to the machine. This provides assurance that all elements of the washing and drying machine de-energize when the ironer is used, so as not to overload the circuit. When the ironer is pulled forwardly, contacts 504 are closed, completing a circuit to the ironer heating element 505, the temperature of which is controlled by a thermostat 506. A circuit is also completed to the motor 257 which drives the ironer roll by a switch 597 which is disposed in series therewith. The switch is operated each time the foot pedal is moved to move the shoe into engagement with the fabrics and roll. It is to be understood that this circuit may be included in the diagram of Fig. 52 when the ironer is mounted within the cabinet of the machine.

The timer for the drying cycle has a main switch 508 which is closed throughout the entire cycle of operation of the timer, indicated by the dotted area 509. A contact 510 of the timer is connected to the accumulator and this produces a flow of current through the full capacity of the heating element 390 of the thermal storage element 97 when the heater is first energized. An additional contact 511 of the timer is closed when the dial timer is set to zero to function in place of the 200° starter thermostat 460 to energize the washer timer motor 404 to start the operation of the washing cycle, which otherwise could not operate due to the dependence of the thermostat 460 which cannot function as the heater element is not energized. The contact 508 is employed in the main line to force the operator to set the dial for the drying cycle at some point other than "off" position if it is desired to dry the fabrics after the washing cycle in order to start the washing cycle of operation.

Referring to FIG. 47, it is to be understood that gas igniting means, such as a spark plug, glow coil or pilot light 400, may be employed for igniting the gas when it is delivered to the burner 393 upon the opening of the solenoid operated valve (not illustrated) in the usual manner. It is to be understood that safety means will be provided to prevent the continuous flow of gas in case it is not ignited when delivered to the burner. Such devices are well known in the art and are not herein described or illustrated. It is also to be understood that the thermostats 460, 461 and 462 will be employed with the gas fired thermal storage device with the thermostat 460 starting the operation of the washing cycle after the device is heated to a predetermined temperature. The temperature of the device is controlled thereafter by the thermostat 461 if high temperature is desired or by thermostat 462 if a lower temperature is to be the maximum temperature of the device. It is further to be understood that an over-current relay could be employed for cutting off the circuit to the heat storage means when a load is present on the motor, on the servo mechanisms or on the main circuit of the machine. The relay will open the contacts to the thermal storage device to provide adequate current for operating the machine without overloading the supply circuit.

While the condenser arrangement is such that adequate condensation of the circulated air occurs with a minimum use of water, nevertheless further economy could be provided if the water from the condenser, as well as the condensate from the air, is collected in a reservoir and used in a subsequent pre-wash or warm operation. The temperature of this water would be raised above the temperature of the water normally supplied from a faucet in the home.

What is claimed is:

1. In a laundering machine, a tub, a receptacle in said tub, means for driving said receptacle in rotation for performing a washing operation, means for extracting water to said tub, means for removing water from the tub, means for driving said receptacle at high speed for extracting water from the fabrics therewithin after a washing operation, a dispensing device at the top of said tub having a tiltable plate thereon on which soap or detergent is placed, and a solenoid for tipping said plate for delivering said soap or detergent to said tub, said plate being located to have extracted water wash thereover during each extracting cycle of operation of the machine.

2. In a laundering machine, a tub, a receptacle in said tub, means for driving said receptacle in rotation for performing a washing operation, means for admitting water to said tub, means for removing water from the tub, means for driving said receptacle at high speed for extracting water from the fabrics therewithin after a washing operation, a dispensing device including an opening at the top of said tub having a tiltable plate thereon on which soap or detergent is placed, a solenoid for tipping said plate for delivering said soap or detergent to said tub, said plate being located to have extracted water wash thereover during each extracting cycle of operation of the machine, a cabinet about said tub, and a bellows extending from the cabinet to said tub about said opening and a blower for blowing air through said opening.

3. In a combination washing machine for performing a complete laundering cycle, a tub, a receptacle in said tub, means driving said receptacle for performing a washing cycle of operation of fabrics contained therein, means driving said receptacle at high speed for a centrifuging operation to extract water from said fabrics, means for circulating air therethrough after said tub, receptacle and fabric for performing a drying operation thereon, said driving means comprising a motor, means for energizing said motor for accelerating the receptacle for a short interval of time when connected for high speed operation to a speed less than that attained during the centrifuging operation and prior to centrifuging operation for extracting an
amount of water from the fabrics after which the receptacle is permitted to coast down and be driven at washing speed, means for repeating said accelerated spin one or more times for removing a further amount of water from said fabrics before the final centrifuging operation, and centrifugal means on said drive means for controlling the speed of said accelerated spin.

4. In a laundering machine, a casing, a tub within said casing, spring means supporting said tub within said casing in a manner to have its horizontal axis slope downwardly from the front to the rear at an angle of at least 5° to the horizontal, a perforated receptacle within said tub with its axis lying on that of the tub, means for driving said receptacle in rotation for tumbling the fabrics contained therein, a load of fabrics being retained in the rear half of the receptacle during the washing cycle and progressively expanded and occupying the entire interior of the receptacle during the drying cycle, means for introducing water into the tub for washing, the greater depth of which will be at the rear of the tub due to the tilt thereof, the speed of rotation of said receptacle during the washing operation being such that the wet fabrics will be maintained substantially in the rear half of the receptacle to thereby wash the fabrics in the greater depth of water which thereby substantially reduces the amount of water required for the washing operation, means for draining the water from the tub, means for extracting a substantial amount of water from the fabrics, means for circulating heated air through the tub and receptacle for removing the remaining water from the fabrics which permits the fabrics to expand forwardly as they dry to substantially fill the receptacle, and a servo mechanism provided at the front of the receptacle which is contacted by the dried fabrics when moved to the front of the receptacle for terminating the operation of the drying cycle.

5. In a combination washing machine for performing a complete laundering cycle, a tub, a receptacle in said tub, means driving said receptacle for performing a washing cycle of operation on fabrics contained therein, means driving said receptacle at high speed for a centrifuging operation to extract water from said fabrics, means circulating air thereafter through said tub, receptacle and fabrics for performing a drying operation thereon, said driving means comprising a motor, and means for energizing said motor for accelerating the receptacle for a short interval of time when connected for high speed operation to a speed less than that attained during the centrifuging operation and prior to the centrifuging operation for extracting an amount of water from the fabrics after which the receptacle is permitted to coast down and be driven at washing speed.

6. In a combination washing machine for performing a complete laundering cycle, a tub, a receptacle in said tub, means driving said receptacle for performing a washing cycle of operation on fabrics contained therein, means driving said receptacle at high speed for a centrifuging operation to extract water from said fabrics, means circulating heated air thereafter through said tub, receptacle and fabrics for performing a drying operation thereon, said driving means comprising a motor, means for energizing said motor for accelerating the receptacle for a short interval of time when connected for high speed operation to a speed less than that attained during the centrifuging operation and prior to the centrifuging operation for extracting an amount of water from the fabrics after which the receptacle is permitted to coast down and be driven at washing speed, and controlled means for repeating said acceleration one or more times for removing a further amount of water from said fabrics before the final centrifuging operation.

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