

Jan. 12, 1960

J. BOCHAN
UNBALANCE CONTROL ARRANGEMENT FOR LAUNDRY MACHINES
OF THE TYPE INCLUDING A CENTRIFUGAL
EXTRACTION OPERATION

2,920,470

Filed Aug. 1, 1958

3 Sheets-Sheet 1

FIG. 1

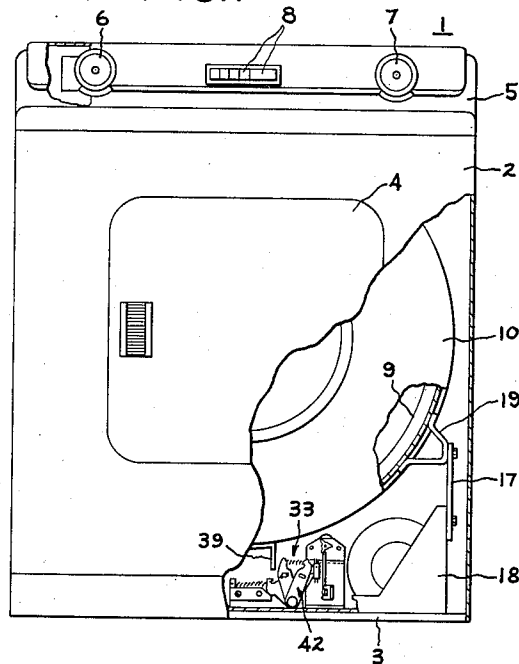
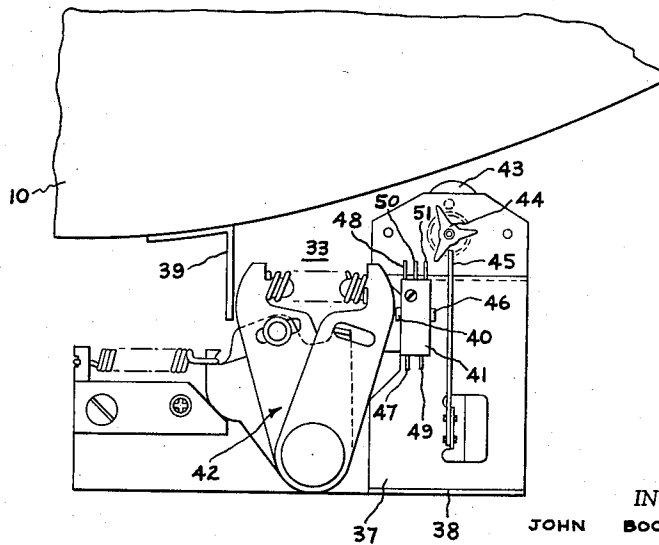


FIG. 2



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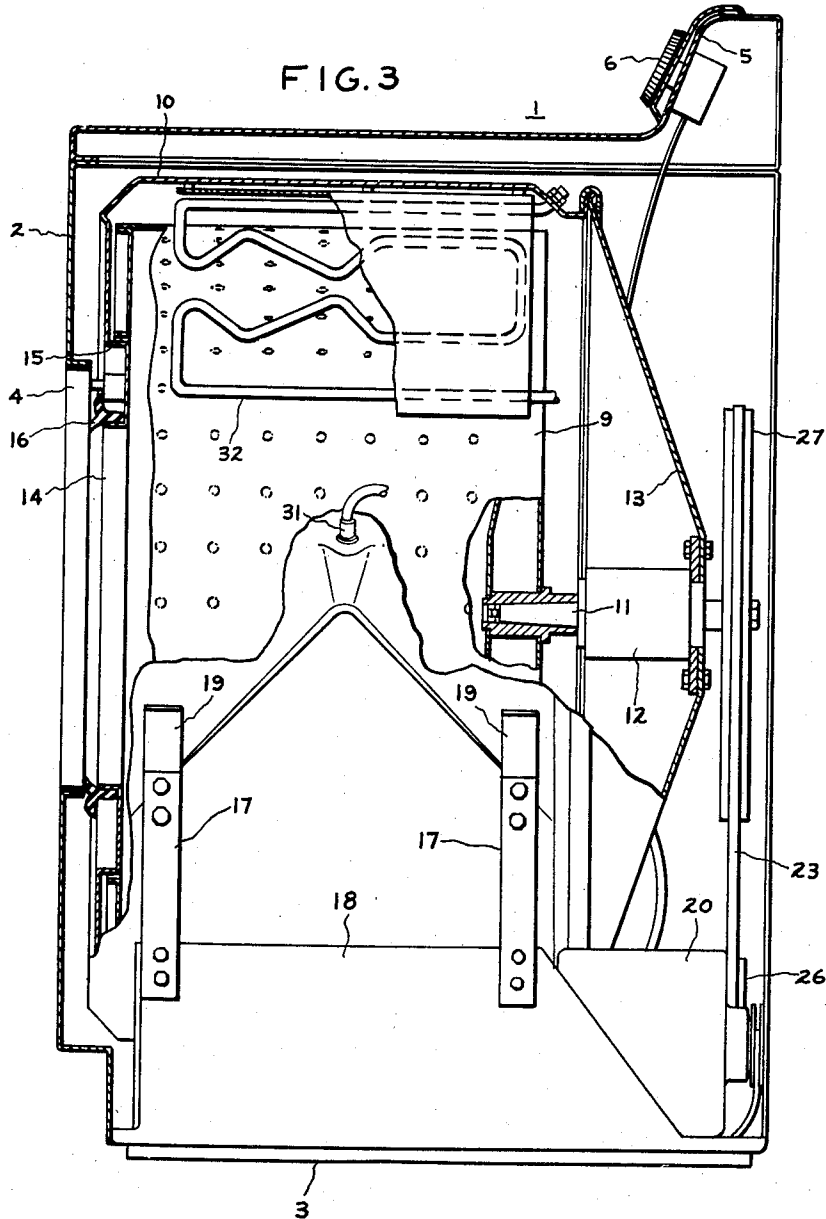
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FIG. 4

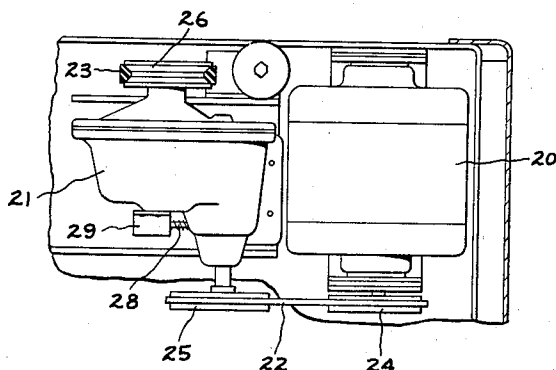
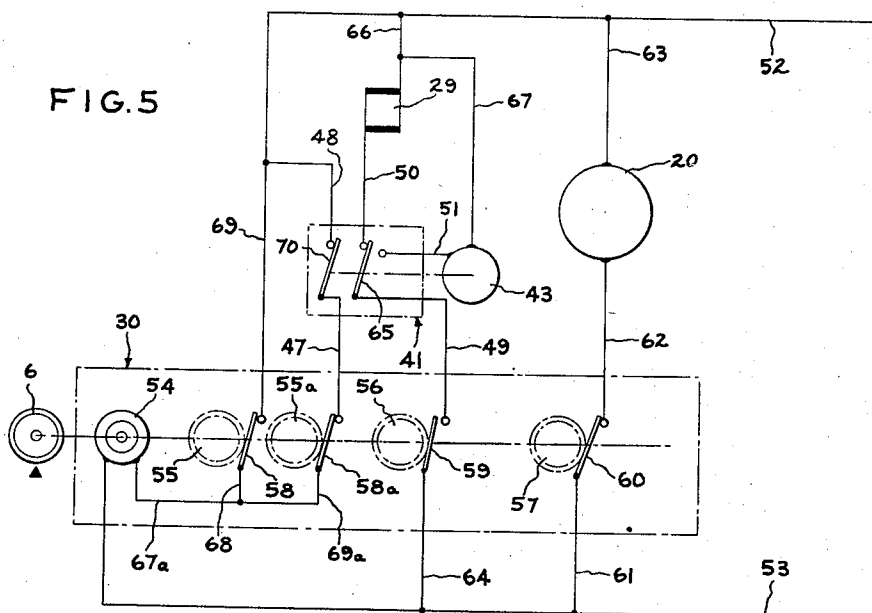


FIG. 5



	WASH	RINSE	PRE SPIN	SPIN	DRY
TIMER (CAM 55)					
TIMER (CAM 55a)					
SPIN (CAM 56)					
MOTOR (CAM 57)					

FIG. 6

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UNBALANCE CONTROL ARRANGEMENT FOR LAUNDRY MACHINES OF THE TYPE INCLUDING A CENTRIFUGAL EXTRACTION OPERATION

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Application August 1, 1958, Serial No. 752,518

5 Claims. (Cl. 68—12)

This invention relates to laundry machines, and more particularly to an improved unbalance control arrangement for use in laundry machines which extract water from the clothes by high-speed rotation of the clothes container.

In domestic washing machines of the type which provide centrifugal extraction of liquid from wet clothes by means of a high speed rotation, some type of safety device is generally necessary to prevent the high speed rotation when the distribution of the clothes in the receptacle is such that excessive unbalance is present. One type of arrangement, which has been found to provide substantially satisfactory results, provides for a low-speed redistribution of the clothes in the basket in response to tripping of the excessive unbalance safety mechanism, followed by another attempt at high speed spinning. If the unbalance should still be excessive, the cycle will be repeated with the machine returning to low speed for redistribution and then again coming up to high speed to attempt a centrifugal extraction sequence.

The usual method of providing the centrifugal extraction, or spin operation is to allot a certain amount of time therefor by means of a timer control mechanism. However, when the above described arrangement is used, i.e., where the clothes are redistributed and then another spin attempt is made, proper distribution of the clothes to permit the spin to continue without interruption from the unbalance mechanism may occur on the first attempt or only after many attempts. If a specific amount of time is provided, as usual, for the spin operation, then the clothes at the end of the operation will vary all the way from being properly damp-dry, if proper balance is obtained on the first attempt, to substantially wet, if many attempts were made and none succeeded throughout the time allotted from the spin operation. If, in attempting to remedy this, enough time is allotted to increase the probability that top spin speed will be reached, or so that even with a series of unsuccessful attempts the clothes will be sufficiently dry, then a considerable length of time may be unnecessarily spent in the spin operation if a proper balance should be obtained relatively early.

It is an object of the invention to remedy the above situation by making the length of the spin cycle dependent on how soon suitable balance is obtained within the container so as to permit uninterrupted high speed rotation.

A further object of the invention is to provide a spin period whose length is influenced by the number of attempts required before balance is obtained.

A more specific object is to achieve the variable spin period by relating the energization of the timer mechanism to the energization of the control for providing high speed rotation of the clothes container, so that the timer motor is in effect timing only the high speed operation rather than the entire sequence of high speed operation and low speed redistribution.

In one aspect, my invention provides a washing machine which has washing means including a rotatable

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clothes basket or container, and electrically controlled drive means therefor. The electric control is operable to cause the drive means to operate at high speed; operation of the drive means at high speed rotates the basket at centrifuging speed so as to extract water from the clothes.

Sensing means, operated in response to a predetermined magnitude of unbalance of the clothes basket, is arranged so that when operated it precludes the control means for a predetermined time from causing high speed operation of the basket. In other words, in response to operation of the sensing means the driving means is slowed down long enough to permit the clothes to redistribute in the basket. Electrically operated timer means is arranged so that, during a predetermined period of the timer means operation, the drive means operates at high speed except as otherwise controlled by the sensing means. Also, the timer means is arranged so that during at least part of the predetermined period it is energized only when the electrical control means is causing high speed basket operation. In other words, if the unbalance should be large enough to cause the sensing means to operate, the timer means will run, during this part of the predetermined period, only when the high speed drive is in effect. Thus, the time taken for redistribution does not affect the timer; as a result, a sufficient amount of spin time to remove moisture from the clothes is provided even though the balance should never be adequate for continued spin. At the other extreme possibility, if the balance should be acceptable at an early point in the predetermined period the timer will run continuously to maintain the spin time at the minimum necessary for adequate liquid extraction.

The features of my invention which I believe to be novel are set forth with particularity in the appended claims. My invention itself, however, may best be understood by reference to the following description taken in conjunction with the accompanying drawings.

In the drawings,

Figure 1 is a front elevational view of a domestic laundry machine suitable for use with the improved control arrangement of this invention, certain surfaces of the view being broken away in order better to illustrate certain details;

Figure 2 is an enlarged fragmentary front elevational view of the unbalance sensing construction provided in the machine of Figure 1;

Figure 3 is an enlarged side elevational view of the machine of Figure 1 with the side panel removed, the view being partly in section and having certain surfaces broken away to illustrate details;

Figure 4 is a fragmentary plan view of drive means which may be included in the machine;

Figure 5 is a schematic diagram illustrating the improved control arrangement provided by my invention for use in the machine of Figures 1 and 3; and

Figure 6 is a cam chart representing a development of the cams schematically shown in Figure 5.

Referring now to Figures 1 and 3, I have shown my invention in one form as applied to a domestic laundry machine 1 comprising a combination washer and dryer. The machine 1 includes an outer cabinet 2 which is mounted on a supporting base structure 3. Access to the machine for loading and unloading of clothes is provided by a hinged door 4 disposed in the front wall of the cabinet. A backsplasher 5 mounted at the top of the cabinet serves as a mounting means for suitable operator controls for the machine. These controls may, for example, comprise the rotatable dials 6 and 7 and the pushbuttons 8.

The machine 1 is of the type which includes a clothes basket rotatable about a non-vertical axis. Specifically,

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referring to Figure 3, it includes a perforated clothes container, or basket, 9 which is disposed for rotation about a generally horizontal axis. The basket 9 is mounted within an imperforate tube structure 10 which encloses it on all sides. The basket is rotatably supported from the tub structure by a horizontally extending shaft 11 which is mounted in an elongated bearing 12 hung from the rear wall 13 of the tub structure. The shaft 11, as well as supporting the basket, also serves as a means for turning it during operation of the machine. The tub and basket are provided respectively with openings 14 and 15 in the front walls thereof, the openings being aligned with the door opening in the front wall of the cabinet 2 so that clothes may be placed into or removed from the basket. The door 4 seals against the gasket 16 around the tub opening 14 to close off the tub completely during operation of the machine.

Tub 10 is supported from base 3 by means of a plurality of brackets or arms 17 which are mounted on upstanding plates 18 fixedly attached to the base 3. Four of these arms are provided, two being secured to each side of the tub. The arms on the opposite sides of the tub are spaced apart so that the tub in effect is supported near its front and near its rear on each side thereof.

Although the arms 17 can be secured directly to the wall of tub 10, preferably, and as shown, the arms 17 are attached thereto by means of suitable brackets 19. With the tub 10 supported in the manner shown, it is able to vibrate sideways in a plane parallel to the front of the machine if the basket 9 should be unbalanced during high speed rotation thereof. The arms 17 are relatively long compared to their width, and they flex so as to allow slight sideways vibration of the tub relative to the base 3. However the arms 17 are effective substantially to prevent vibration of the tub from front to rear and in the vertical direction since they are not at all flexible in these directions. As is more fully explained herein-after, I provide means for sensing the amount of sideways unbalance vibration thereby to prevent that vibration from ever becoming great enough to damage the machine or to cause it to move on the floor.

During the operation of the machine, basket 9 is driven from suitable means, such as an electric motor 20, through a drive which includes a transmission assembly 21 and a pair of flexible belts 22 and 23 (Figures 3 and 4). Belt 22 connects the motor pulley 24 to the input pulley 25 of the transmission assembly. Belt 23 connects the output pulley 26 of the transmission assembly to basket drive pulley 27 mounted on shaft 11 of basket 9. The transmission assembly 21 is of the multi-speed type, that is, the gear ratio thereof can be changed so that the basket is driven at two different speeds. The ratio of the transmission assembly input to output speed is changed by any suitable control means, such as spring biased solenoid operated plunger 28. When the electrically operated solenoid 29 controlling the plunger is de-energized, the transmission ratio is such that the basket is driven at a suitable speed for washing and tumbling clothes, for instance 47 revolutions per minute. When the solenoid 29 is energized, plunger 28 changes the ratio of transmission so that the basket is driven at a relatively high centrifugal extraction speed, for example, 210 revolutions per minute. The constructional details of the transmission are not further described, many such arrangements adapted for electric control (such as by solenoids) being known to those skilled in the art.

The complete operation of the machine normally provides a washing period, a draining of the wash liquid, a rinse, and draining of the rinse liquid, during which basket 9 rotates at a tumbling speed of approximately 47 r.p.m., followed by a centrifugal liquid extraction at 210 r.p.m., and, if desired, a heat drying period at 47 r.p.m. While variations of the sequence can be provided, it will be understood that the described sequence is typical.

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During the operation of the machine, the various electrical components thereof are under the control of a timer operated sequence control, indicated schematically at 30 in Figure 5. Such sequence controls, including complete circuits for providing operation of washer-dryer machines of the type shown, are well known in the art and therefore are not further described herein except in specific connection with the novel arrangement. It will, however, be understood that in addition to the elements specifically illustrated and described below as electrically controlled by sequence timer 30, the timer also controls suitable means whereby the water is admitted to and discharged from the machine, suitable means for effecting heat drying of the clothes and suitable interlocking and safety arrangements. A water inlet connection 31 and a sheathed type electric resistance heater 32 are both shown in Figure 3. Any suitable electrically operated means, such as a drain pump (not shown), can be used to control the discharge of water from the machine.

Referring now particularly to Figures 1 and 2, the unbalance sensing means 33 is mounted on the base 3 of the machine by means of an upstanding plate or bracket 37 which is attached to the base 3 through a flange 38 formed thereon. Actuating means for the sensing means is provided in the form of a bracket 39 which is mounted on the tub 10 so that, when an unbalance occurs in the rotating basket to cause a predetermined magnitude of vibration of the basket and tub relative to the base, the actuating means moves sufficiently to operate the button 40 of a switch generally indicated at 41.

While any suitable mechanism may be provided for this purpose, I prefer to use the arrangement shown, which is described and claimed in Patent 2,832,208 issued on April 29, 1958, to A. M. Stone, and assigned to the General Electric Company, owner of the present invention. This mechanism includes a scissors device 42 which is interposed between actuating bracket 39 and button 40 to cause actuation of the button in response to a predetermined magnitude of vibration of the tub 10. As will be more fully explained below, actuation of button 40 causes energization of auxiliary timing means including motor 43 which drives a star wheel 44 through reduction gear means (not shown). The star wheel 44 rotates counterclockwise, as viewed in Figure 2, and is adapted to engage the upper end of a leaf spring 45 which is fixedly mounted at its lower end on the switch mounting bracket 37. As the star wheel 44 rotates, it bends the upper end of the leaf spring 45 to the right. This bending of the leaf spring continues until such time as the spring is bent far enough for the engaging arm of the star wheel to slip over its top. At that time, the spring moves quickly in the opposite direction, striking button 46 of switch 41. The switch is internally formed, as more fully explained herebelow in connection with Figure 5, so that actuation of button 46 causes connection of conductor 47 and conductor 48, and of conductor 49 with conductor 50; actuation of button 40, as described above, causes disconnection of the conductors 47 and 48, and causes conductor 49 to be engaged with a conductor 51 instead of conductor 50.

Referring now to Figure 5 in particular, the improved control arrangement of this invention is described. A pair of supply conductors 52 and 53 are connected across a suitable course of alternating current power (not shown). The timer sequence control 30 includes an electric timer motor 54 which, through suitable speed reduction means (not shown) drives cam members 55, 55a, 56, and 57. The cam members in turn respectively control the position of switch arms 58, 58a, 59 and 60. It will further be seen that control knob 6 is arranged in controlling relationship to the cams 55, 55a, 56 and 57, so that it may be used to position the cams correctly at the start of a cycle.

Switch arm 60 controlled by cams 57 controls the

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energization of drive motor 20, the circuit through the motor being completed from conductor 53 through a conductor 61, switch 60, conductor 62, motor 20, and conductor 63 back to conductor 52. The energizing circuit for solenoid 29 extends from conductor 53 through a conductor 64 to switch arm 59 controlled by cam 56. The circuit then continues through conductor 49 to switch arm 65 of switch 41 which connects conductor 49 to conductor 50 upon actuation of button 46 (see Figure 2). The solenoid energizing circuit then continues through the solenoid 29, and conductor 66, back to conductor 52.

It will be recalled that, in connection with Figure 2, it was stated that upon actuation of button 40 conductor 49 became connected to conductor 51. It will be seen, returning to Figure 5, that this is effected when switch arm 65 moves out of engagement with conductor 50 and into engagement with conductor 51 leading to auxiliary timer motor 43. The auxiliary timer motor then becomes energized through conductors 53 and 64, switch arm 59, conductor 49, switch 65, conductor 51, the motor 43, and conductors 67, 66 and 52. It will thus be seen that energization of the solenoid 29 and of the auxiliary timer motor 43 is alternative in nature.

Referring now to the energizing arrangement for the timer motor 54, an energizing circuit is provided starting with conductor 53, through the timer motor itself, conductors 67a and 68, switch arm 58, and conductor 69 back to conductor 52. In parallel with the switch 58, an auxiliary energizing circuit for the timer motor 54 is completed through conductor 69a and switch 58a to conductor 47 which is connected to conductor 48 by switch arm 70 of switch 41. Conductor 48 in turn is connected back to conductor 52 to complete the auxiliary energizing circuit for the timer motor. It will be seen that when switch arm 58 engages conductor 69, energization of the timer motor is continuous and is independent of switch 41; when switch arm 58 is separated from conductor 69, energization of the timer motor 54 is dependent on the connection of conductors 47 and 48 through switch arm 70, provided switch 58a is closed. Switch arm 70 and switch arm 55 are ganged together within switch 41, that is, upon actuation of button 46 they both assume the position shown in Figure 5, and upon actuation of button 40 they both move to a position where contact arm 70 is out of engagement with conductor 48 and contact 65 is out of engagement with conductor 50 and in engagement with conductor 51.

Referring now to Figure 6, in conjunction with Figures 2 and 5, the operation of the improved unbalance control arrangement of my invention will be described. The time sequence control 30 provides, first, a suitable washing operation of machine 1, with liquid being introduced through suitable means such as inlet 31 (Figure 3). During this time, as throughout the entire operating cycle of the machine, cam 57 causes switch arm 60 to complete the circuit to motor 20. In other words, motor 20 is generally energized to operate throughout the cycle of machine 1. During this early part of the cycle, switch 59 is maintained open by cam 56 so that solenoid 29 is de-energized. In this condition of the solenoid, transmission 21 causes slow speed rotation of basket 9. Also during this time, timer motor 54 which drives the cams is itself energized by virtue of the closed position of switch 58. The circuit through timer 54 is also completed at this time through contact arm 70 in parallel with switch arm 58.

The machine proceeds through the wash and rinse operations, with other suitable electrical components being controlled through timer motor 54 to provide an appropriate amount of wash liquid in tub 10, draining, clean rinse water, and again draining. After these washing and rinsing steps, solenoid 29 is energized by cam 56 closing switch arm 59 to connect conductors 64 and 49. Also, cam 55 opens switch arm 58 thus leaving ener-

gization of timer motor 54 entirely within the control of switch arm 70 as controlled by buttons 40 and 46 of switch 41, cam 55a keeping switch arm 58a connected to conductor 47 throughout a cycle.

Energization of solenoid 29 causes high speed operation of basket 9 through transmission 21. If the clothes are properly distributed in the basket so that actuating member 39 does not actuate button 40, the high speed spin operation will continue through the pre-spin and spin times (Figure 6), at the end of which solenoid 29 is de-energized by the opening of switch 59. As an example, if the pre-spin time is on the order of 30 seconds and the spin time about one minute and 30 seconds, then, since timer 54 is continuously energized, the spin will take two minutes.

However, if there is an unbalance within basket 9 sufficient to cause actuating member 39 to operate button 40, switch arm 65 moves into engagement with conductor 51 and switch arm 70 disconnects conductors 47 and 48. The action of switch arm 65 energizes auxiliary timer motor 43 which starts to rotate the star wheel 44 as set forth above. At the same time, timer motor 54 ceases to be energized since no energizing circuit therefor is completed.

After a predetermined period which may, for instance, be on the order of fifteen to twenty seconds, the operation of auxiliary timer motor 43 causes actuation of button 46 by spring 45, and this in turn moves the switch arms 65 and 70 back to the position shown in Figure 5. At this time, high speed rotation of the basket 9 will again be started because of the energization of solenoid 29, timer 54 will again start operation because an energizing circuit therefor is completed through switch arm 70 and auxiliary motor 43 will stop. If the clothes are now distributed properly so that the unbalance is not excessive, the spin will continue through pre-spin and spin until solenoid 29 is de-energized as a result of the action of cam 56. Otherwise, if there is still an undesirable unbalance present, the cycle will be repeated, with solenoid 29 and timer motor 54 being de-energized and auxiliary timer motor 43 being re-energized to permit the clothes basket to slow down for redistribution of the clothes.

It has been found in practice, with a typical machine, that the acceleration to spin speed upon energization of solenoid 29 takes about 2 seconds, while the deceleration to and redistribution at tumble speed may be provided to take about 18 seconds.

With such a machine then, taking the 30 seconds of timer operation for pre-spin as previously mentioned, it will be seen that up to 15 attempts can be made to correct unbalances; the timer will run for only two seconds during each attempt which is made, even though the attempt takes a total of twenty seconds. If all 15 attempts should be required, there is thus an actual time lapse of 5 minutes during pre-spin. In other words, if necessary because of the unbalance situation up to 15 attempts can be made taking up to 5 minutes. However, if the unbalance situation should be quickly remedied or should not exist, then the pre-spin operation will finish in as little as thirty seconds. Thus, the pre-spin operation does not last a substantial length of time where there is no need for it, as has heretofore been true, but there is ample time for the pre-spin operation where there is need of it because of an uncorrected unbalance.

In the preferred arrangement, at the end of the pre-spin operation switch arm 58 again engages conductor 69 to provide energization of timer 54 without dependence on the position of switch arm 70. However switch arm 65 continues to control the energization of solenoid 29 and of auxiliary timer motor 43, so that in the event the unbalance is such that it continues not to be corrected (which will occur only rarely), still no harm will come to the machine. However, the spin cycle will now time itself out. At this point, even if the unbalance continues through to the end of the spin cycle, the machine has

reached a relatively high speed sufficiently often to have removed a large amount of water from the clothes in the machine.

Where a combination washer-dryer such as the one illustrated is provided, a drying operation using heaters 32 (Figure 3) may be initiated by the timer mechanism in a manner well known in the art at the end of spin, when solenoid 29 is de-energized by the opening of switch 59. The timer motor 54 and the main drive motor 20 continue to operate to provide tumbling of the clothes within the basket 9 until the end of the cycle is reached, at which time all the timer operated switches are opened.

It will be observed from the foregoing that where there is no unbalance so that there is no need to allot time for attempts at spin, the pre-spin operation passes very rapidly. On the other hand, a substantial number of attempts can be made, with the length of the cycle increasing only to the extent that the number of attempts increases before proper balance is obtained. Also, by virtue of this arrangement, even with an unbalance existing throughout the spin part of the cycle, a substantial amount of water can be removed by centrifugal extraction; this is achieved without requiring a similarly relatively long spin time where there is no such unbalance problem.

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

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

1. In a laundry machine, washing means including a rotatable clothes basket; drive means for said basket; electrical drive control means for said drive means operable to cause said drive means to rotate said basket at centrifuging speed to extract water from the clothes therein; electrically operated timer control means controlling said drive control means to rotate said basket at centrifuging speed for a predetermined period of said timer control means operation; sensing means operated in response to a predetermined magnitude of unbalance of the clothes within said basket; auxiliary timing means controlling said drive control means during said predetermined period in response to operation of said sensing means; said auxiliary timing means, in response to said operation of said sensing means precluding for a predetermined period of time operation of said drive control means so as to prevent centrifuging speed operation of said basket during said period; said auxiliary timing means, upon the expiration of said predetermined time, again causing operation of said drive control means to provide rotation of said basket at centrifuging speed; said auxiliary timing means, during at least a portion of said predetermined period of said timer control means operation, causing energization of said timer control means only when said drive control means is operating, whereby said portion of said predetermined period passes without interruption if said sensing means does not operate said auxiliary timing means but is interrupted as often and as long as said auxiliary timing means precludes operation of said drive control means.

2. In a laundry machine, washing means including a clothes basket rotatable on a substantially non-vertical axis; drive means for said basket; electrical drive control means having two operative conditions, said electrical control means when in the first of said conditions causing said drive means to operate at low speed and when in the second of said conditions causing said drive means to operate at high speed, said drive means when operating at low speed rotating said basket at tumbling speed to wash the clothes and when operating at high speed rotat-

ing said basket at centrifuging speed to extract water from the clothes; electrically operated timer control means controlling said drive control means to rotate said basket at centrifuging speed for a predetermined period of said timer control means operation; sensing means operated in response to a predetermined magnitude of unbalance of the clothes within said basket; auxiliary timing means controlling said drive control means during said predetermined period; said auxiliary timing means, in response to operation of said sensing means, providing said first condition for a predetermined time so as to provide tumbling speed operation of said basket; said auxiliary timing means, upon the expiration of said predetermined time, returning said drive control means to said second condition to provide rotation of said basket at centrifuging speed; said auxiliary timing means, during at least a portion of said predetermined period of said timer control means operation, causing energization of said timer control means only when said drive control means is in said second condition, whereby said portion of said predetermined period passes without interruption if said sensing means does not operate said auxiliary timing means, but is interrupted as often and as long as said auxiliary timing means provides said first condition of said drive control means.

3. The apparatus defined in claim 2 wherein the axis of rotation of said clothes basket is substantially horizontal.

4. The apparatus defined in claim 2 wherein said portion of said predetermined period of timer control means operation is immediately followed by a second portion of said predetermined period during which said timer control means is energized continuously independently of said sensing means.

5. In a laundry machine, washing means including a clothes basket rotatable on a substantially non-vertical axis; two speed drive means for said basket; a solenoid positioned in controlling relationship to said drive means, said solenoid when energized causing said drive means to operate at high speed and when not energized causing said drive means to operate at low speed, said drive means when operating at low speed rotating said basket at tumbling speed to wash the clothes therein, said drive means when operating at high speed rotating said container at centrifuging speed to extract water from the clothes; electrically operated timer control means controlling said solenoid and providing energization of said solenoid during a predetermined period of timer control means operation; switch means for controlling energization of said solenoid; actuating means for said switch means sensitive to an unbalanced condition of predetermined magnitude of said basket and operative at said unbalanced condition to actuate said switch means, said switch means when actuated causing de-energization of said solenoid so as to provide low speed operation of said drive means; auxiliary timing means operated during said predetermined period by said switch means when actuated to retain said solenoid de-energized for a predetermined time and upon the expiration of said predetermined time to de-actuate said switch means to cause re-energization of said solenoid; actuation of said switch means, during at least a portion of said predetermined period, also causing de-energization of said timer means; de-actuation of said switch means, during said portion of said predetermined period, causing re-energization of said timer means, whereby said portion of said predetermined period passes without interruption if said sensing means does not actuate said switch means but is interrupted as often as said sensing means actuates said switch.

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