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2,990,706

COMBINATION WASHER AND DRYER

Filed Dec. 14, 1960

3 Sheets-Sheet 1

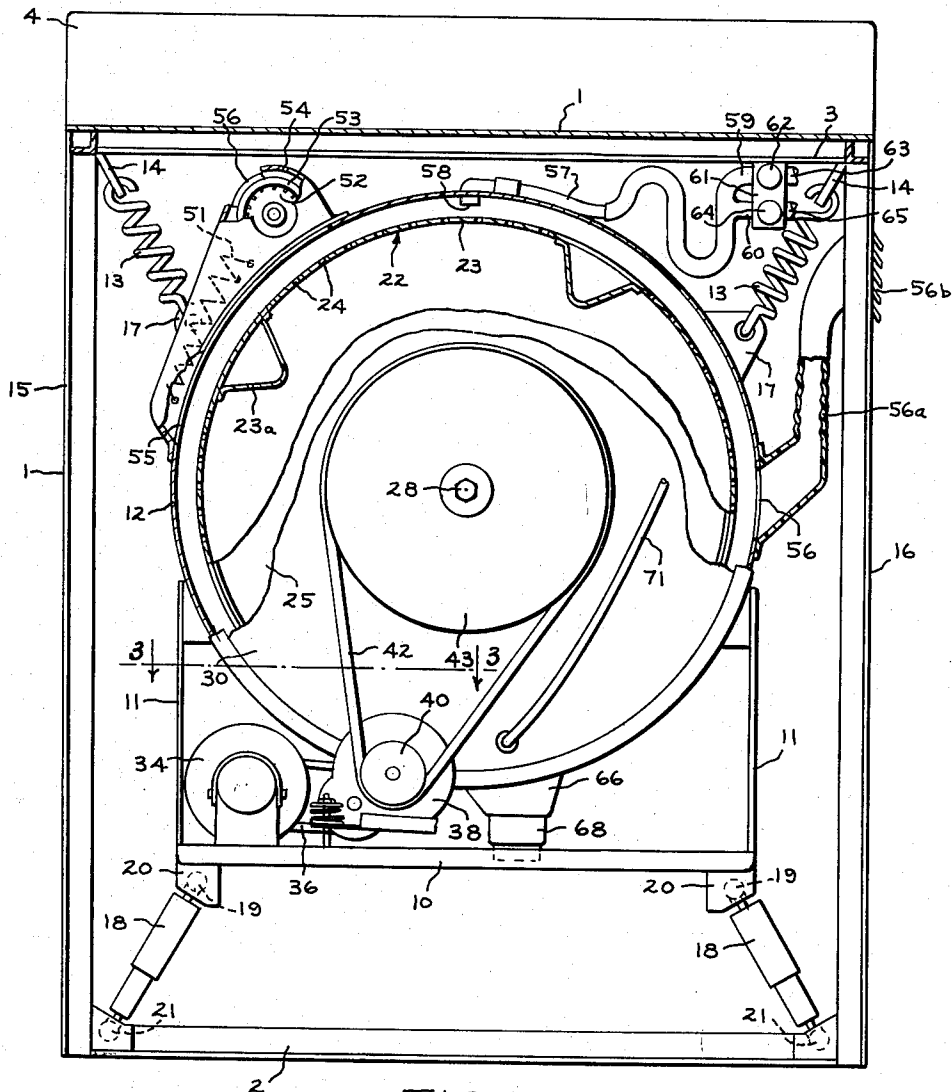


FIG. 1

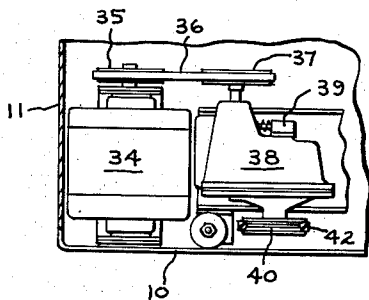


FIG. 3

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3 Sheets-Sheet 2

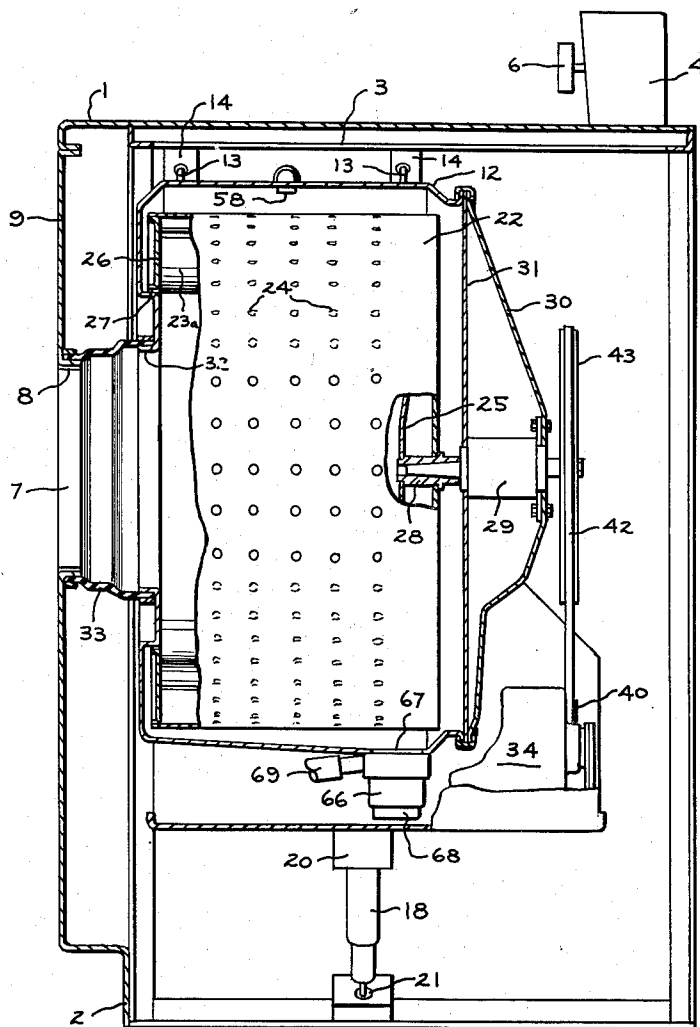


FIG. 2

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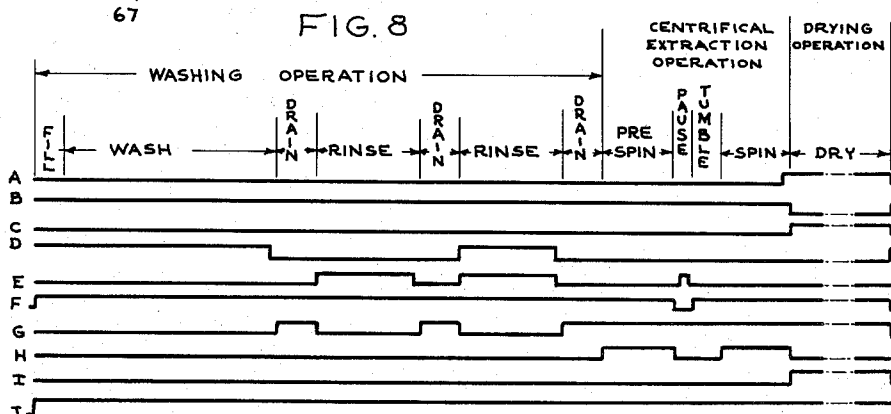
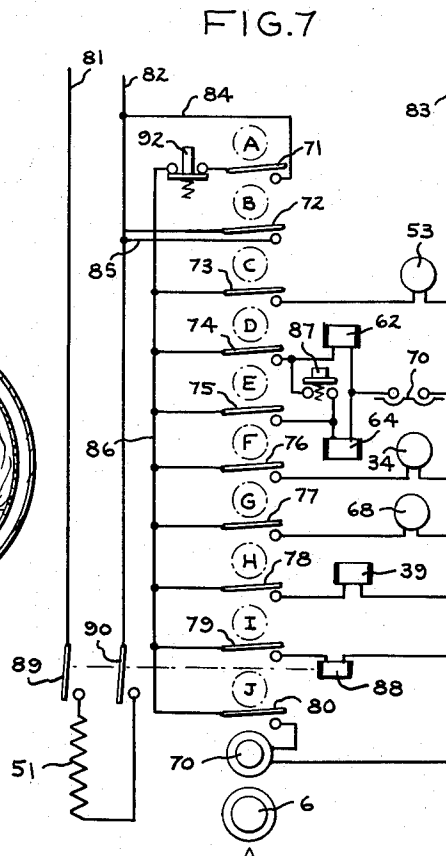
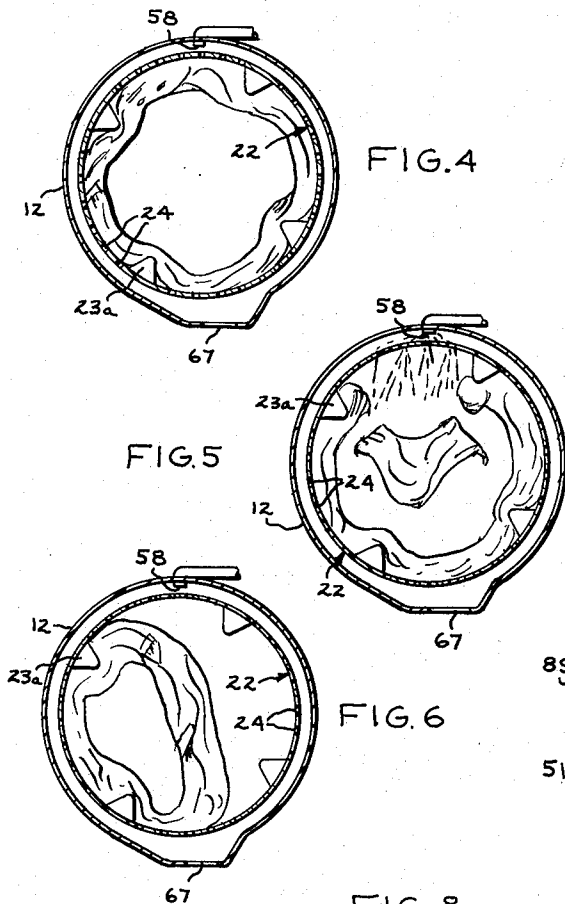
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COMBINATION WASHER AND DRYER

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3 Sheets-Sheet 3



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1

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COMBINATION WASHER AND DRYER

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7 Claims. (Cl. 68—12)

This invention relates to combination washer dryers, and more particularly to such machines wherein a washing operation is followed first by a centrifugal liquid extraction operation and then by a heat drying operation.

Combination washer dryers are machines which provide for complete laundering of textile materials, that is, they provide a washing operation which includes washing and rinsing, a centrifugal extraction operation for removing a substantial part of the water from the clothes after the wash operation, and a complete drying of the material, generally effected by tumbling the clothes in the presence of warm air.

It is highly desirable in such machines to provide the centrifugal extraction at a high speed, since the amount of liquid removed from the clothes increases with the speed at which the operation is performed. This removal of water from the clothes determines the length of time that will be needed for the heat drying operation, an important factor to the operator since (1) an unduly long operation will probably be an inconvenience, and (2) the longer the heat drying operation the greater the expense of fuel (either gas or electric, usually).

However, at the high rotational speeds desirable for maximum liquid removal, it has been found that the passage of liquid radially outward through the materials—because of the centrifugal force—has the effect of matting down the fibers of the materials and causing them to adhere in an annulus to the inner surface of the clothes container. This adherence, or sticking, occurs to the extent that even after the container ceases to rotate at centrifuging speed the clothes remain in that position. Inasmuch as the effectiveness of the heat drying operation is dependent upon tumbling of the clothes so that they continually present different surfaces to the circulating air, it will readily be seen that, if the materials adhere to the periphery of the container after the centrifugal operation, the necessary tumbling will not occur and drying will not be effected.

There are two factors which have been found to be material with regard to the phenomenon of adherence or sticking of the materials to the inner surface of the container after a centrifugal extraction operation. One of them is time: it has been found that, up to a certain speed for any particular diameter container, very brief spin operations can be provided at "sticking" speeds without the sticking occurring. However, this time factor disappears at a certain speed, i.e., any rotation at such a speed causes sticking. The other factor which is of primary interest is that the greater the amount of liquid forced through the clothes the greater the tendency of the clothes to stick to the container wall. It follows, then, that the less liquid contained in the clothes the higher the speed at which the container or basket can be rotated without the undesired sticking occurring.

In addition to the foregoing it is well known that soaking of the clothes unsticks them from the container surface. I have found that it is possible to make use of these phenomena by, after spinning the container, soaking the clothes which are sticking to a small part of the container wall; this makes them fall away from the wall. Then, by rotating the container at tumbling speed, those clothes which have been soaked free, knock unstuck the remainder of the garments. When this is done, a subsequent spin at a high speed which normally causes stick-

2

ing may be provided without the undesirable sticking occurring.

Based on the foregoing findings, it is therefore an object of my invention to provide a combination washer and dryer wherein the centrifugal liquid extraction operation is conducted at a speed at which the clothes would normally be stuck at the end of the operation, yet in which the clothes are not stuck and are therefore free to tumble as desired during the heat drying operation.

A further object of my invention is to achieve this goal by providing a structure in which the spin operation includes a high speed spin during which the clothes are stuck, a soaking of a small part of the container wall and the clothes stuck thereto to release the clothes from that part of the wall, and a tumbling operation during which the unstuck clothes knock the remainder of the clothes away from the wall so that all of the clothes after a period of tumbling are then unstuck. At this point, a substantial part of the water has been removed from the clothes and they are not stuck to the wall of the container; in fact, they will not stick to the wall even though the high speed operation which initially caused sticking be provided once again.

In accordance with my invention, I provide, in a combination washing and drying machine, a rotatable clothes basket which rotates on a non-vertical axis and which has a foraminous peripheral wall. The basket is driven by a suitable drive means, and the drive means in turn is controlled so as to cause the basket to rotate at a relatively low clothes tumbling speed for washing and drying operations and at a relatively high speed for a centrifugal liquid extraction operation. The machine includes, in the conventional manner, means for effecting the washing operation and means for effecting the drying operation. As a basic part of my invention, I provide means which is positioned so as to introduce liquid into the clothes basket so as to wet a relatively small part of the wall thereof when the basket is stationary; this liquid introducing means may, of course, perform the additional function of providing the liquid for washing and rinsing steps or, if so desired, it may be an entirely separate inlet.

The machine also includes sequence control means which controls all the various components of the machine so as to provide in sequence the washing operation, a centrifugal liquid extraction operation, and a drying operation. The sequence control means causes, during the extraction operation, a sequence of events in which first the basket is rotated at a relatively high speed which causes the clothes to stick to the wall and removes a substantial part of the liquid from the clothes. Second, the basket is stopped, and while it is stopped the liquid introducing means is operated so that clothes sticking to the relatively small wall part which receives liquid therefrom becomes sufficiently wet to become unstuck. Third, the basket is started up again but at a rate of rotation which causes a tumbling effect. During this tumbling the clothes which were soaked loose from the basket wall knock the other clothes unstuck.

At this point a substantial amount of liquid has been removed from the clothes, and the clothes are all in an unstuck condition. The heat drying operation may either be started immediately or, preferably, a high speed rotation may again be provided. While this rotation is at a speed which would normally cause the clothes to be stuck, the fact that they have had a major part of the water removed from them already permits the high speed rotation without any additional sticking of the clothes.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. My invention itself, however, may best be understood by reference to

3

the following description taken in conjunction with the accompanying drawings.

FIGURE 1 is a rear elevational view of a combination washer dryer incorporating my improved arrangement, with the rear panel removed to illustrate details;

FIGURE 2 is a side elevational view of the machine of FIGURE 1, partly in section, with certain surfaces broken away to show details;

FIGURE 3 is a partial cross-sectional plan view taken on line 3—3 of FIGURE 1;

FIGURE 4 is a front elevational view, partly schematic, of the tub and basket of the machine of FIGURES 1 and 2 during a first part of the centrifugal extraction operation;

FIGURE 5 is a view similar to FIGURE 4 during a second part of the centrifugal extraction operation;

FIGURE 6 is a view similar to FIGURE 4 during a third part of the centrifugal extraction operation;

FIGURE 7 is a schematic diagram of a simplified control circuit appropriate for use in providing the control sequence; and

FIGURE 8 is a cam chart representing a development of the ten cams shown in FIGURE 7.

Referring now to FIGURES 1 and 2 of the drawings, there is shown a combination clothes washing and drying machine wherein the operating elements of the machine are included within an outer cabinet structure having a central wrap-around section 1. Section 1 is supported on a base and toe board assembly 2 and includes a top portion 3 on which is supported a backplasher and control panel 4. Panel 4 is provided with appropriate manual controls, generally shown at 6, which may be used for the initiation of washing and drying sequences. Access to the interior of the machine is provided by a door 7 positioned to close an opening 8 formed in the front portion 9 of wrap-around section 1. Preferably, the door 7 fits in opening 8 in substantially leak-proof relation therewith, and may be mounted on suitable hinges (not shown).

Within the wrap-around section 1, there is provided a platform member 10 having upstanding ends 11 which support an imperforate generally cylindrical tub structure 12. The tub 12 and platform 10 are rigidly secured together and may be suspended within the wrap-around section 1 by any preferred means. These may be provided, as shown, in the form of four coil springs 13 (two on each side) each of which extends down at an angle from a member 14 formed at the junction of top 3 and side panels 15 and 16 of wrap-around section 1. Each spring 13 is connected at its lower end to a projection 17 formed extending outwardly from the outer surface of tub 12.

In addition to the resilient support provided by springs 13, the platform 10 may be supported from beneath by any suitable means. For instance, cylinder and piston type damping structures 18 may be provided, connected by universal joints 19 at their tops to projections 20 extending down from platform 10, and by universal joints 21 at their bottoms to base 2.

Within the tub 12, there is provided a clothes basket or container 22 mounted for rotation on a non-vertical axis, the axis being horizontal in the present case. Basket 22 includes a cylindrical outer wall 23 provided with a substantial number of foramina, the foramina in the present case being provided by perforations 24 punched in wall 23. The perforations 24 give suitable air and water communication between the interior of basket 22 and the exterior thereof, that is, the space between wall 23 and tub 12. The rear of the basket 22 is closed by means of a suitable double wall or plate 25. The basket also includes a front wall 26 which is formed so as to define an access or loading opening 27 in registry with opening 8.

Basket 22 is rotatably supported by a shaft 28 which is mounted in an elongated bearing 29 supported between

4

the rear wall 30 of tub 12 and an intermediate wall 31 which also forms part of the structure of tub 12. Tub 12 is also provided with an opening 32 aligned with openings 27 and 8 so that clothes may be placed into and removed from basket 22 when door 7 is opened. A suitable flexible rubber boot 33 may be provided connecting opening 32 to opening 8 in leakproof relation while permitting relative motion therebetween, it being understood that during high speed rotation of basket 22, as will be explained herebelow, unbalances within the basket may cause a substantial amount of movement of the system suspended on springs 13 and damping members 18. It will further be understood in this connection that the suspension system represented by the springs and the damping members is such that it prevents a substantial part of the vibratory force caused as a result of unbalanced high speed rotation from reaching the wrap-around section 1. Also, the suspension system restricts the movement of the suspended parts sufficiently to prevent unbalanced loads from providing a vibratory movement large enough to cause the suspended system to strike any part of the cabinet of the machine.

During the operation of the machine, the basket 22 is driven from an electric motor 34. As best shown in FIGURE 3, the drive from the motor includes a pulley 35 which is secured to the motor shaft so as to rotate therewith and over which passes a belt 36 driving input pulley 37 of a transmission assembly 38. The details of transmission assembly 38 are not illustrated herein, since the particular construction thereof does not form part of the present invention. It will be understood, however, that this transmission is of the type providing a speed reduction in one ratio for driving basket 22 at clothes-tumbling speed, and with another ratio being provided to effect high-speed spinning of the basket for centrifugal liquid extraction purposes. In the present instance, it is contemplated that transmission 38 will be automatically shifted from its tumbling speed ratio to its spin speed ratio by energization of a spin solenoid 39. Obviously, however, other arrangements may be employed for shifting from tumbling speed to extraction speed, this invention requiring only that the shift take place responsive to an electrical signal as will be more fully discussed herebelow. A transmission output pulley 40 is connected by means of a flexible belt 42 to rotate a large diameter pulley 43 (FIGURE 1) secured on the end of shaft 28 so that rotation of pulley 43 causes a like rotation of the shaft and basket 22. With this arrangement, it is evident that when motor 34 is in operation, basket 22 is rotated either at tumbling speed or at centrifuging speed depending upon energization of spin solenoid 39. An appropriate tumbling speed is, for instance, on the order of 47 r.p.m.; for centrifuging, a high speed on the order of several hundred r.p.m. is preferred—for instance, 700 r.p.m. represents a speed effective to decrease the amount of liquid retained in clothes by a substantial amount.

To cause warm air to be provided for heating clothes during the heat drying portion of the cycle and carrying off evaporated moisture from the clothes, there is provided an electric heater 51 which heats air drawn by a blower 52 through an inlet 53 into a housing assembly 54 secured to tub 12. After being pulled into the housing 54, the air is forced over the heater 51 by blower 53 and then into the tub 12 through opening 55. Blower 53 may be operated in the conventional manner by any suitable means such as, for instance, a motor 56 connected in direct driving relation to the blower. During heat drying, the air passes through opening 55 into tub 12 and then, through perforations 24, passes into the basket 22 to contact the clothes tumbling therein and evaporate moisture therefrom. The air carrying the evaporated moisture then is forced out through an opening 56 formed in tub 12 and then through a flexible con-

5

duit 56a to louvered opening 56b so as to be exhausted from the machine.

In order to supply water to the interior of tub 12 for washing operations, a conduit 57 is arranged with its outlet 58 positioned so as to discharge into the tub 12 downwardly onto the top of basket 22. The conduit 57 may be connected to a pair of hoses 59 and 60 which lead from a valve 61 controlling the admission of hot and cold water to the machine. In the conventional manner, the valve 61 may include a hot water solenoid 62 controlling the admission of hot water from a conduit 63, and a cold water solenoid 64 to control the admission of cold water from a conduit 65. Energization of solenoid 62 causes hot water to be admitted through outlet 58 into the machine, energization of solenoid 64 causes admission of cold water to the machine, and energization of both solenoids 62 and 64 causes admission of warm water to the machine.

In order to control the removal of water from the tub 12, an appropriate drain pump 66 may be provided communicating with an opening 67 formed at the lowest part of the bottom of the tub. The drain pump 66 may be operated by any suitable means such as a motor 68. When motor 68 operates pump 66, liquid is removed from the basket 22 and tub 12 through a drain conduit 69 which leads to a suitable drain (not shown). At other times, liquid is retained in the tub 12. As will be explained herebelow the operation of the water admitting means and the drain means is correlated to cause water to be present in suitable quantities for washing and rinsing operations at the desired time during a washing operation, and to cause the draining of vitiated water at the end of such operations.

In connection with the admission of water, this may be caused to terminate when a suitable liquid level is reached by means of a suitable water level control switch of any conventional type. One such switch (indicated only schematically, in FIGURE 7, by the numeral 70), may be positioned within control panel 4 and connected by a conduit 71 (FIGURE 1) to a point adjacent the bottom of tub 12 thereof. When water rises within the tub and basket a column of air is trapped in the conduit 71 and, when the pressure within the conduit 71 becomes sufficiently high in response to a predetermined level of water, the device 70 deenergizes whichever of solenoids 62 and 64 is energized to cause the flow of water into the tub 12 to cease.

With the apparatus described, any suitable sequence including the basic sequence of washing, draining, and rinsing may be utilized to effect the washing operation of the cycle (spinning after the wash and after the rinses may also be provided); this is followed by a suitable centrifugal liquid extraction operation or spin which will be more fully explained herebelow and which causes a substantial part of the liquid in the clothes to be removed therefrom after the washing operation. This in turn may be followed by a suitable heat drying of the clothes as they are tumbled in basket 22.

Referring now to FIGURE 7, in order to provide automatically the proper sequence of operation there is provided a sequence control in which a timer motor 70 controls the rotation of several cams A, B, C, D, E, F, G, H, I, and J, the cams in turn respectively controlling timer switches 71 through 80. Switches 71 through 80 are actuated in a desired sequence as a result of the cams being driven by the timer motor 70 as indicated schematically in the figure. Sequence controls are well known, and several types are commercially available; the representation of FIGURE 7 is therefore schematic it being understood that each of the switches 71 through 80 is operated by its associated cam in a sequence which is indicated in FIGURE 8. It will be understood that the chart of FIGURE 8 may be regarded for the purposes of this application as a development of the peripheries of the respective switch operated cams, the raised parts

6

showing the cam rises of each cam when the switch associated therewith is closed, and the lower parts of the lines showing the dwells when the switch is open.

The power connections for the machine conventionally include a pair of line conductors 81 and 82 having a potential of 230 volts between them, and a neutral conductor 83 which has a potential difference of 115 volts with each of the conductors 81 and 82. Switches 71 and 72 are respectively connected by conductors 84 and 85 between conductor 82 on the one hand and a conductor 86 on the other hand. Switch 73 controls the blower motor 53, being in series with it between the conductor 86 and neutral line 83 (and thus across 115 volts). Switch 74 is in series with hot water valve solenoid 62 and switch 75 is in series with cold water valve solenoid 64, the level control device 70 being in the form of a switch in series with both solenoids. In addition a manually operable switch 87 may be provided to permit both solenoids 62 and 64 to be energized when switch 74 is closed so as to provide warm water rather than hot water for washing purposes.

Switch 76 controls the main motor 34, switch 77 the drain pump motor 68, and switch 78 the transmission solenoid 39. Switch 79 is in series with a heater relay 88 which, when energized, closes a pair of switches 89 and 90 to permit energization of heater 51 across 230 volts. The last timer switch 80 is in series with timer motor 70 which drives the cams A through J.

The manually operable member 6 is schematically shown arranged so that it may be used to manually advance the cams to an appropriate start position in which, among others, switch 80 is closed by cam J so as to energize the timer motor 70. The timer motor, from that point, carries the cams through a complete cycle of operation.

Returning to switches 71 and 72 it will be seen that they both perform the same function of connecting the conductor 86 to conductor 82. As will be more fully explained herebelow, it is anticipated that cam B will cause switch 72 to be closed during the washing and centrifugal extraction operations and open during the drying operation, and that conversely cam A will cause switch 71 to be open during the washing and centrifugal extraction operations and closed during the drying operation. Included in series with switch 71 is a manually operable switch 92 which, when depressed, makes the closing of switch 71 inoperative. When switch 92 is not manually depressed, conductor 82 is connected to conductor 86 for a complete laundering operation including washing, extraction, and drying since connection between the conductors will be made through one of the switches 71 and 72 throughout the operation. However, when switch 92 is opened, all connection is severed once switch 72 opens; since this occurs at the end of the centrifugal extraction operation, it is possible, by operation of switch 92 to an open position, to eliminate the drying operation.

At the beginning of an operation, the cams are manually turned by dial 6 to the starting position as shown in FIGURE 8. In this position it will be observed that cams B, D, F, and J are respectively closing switches 72, 74, 76, and 80. The closing of switch 72 connects conductor 86 to conductor 82. The closure of the timer motor switch 80 causes timer motor 70 to be energized and to advance the cams without further manual operation. The closure of switch 76 by cam F causes the motor 34 to operate so as to rotate basket 22 at clothes tumbling speed, and the closure of switch 74 by cam D causes the hot water solenoid 62 to be energized to provide for the introduction of hot water for a washing operation. The hot water solenoid 62 is deenergized when sufficient water is present in the tub 12 to open switch 70, whereupon the clothes are tumbled in the presence of hot water during the wash period shown in FIGURE 8. It is contemplated, of course, that suitable detergent and other treating materials

may be added prior to the washing operation so that the desired cleansing effect will be obtained.

At the end of the washing operation the switch 74 is opened so that the draining of water will not cause the solenoid 62 to be reenergized. After this, cam G closes switch 77 to cause the vitiated wash water to be drained out the machine. After an appropriate period, switch 77 is opened and switch 75 is closed by cam E. As a result, cold water enters through inlet 58 until the liquid level control 70 de-energizes the solenoid 64. Toward the end of the rinse operation, cam E opens switch 75, and immediately thereafter the drain pump is again energized to remove the vitiated rinse water. Usually a suitable number of rinses will be provided; in the present case, for illustrative purposes only, two such rinses are provided during the washing operation subsequent to the wash step. Conventionally, the first rinse may be with cold water and subsequent rinses may be at other temperatures. For this purpose, we have shown, at the beginning of the second rinse, both solenoids 62 and 64 being energized to provide warm water into the tub 12 until level control switch 70 opens. In other respects the second rinse period is like the first rinse period. Toward the end of it, the timer switches controlling the valve solenoids are opened, and thereafter the drain pump switch is closed to cause the drain pump to operate.

At the end of the draining period the drain pump continues to operate as shown. However, the centrifugal extraction operation is started by having cam H close switch 78. This energizes solenoid 39 and the speed therefore increases to full spin speed (subject to any unbalance controlling arrangements which may conventionally be provided in such machines). This high speed spin continues for an appropriate period, for instance, on the order of five minutes. The clothes during this high speed spin are plastered about the inner surface of peripheral wall 23 in the manner shown in FIGURE 4. It will be understood, in this connection, that the clothes, as a result of the high speed of rotation and due to the liquid being forced radially outwardly through the clothes, are packed into an annular mass adhering firmly to the inner surface of wall 23.

As an important part of my invention, I form the cam F to open switch 76 so as to deenergize drive motor 34 after the termination of the first high speed spin, or pre-spin. At the same time, of course, the switch 78 may also be opened. The deenergization of the drive motor provides a pause during which the motion of the basket 22 is entirely stopped. During this pause, that is, the period when the basket is stationary, the switch 75 is closed by cam E for a brief period to cause cold water to be passed from outlet 58. The position of outlet 58 directly over the top of basket 22 causes the water coming out from it to pass in through the perforations 24 over a relatively small part of the basket wall so as to soak the clothes which are adhering to that small part of the inner wall surface which receives the water. Sufficient water is introduced in this manner to soak the clothes adhering to that small part of the wall so that they fall away from the wall, as shown in FIGURE 5. In this connection, it will be observed that just a very small part of the clothes fall away from the wall, the remainder of the clothes remaining stuck to the wall as also shown in that figure. As an example, I have found that introduction of approximately half a gallon of water is sufficient to soak loose part of the clothes so that they fall away from the wall in the manner shown in FIGURE 5.

At the end of the pause, the switch 76 is reclosed so as to provide clothes tumbling rotation of the basket. This clothes tumbling rotation causes the loosened clothes to tumble against the clothes which still adhere to the inner surface of the basket. I have found that this impact of the freed clothes against the clothes still adhering to the basket causes all of the clothes to be knocked loose from the basket wall during the tumbling operation, provided

tumbling is continued for a suitable length of time which may, for instance, be on the order of two minutes. At this point then, it will be seen that the clothes are all unstuck, that is, substantially as shown in FIGURE 6, they are tumbling in relatively loose fashion.

Returning for an instant to the high speed spin which forms the initial part of the centrifugal extraction operation, it will be understood that when clothes are dripping wet they may retain approximately three times their own weight in water. Thus, for a load of eight pounds of towels and other cotton garments, one may readily assume a liquid retention of twenty pounds or two-hundred-fifty percent of the weight of the clothes. During rotation at the speed of 700 r.p.m., approximately sixteen pounds of water is removed from such a load leaving the clothes with a fifty percent water retention of four pounds. This, together with the four pounds of water represented by the half gallon added to soak some of the clothes loose from the wall, means that the eight pound load of clothes has a total water retention of about eight pounds, or one-hundred percent. While this is a relatively low water retention, and permits heat drying of the clothes in a relatively brief period of time the preferred form of my invention provides the additional spin shown in FIGURE 8 at the end of the centrifugal extraction operation. This additional spin, when conducted at a speed on the order of 700 r.p.m., permits the water retention of even such articles as towels to be reduced approximately to 50 percent so that an eight pound load of towels would have only four pounds of water retained in it at the end of the spin operation. Even more important, however, is the fact that, as a result of (a) the first spin operation, (b) the soaking of a small part of the clothes and (c) the subsequent tumble, the amount of liquid passing through the clothes during this second high speed spin has been decreased to the extent that no sticking of the clothes occurs even though, when such a speed was provided with the clothes soaking wet, there was firm adherence of the clothes to the wall of the basket. Of course, the few clothes that were soaked may stick to the wall during this second high speed spin; but when tumbling resumes (during drying), the clothes that did not have water added to them will be loose and will knock the few stuck clothes loose. In other words, the roles are reversed: the clothes which previously knocked the other clothes loose are now themselves knocked loose (if stuck) by the other clothes.

In other words, my invention provides an improved centrifugal extraction operation where, by provision of a particular sequence of operations, I decrease the amount of water retained in the clothes to a very low percentage while at the same time precluding sticking of the clothes so that there is no necessity for mechanical devices to unstuck the clothes from the wall. In its broadest aspect, my invention makes possible the removal of a substantial amount of water by a pre-spin, a pause during which a small part of the clothes are soaked, and then a tumble. In a narrower and preferred aspect of the invention, even more liquid is removed from the clothes without sticking by providing, after the first three steps, another spin at high speed which, in the absence of the first three steps, would inevitably cause sticking of the clothes in a tight annulus about the interior of the basket 22.

Completing the description of the complete laundering operation, it will be noted that, toward the end of the spin which terminates the centrifugal extraction operation, switch 71 may be closed so that, when switch 72 is opened at the end of the spin operation, the machine will automatically go into the drying operation, if switch 92 is closed, but will terminate all operations if the switch 71 has been opened. In addition, at this time the impeller motor 53 is energized by the closure of switch 73, the high speed rotation of the basket is stopped, and the basket returns to tumble speed as a result of de-energization of solenoid 39. Also, the energization of

relay 88 by the closing of switch 79 causes a 230 volt circuit to be completed for the heaters 51. This drying operation may be continued in the conventional manner, either for a timed period as shown for purposes of simplicity, or so arranged as to be terminated automatically in response to a dry condition of the clothes as provided in many commercially available machines.

It will be seen from the foregoing that, by my invention, there is provided, in a machine which provides a complete laundering operation, a centrifugal extraction operation which permits the extraction of a very high amount of liquid from the clothes by use of high rotary speeds, yet which does not cause the sticking of the clothes to the basket wall which prevents the drying operation to be performed properly. An important advantage which is obtained by the removal of a very high percentage of the clothes by a centrifugal operation is that, due to the resulting shortening of the drying operation, the heat drying of the clothes may be effected in a time which receives greater commercial acceptance. In fact, as opposed to the 230 volt heater shown for illustrative purposes in my application, it is readily conceivable, particularly where the spin speed is raised to about 1,000 r.p.m., that a machine with a 115 volt heater will give the desired results of heat drying in a commercially acceptable length of time, thereby removing the need for special 230 volt wiring which sometimes is an inconvenience when laundering machines are installed in older homes.

While in accordance with the patent statutes I have described what at present is considered to be the preferred embodiment of my invention, it will be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and I therefore aim to cover in the appended claims all such changes and modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. In a combination washing and drying machine: a clothes container rotatable on a non-vertical axis and having a foraminous peripheral wall; drive means for said container; control means for said drive means operable to cause said drive means to rotate said container at a relatively low clothes tumbling speed for washing and drying operations and at a relatively high speed for a centrifugal liquid extraction operation; means for effecting a washing operation; means for effecting a drying operation; means positioned to introduce liquid into said container so as to wet clothes sticking to a relatively small part of said wall thereof when said container is stationary; and sequence control means controlling all the aforesaid means to provide in sequence a washing operation, a centrifugal extraction operation, and a drying operation, said sequence control means during said extraction operation causing, first, container rotation at a relatively high speed during which the clothes stick to said wall, second, a stationary condition of said container and operation of said liquid introducing means during said stationary condition so that clothes sticking to said relatively small wall part are sufficiently wet to become unstuck, third, container rotation at clothes tumbling speed during which the clothes which were unstuck by the soaking knock the other clothes unstuck, and fourth, container rotation at a relatively high speed again.

2. The apparatus defined in claim 1 wherein said clothes container is substantially cylindrical.

3. The apparatus defined in claim 1 wherein said sequence control means causes said liquid introducing means to introduce approximately half a gallon of water during said stationary condition of said receptacle.

4. The apparatus defined in claim 1 wherein said liquid introducing means is positioned directly above said container with its outlet arranged so that water emerges therefrom in a directly downward direction.

5. The apparatus defined in claim 1 wherein said sequence control means causes operation of said liquid introducing means also during said washing operation, whereby said liquid introducing means also is a part of said means for effecting a washing operation.

6. In a combination washing and drying machine: a substantially cylindrical clothes container rotatable on a horizontal axis and having a foraminous peripheral wall; drive means for said container; control means for said drive means operable to cause said drive means to rotate said container at a relatively low clothes tumbling speed for washing and drying operations and at a relatively high speed for a centrifugal extraction operation; means for effecting a washing operation including liquid inlet means and a drain; means for effecting a drying operation including a heating element; said liquid inlet means being positioned so as to wet clothes sticking to a relatively small part of the wall of said container when said container is stationary during liquid introduction; and sequence control means controlling all the aforesaid means to provide in sequence a washing operation, a centrifugal liquid extraction operation, and a drying operation; said sequence control means during said extraction operation causing, first, container rotation at a relatively high speed during which the clothes stick to said wall, second, a stationary condition of said container and operation of said liquid introducing means during said stationary condition so that clothes sticking to said relatively small wall part are sufficiently wet to become unstuck, third, container rotation at clothes tumbling speed during which the clothes which were unstuck by soaking knock the other clothes unstuck, and fourth, container rotation at a relatively high speed again.

7. In a combination washing and drying machine: a clothes container rotatable on a non-vertical axis and having a foraminous peripheral wall; drive means for said container; control means for said drive means operable to cause said drive means to rotate said container at a relatively low clothes tumbling speed for washing and drying operations and at a relatively high speed for a centrifugal liquid extraction operation; means for effecting a washing operation; means for effecting a drying operation; means positioned to introduce liquid into said container so as to wet clothes sticking to a relatively small part of said wall thereof when said container is stationary; and sequence control means controlling all the aforesaid means to provide in sequence a washing operation, a centrifugal extraction operation, and a drying operation; said sequence control means during said extraction operation causing, first, container rotation at a relatively high speed during which the clothes stick to said wall, second, a stationary condition of said container and operation of said liquid introducing means during said stationary condition so that clothes sticking to said relatively small wall part are sufficiently wet to become unstuck, and third, container rotation at clothes tumbling speed during which the clothes which were unstuck by the soaking knock the other clothes unstuck.

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