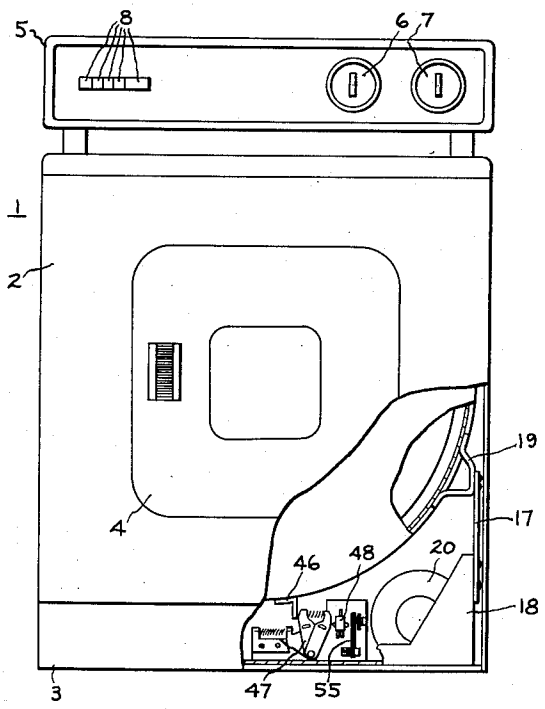
Jan. 10, 1961 M. F. METZGER 2,967,621

UNBALANCE CORRECTING SYSTEM FOR USE IN LAUNDRY MACHINES

Filed Dec. 9, 1959 3 Sheets-Sheet 1

FIG. 1



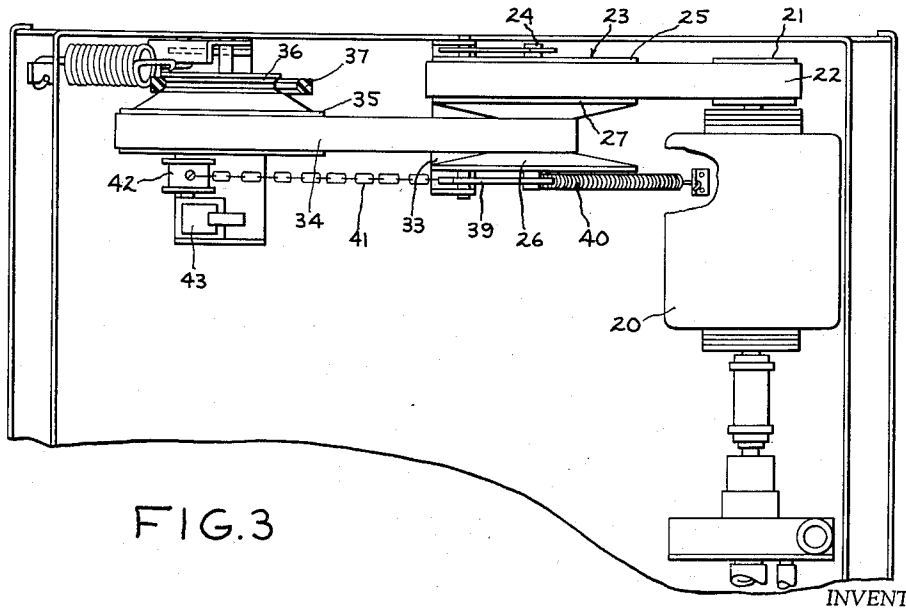




FIG. 3

INVENTOR
MATT F. METZGER

BY Derek P Lawrence

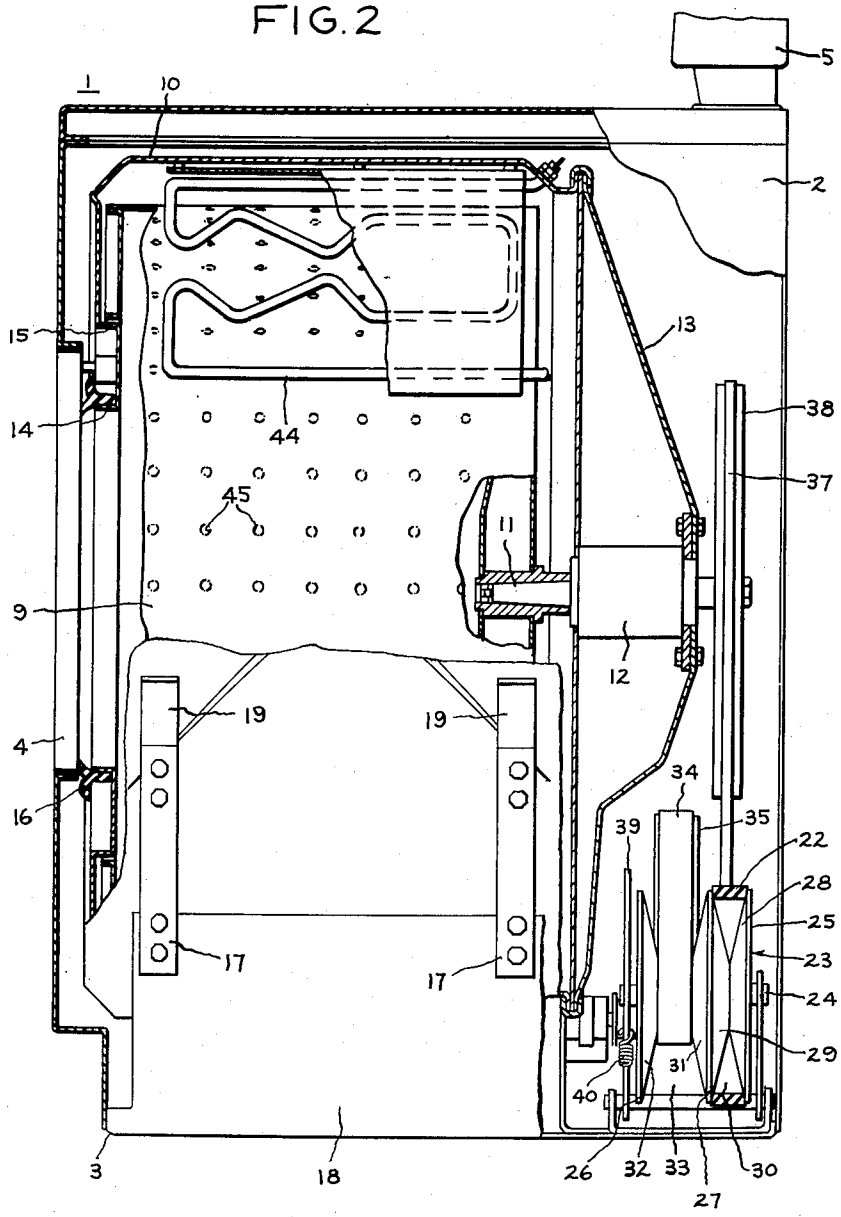
HIS ATTORNEY

Jan. 10, 1961 M. F. METZGER 2,967,621

UNBALANCE CORRECTING SYSTEM FOR USE IN LAUNDRY MACHINES

Filed Dec. 9, 1959 3 Sheets-Sheet 2

FIG. 2




*INVENTOR.*

MATT F. METZGER

BY Derek P Lawrence

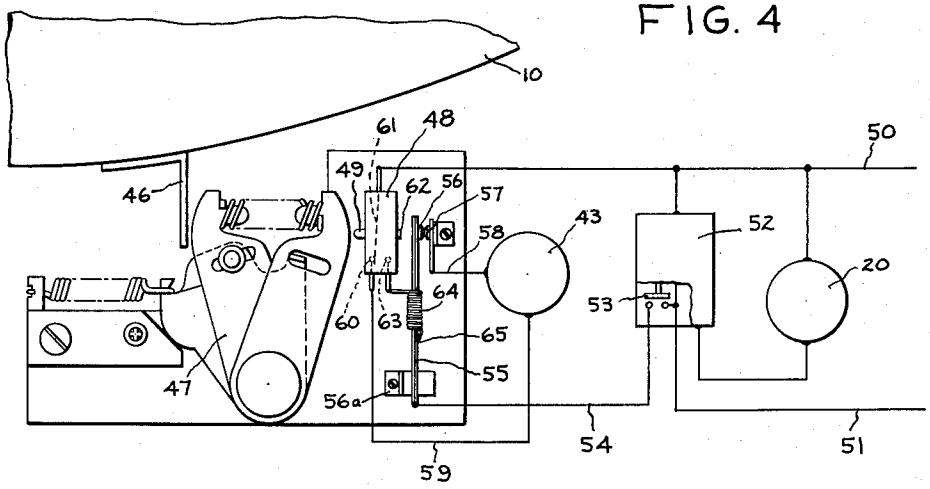
HIS ATTORNEY

Jan. 10, 1961 M. F. METZGER 2,967,621

UNBALANCE CORRECTING SYSTEM FOR USE IN LAUNDRY MACHINES

Filed Dec. 9, 1959 3 Sheets-Sheet 3

FIG. 4



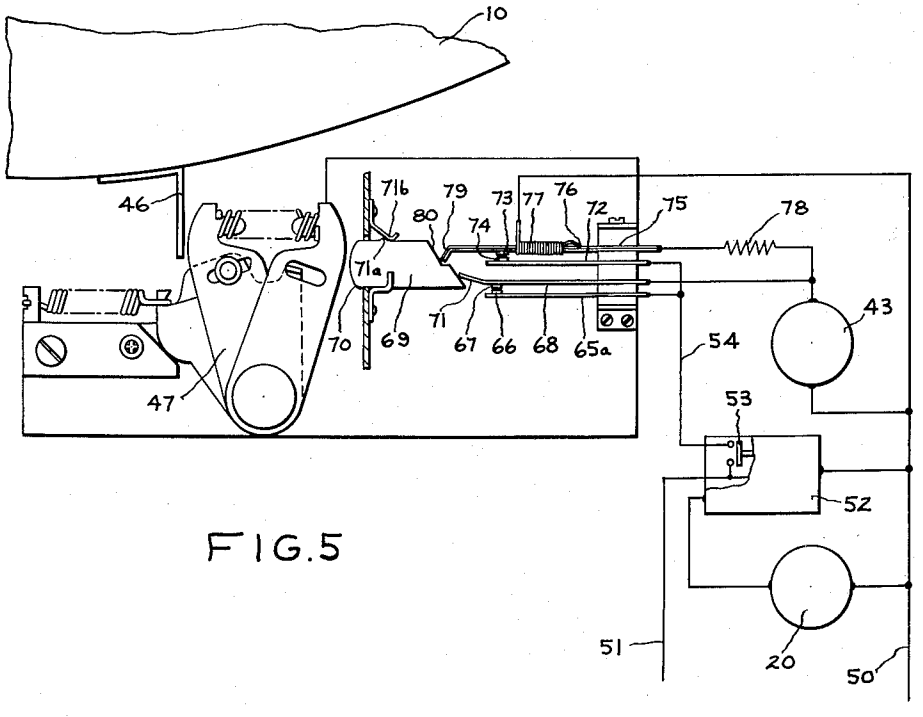




FIG.5

INVENTOR

MATT F. METZGER

BY Derek P Laurence

HIS ATTORNEY

United States Patent Office

2,967,621

Patented Jan. 10, 1961



2,967,621

# UNBALANCE CORRECTING SYSTEM FOR USE IN LAUNDRY MACHINES

Matt F. Metzger, Jeffersonville, Ind., assignor to General Electric Company, a corporation of New York

Filed Dec. 9, 1959, Ser. No. 858,548

5 Claims. (Cl. 210—138)

This invention relates to automatic laundry machines of the type having a rotatable clothes basket which is rotated at a relatively low speed to tumble the clothes in order to wash them and at a higher speed for centrifugal extraction of liquid from the clothes; more particularly, it relates to provision in such machines of improved means for providing a return to tumble speed when an excessive unbalance is present during the high speed extraction operation, with the low speed redistribution being then automatically followed by a return to high speed.

Many domestic washing machines provide a centrifugal extraction of liquid from wet clothes by means of a high speed rotation. It is most desirable in these machines to provide some type of safety device for correcting the situation when the clothes are so distributed in the clothes receptacle during high speed rotation that excessive unbalance is present and vibrations harmful to the machine could result therefrom. A frequently used arrangement is to provide a member positioned to be sensitive to vibrations so that it moves substantially in proportion thereto. When the vibrations attain a certain limit the movement of the sensing member is transmitted by a suitable device to actuate a switch. This in turn has provided both a return to the low tumble speed for redistribution of the clothes and has started a timing device which, upon the expiration of a predetermined period of time, both shuts itself off and returns the unbalance sensing switch to its initial position to restart the high speed operation. In the past, the structure for effecting the timing operation has generally been in a relatively expensive form such as a small synchronous motor which, while it provides suitable operation, represents a substantial added cost in the structure. Although it has long been recognized that it is desirable to decrease this expense without affecting the general operation of the device, known means of decreasing the expense, such as by using a heating cycle, have proved most difficult in practice since a heating cycle invariably decreases substantially in length when repeated trips of the unbalance switch occur (as may well happen). In such cases, it has not been practical to use a heating arrangement because of the fact that the time for tumbling will become shorter to the extent where redistributing tumbling may not even occur before the heating cycle is ended.

It is accordingly an object of this invention to achieve an improved system for providing a timed redistribution and then a return to high speed in which a heating arrangement is used to effect the timing and in which the cycle is not appreciably shortened because of repeated redistribution attempts.

A more specific object of the invention is to provide a system of the type described hereabove in which the timing, at least in part, is effected during the cooling of a heating element from a high temperature back to a lower temperature. It has been discovered that this varies relatively little and that what variation there is tends to cause an increase in the cycle time, which is acceptable, rather



than a decrease which may well prevent redistribution from occurring and thus is not acceptable.

In a preferred embodiment of the invention, it is an object of the invention to use both the heating and cooling cycles of the heating arrangement to time out the redistribution period. In this particular type of arrangement, the lengthening of the cooling offsets to some extent the shortening of the heating time upon repeated trips of the unbalance switch so that a virtually constant time period is obtained.

Yet another specific object of the invention, in a second embodiment thereof, is to achieve the desired goal by causing the redistribution time to be controlled by the cooling cycle of the heating arrangement alone since, while this will not have the same degree of consistency as the first embodiment, it will insure an adequate period of time for redistribution even if repeated trips do occur.

In accordance with the invention, I provide a laundry machine which has a clothes receptacle rotatable on a non-vertical axis. Suitable means are also provided for rotating the receptacle which include electrical speed control means having an energized condition and an unenergized condition. One of the two conditions causes the receptacle to be rotated at a low clothes-tumbling speed and the other of the conditions causes the receptacle to be rotated at a high liquid-extraction speed. The energizing circuit for the control means includes a mechanical unbalance switch which is movable from a first position to a second position when unbalances during the high speed rotation cause undesirable vibrations to occur. In combination with these components, which are conventional and are present in the prior art, I provide resistance heating means with an energizing circuit therefore, and a heat sensitive member controlled by the heater means so as to assume a first position when the heater means reaches a high temperature and a second position when the heater means cools down to a lower temperature.

When the unbalance switch assumes its second position as a result of vibrations occurring, the speed control means circuit causes the speed control means to assume its first condition so as to decrease the speed for clothes redistribution purposes; when both the heat sensitive member and the unbalance switch are moved to their first positions the speed control means circuit is in condition to cause the speed control means to provide the high speed rotation once again. The heat sensitive member and the unbalance switch cooperate to control completion of the heater energizing circuit and cause de-energization of the heater means in response to operation of the unbalance switch to its second position. In addition, movement of the heat sensitive member from one of its positions to the other causes it to engage the unbalance switch and move it to its first position. Also, when the heater means is de-energized (as a result of the operation of the unbalance switch to its second position) it cools and causes a consequent movement of the heater switch at a later time back to its first position. This sequence causes both the heater switch and the unbalance switch to have been moved back to their first positions after redistribution has proceeded for a predetermined period, thereby to cause the redistribution low speed to be terminated and the high speed to be resumed.

It can be seen that by proper interaction of the different components, it has been made possible to use a simple heater control thereby to replace the previously used means such as a synchronous motor, thereby effecting a substantial decrease in the cost of the system without losing any effectiveness in the system.

The features of my invention which I believe to be novel are set forth with particularity in the appended claims. My invention, 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 showing vibration sensing means for transmitting movement to a switch in accordance with my invention, certain surfaces of the view being broken away in order to better illustrate certain details;

Figure 2 is an enlarged side elevational view of the machine of Figure 1 with the side panel removed, the view being partially in section and having certain surfaces broken away to illustrate certain details;

Figure 3 is a fragmentary plan view of drive means which may be included in the machine;

Figure 4 is a front elevational view of a preferred embodiment of my improved unbalance sensing and redistribution timing arrangement, the view showing schematically a control circuit suitable for use in a machine embodying my arrangement; and

Figure 5 is a front elevational view of a second embodiment of my improved unbalance device, the view showing schematically a control circuit used in the machine.

Referring now to Figures 1 and 2, 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, referring to Figure 2, it includes a perforated 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, with 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 a 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 an upstanding plate **18** fixedly attached to the base **3**. Four of these arms **17** are provided, two of them 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 caused 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 both from front to rear and in the vertical direction since they are not at all flexible in these directions. As is more fully explained hereinafter, I provide means for sensing the amount of sideways vibration thereby to prevent that vibration from ever becoming great enough to damage the machine or to cause it to move on the floor.

Referring now particularly to Figure 4, and also to Figures 2 and 3, during the operation of the machine the basket **11** is driven from an electric motor **20**. The drive from the motor to the basket includes a pulley **21** which is secured to the motor shaft so as to rotate therewith and over which passes a belt **22** driving an adjustable sheave assembly **23**. The adjustable sheave assembly includes a shaft **24** to which are rigidly secured sheave plates **25** and **26**. An intermediate sheave plate **27** is keyed on the shaft **24** so as to be movable along the shaft to varying distances from sheave plates **25** and **26**. It will be observed (Figure 2) that sheave plate **25** has a sloping surface **28** which in cooperation with a sloping surface **29** on movable sheave plate **27** forms a groove **30** of adjustable width. Similarly, on its other side movable sheave plate **27** is provided with a sloping surface **31** which cooperates with a sloping surface **32** on rigidly secured sheave plate **26** to form a second groove **33** of adjustable width.

Since belt **22** has a predetermined width, it can be seen that movement of sheave plate **27** relative to sheave plate **25** will cause the belt **22** to seat in groove **30** at a distance from the center of shaft **24** which is determined by the distance of sheave plate **27** from sheave plate **25**. The linear speed of belt **22** is constant, assuming the speed of motor **20** to be substantially constant, and therefore the rotational speed of the adjustable sheave assembly **23** is determined by the sheave diameter provided by the cooperation of sheave plates **25** and **27**. When the sheave plates **25** and **27** are in the position shown in the figures, sheave assembly **23** is rotating at a relatively low speed. When sheave plate **27** is moved to the left, as viewed in Figure 2, away from sheave plate **25**, then belt **22** will move inwardly toward shaft **24** as groove **30** widens and will cause a greater rotational speed of the sheave assembly **23** for a given rotational speed of pulley **21** by motor **20**.

A second belt **34** is driven in groove **33** by the cooperation of sheave plates **27** and **26**. When adjustable sheave plate **27** is in the position shown so that groove **33** is quite wide, belt **34** has to move in radially toward the shaft **24** a substantial amount before it seats on the surfaces **31** and **32** of sheave plates **27** and **26** respectively. This means that for a given rotational speed of the adjustable sheave assembly **23** (as imparted to it by belt **22**), belt **34** will be travelling at a relatively low rate of linear speed. If sheave plate **27** is moved to the left so that belt **34** is forced outwardly in groove **33**, then for a given rotational speed of the sheave assembly a relatively high linear speed of belt **34** is provided. Thus, by controlling the position of sheave plate **27**, an infinite variety of speeds between the two limits of the position of the sheave plates may be provided, with the arrangement shown in Figures 2 and 3 providing the lowest output speed to belt **34** since belt **22** is causing a low speed of rotation of sheave assembly **23** and rotation of the sheave assembly **23** is causing the lowest linear speed of belt **34**. The highest rate of speed will be provided if sheave plate **27** is moved as far as possible to the left: this will provide the highest rotational speed of the assembly **23** for a given linear speed of belt **22**, and the highest output linear speed of belt **34** for a given rotational speed of assembly **23**.

Belt **34** passes over a sheave **35** which forms a unitary assembly with a sheave **36** driving a belt **37**. Referring to Figure 2, it will be seen that belt **37** drives a sheave **38** which is rigidly secured to the end of shaft **11** so as to rotate the basket **9**.

Referring now particularly to Figure 3, an arm **39** is secured to one end of the shaft **24** and a spring **40** has one end secured to the arm and the other end secured to the base of the machine so as to bias the assembly to the right as viewed in Figure 3. Also, secured to the arm

39 is a chain member 41 which at its other end is secured to a pulley 42 operated through a small electric motor and gear assembly 43. It will be seen that when pulley 42 is caused to rotate by assembly 43 it will wind up chain 41 and pull the arm 39 to move the entire adjustable sheave assembly to the left as viewed in Figure 3. Since belt 22 cannot stretch, it will be apparent that when this occurs belt 22 will move inwardly within groove 30 forcing sheave 27 to the left (as viewed in Figure 2) to effect an increase in the speed transmitted to the sheave 38 and basket 9. When motor and gear assembly 43 is shut off, the spring 40 overcomes the motor and gear assembly and pulls the adjustable sheave 23 back to the position shown in the figures to reduce the speed. The motor and gear assembly 43 is of the type which can, without adverse effect, remain energized although stalled; this has the result that high speed operation is maintained only as long as energization of the motor 43 continues.

The proportioning of the various parts of the drive assembly above described is such as to provide an appropriate range of speeds. For instance, when the parts are in the positions shown, and when the diameter of the basket 9 is on the order of 26 inches, a tumbling speed of approximately 47 r.p.m. may be provided to the basket, while in the other extreme position a suitable liquid extraction centrifuging speed, such as, for instance, 250 r.p.m. may be provided. This transmission arrangement is not a part of my invention, and is in conventional use on machines commercially produced and marketed by the assignee of my invention.

Machine 1 is provided with suitable water supply and water drain means which, since they form no part of the present invention, are not illustrated herein. In addition, suitable means for effecting heating during the drying portion of the cycle which may, in the combination washer-dryer, follow a centrifugal extraction operation, are provided. In the present machine, this includes a heater assembly 44 mounted within the upper portion of tub 10 so that when energized heater 44 heats the basket 9. When the heaters are energized, the heat transfererd to the clothes basket is then passed on to the clothes to cause vapor migration out of the clothes. Since the outer cylindrical wall of the basket is perforated by a substantial number of small spaced openings 45, there is also some heat from the elements which passes directly to the clothes by radiation.

The complete operation of the machine normally provides a washing period, a draining of the washing liquid, and one or more rinses, all conducted at 47 r.p.m., a centrifugal liquid extraction operation at 250 r.p.m., and if desired, a drying period at 47 r.p.m. While variations of the sequence may be provided, it will be understood that the described sequence is typical and is provided by standard control apparatus in the usual manner.

Referring now particularly to Figure 4 for a description of my invention, it will be recalled that tub 10 as it is mounted vibrates in response to an unbalanced load in the basket when the basket is rotating at high speed. This unbalance is transmitted from a projecting member 46 secured to the basket, through a motion transmittal mechanism generally indicated at 47 (fully described in Patent 2,823,208 issued to A. M. Stone on April 29, 1958 and assigned to the assignee of the present invention), to an unbalance switch mechanism 48 having a projecting member of button 49 which is depressed in response to motion transmitted to it from tub 10 during excessive vibration.

Turning now to the electrical circuitry in Figure 4, it will be seen that the entire control system may be energized from a suitable source of power (not shown) through a pair of supply lines 50 and 51. A conventional sequence control mechanism 52 is connected across the two supply lines and controls all the other electrical elements of the machine, most of which are not shown in the drawings since they do not pertain to the invention. It will be observed that drive motor 20 is connected through the control 52 so that its energization is controlled thereby. Control 52 includes, among others, a timer switch 53 which controls the connection of conductor 51 to a conductor 54. Conductor 54 leads to a bimetallic element 55 mounted on a bracket 56a secured to the base of the machine. At the free end of element 55 there is a contact 56 which is engageable with a stationary contact 57 connected by a conductor 58 to the speed controlling motor assembly 43. Assembly 43 is then in turn connected by conductor 59 to contact 60 of switch 48. The switch 48 further includes a movable contact arm 61 which, in response to depression of a button 62, moves to the position shown and stays there until button 49 is depressed at which point the arm 61 is then moved over into engagement with a contact 63 and button 62 is moved to an outer position. The contact arm 61 then remains in engagement with contact 63 until button 62 is depressed again. The button 62 is so located relative to the bimetallic element 55 that when the element is heated to a certain predetermined temperature it depresses the button 62 and when it cools again to a second lower predetermined temperature contacts 56 and 57 engage. The contact arm 61 is directly connected to conductor 50 as shown. The contact 63 is connected to a resistance heating coil 64 which is positioned so as to be in heat transfer relationship to the bimetallic element 55. As shown, this may be effected by wrapping the coil around the element. The other end of the coil is connected to a conductor 65 through the bimetal element itself.

In operation, the machine of Figures 1 and 2 proceeds through a normal washing operation and, at the end of the last rinsing operation when it is time to provide a centrifuging operation, sequence control 52 causes contact 53 to connect conductors 51 and 54. With the parts in the position shown, that is, with contact arm 61 in engagement with contact 60 because button 62 has been the last one depressed and button 49 is in its extended position, an energizing circuit for motor 43 is completed from conductor 54 through the bimetal element 55, contacts 56 and 57, conductor 58, the motor 43, conductor 59, contact 60, contact arm 61, and conductor 50. As a result, the basket speed increases.

If excessive vibration should now occur within the basket 9 because of unbalance of the clothes therewithin, the vibration of tub 10 will cause projecting member 46 to strike assembly 47 which is then moved over to strike projecting button 49 and depress it. As explained, this moves the contact arm 61 over into engagement with contact 63 and out of engagement with contact 60, at the same time causing button 62 to move out to its extended position closely adjacent the bimetal element. This action opens the energizing circuit for motor 43.

The de-energization of motor 43 causes the basket rotation to slow down to tumble speed whereby the clothes are redistributed by the tumbling action. In addition, the engagement of contact arm 61 with contact 63 establishes an energizing circuit for heater coil 64 which extends from conductor 50 through contact arm 61, contact 63, the heater coil 64, bimetallic element 55, conductor 54, switch 53, and conductor 51. With the heater coil thus energized through the circuit described, it starts to heat up and, because of its physical adjacency to bimetal element 55, in so doing it heats the bimetal element. When the bimetal reaches a predetermined high temperature the free end thereof deforms by bending to the left. This action separates contacts 56 and 57 and depresses button 62 so that contact arm 61 is moved over into engagement with contact 60 and button 49 is pushed out to its extended position. The movement of the contact arm 61 completes the connection from conductor 50 to contact 60, but since contacts 56 and 57 are separated the energizing circuit for the motor 43 is still not complete and it remains de-energized with tumbling continu-

ing. Also, the movement of the contact arm 61 opens the heater energizing circuit so that the heater element starts to cool; this, of course, also causes the bimetal element 55 to cool.

When it cools to a predetermined temperature the bimetal element moves back to the position shown in which it separates itself from button 62 and in which contacts 56 and 57 are again in engagement. The button 62 of course remains depressed. The re-engagement of contacts 56 and 57 once again completes the energizing circuit for motor 43 so that the speed then increases to effect the centrifuging operation.

It will be observed at this point that the button 49 and the bimetal element 55 are back in their original positions each one having moved away from its original position and then back to it. It will further be observed that the movement of the unbalance switch 48 back to its original position is effected by the movement of the bimetal element 55 to a second position (as opposed to its first position in which contacts 56 and 57 are in engagement). If now there should be repeated trips of the machine (because the load being washed is one which is particularly difficult to balance) a repetition of the sequence just described will take place. It will be recognized that, because of the thermal mass of the elements of the machine, for each trip it will take a shorter time for the temperature to rise to the point where bimetal element 55 is moved to its second position. However, by the same token, a somewhat longer time is taken to cool so that the total time remains approximately the same. Thus, a substantially constant length of time is obtained for the redistribution period subsequent to an unbalance trip, the timing function being effected by the heating and cooling of the bimetal element as influenced by the heater coil 64.

Referring now to Figure 5, there is shown a second embodiment of the invention in which like parts are referred to by like numerals. Conductor 54 connects with a contact arm 65*a* having a contact 66 engageable with a contact 67 secured on a movable contact arm 68. Contact arm 68 in turn is connected to motor 43 which is then connected on its other side to the conductor 50. The position of arm 68 is controlled by a movable member or slide button 69 having an end 70 engageable in the same manner as button 49 was engaged in connection with Figure 4. When excessive vibration causes member 46 to push assembly 47 over, the assembly engages end 70 of the button and slides it to the right. This movement causes the button to engage sloping portion 71 of contact arm 68 which then forces the contact arm up to separate contact 66 from contact 67. The button 69 may be caused to remain in this position by suitable means such as a small detent 71*a* which is held by a flexible member 71*b* with sufficient force to prevent accidental movement of button 69. Member 71*b* is forced upwardly when an appreciable force is exerted on either end of button 69 to permit the button to move.

Conductor 54 also connects with a flexible stationary contact arm 72 having a contact 73 engageable with a contact 74 secured near the free end of a bimetallic element 75. The bimetallic element in turn is connected at point 76 to a heating coil 77 directly connected at its other end to conductor 50. A resistor 78 is connected at one end to the bimetal element 75 and the heating coil 77, and at its other end to contact arm 68. A further feature of the bimetal 75 is a downwardly extending projection 79 formed at the end thereof which engages a camming surface 80 on member 69. This arrangement prevents the member 69 from being moved to the right when the bimetal is in the position shown; however, when the bimetal deforms so that the free end moves upwardly the member 69 may then be moved to the right. When this is done, it will separate contact 66 from contact 67 as described. When the member 69 has been moved to the right and the bimetal is allowed to cool it will in descending, by engagement of its end 79 with cam surface 80, cause the member 69 to be moved back to the left to its unactuated position and this action will at the same time permit reclosing of contacts 66 and 67 by the spring action of contact arm 68.

In operation, the machine 1 proceeds as before through the appropriate washing and rinsing steps at tumbling speed and then, when centrifuging is desired, switch 53 is closed. This completes a circuit, starting at conductor 50, through motor 43, contact arm 68, contacts 67 and 66, contact arm 65*a*, conductor 54, switch 53 and conductor 51. The resulting energization of motor 43 through this circuit effects high speed centrifuging as previously described. At the same time, a circuit is completed from conductor 50 to heater coil, bimetal element 75, contacts 74 and 73, contact arm 72, conductor 54 and switch 53 to conductor 51. The heater coil is thus energized across the full line current and in a very brief period of time heats the bimetal enough to cause it to open thereby separating contacts 73 and 74. Experience has shown that this may readily be effected in a matter of two or three seconds.

The openings of contacts 73 and 74 still leaves an alternate heating circuit for the bimetal element which passes from conductor 50 through the heater 77, resistance 78, contact arm 68, contacts 67 and 66, contact arm 65*a*, conductor 54 and switch 53 to conductor 51. This more limited current—because of the series relationship of resistor 78 and coil 77—is effective to maintain the bimetal in its tripped position with contacts 73 and 74 opened and with end 79 of the bimetal raised and out of the way of the button member 69 should it be pushed to the right. As a result, if there should be a trip by virtue of movement of member 69 to the right because of the vibrations transmitted from tub 10, the member 69 engages end 71 of arm 65*a* to separate contacts 66 and 67. This then opens the circuit to the motor 43, and since motor 43 is then deenergized the basket speed returns toward tumble to permit redistribution of the clothes.

The opening of contacts 66 and 67 also opens the alternate energizing circuit for heater coil 77. Since contacts 73 and 74 are also open the heater coil is deenergized and the bimetal element starts to cool. When it reaches a predetermined low temperature the bimetal element engages member 69 and cams it to the left back into its first position. This movement of member 69 permits contacts 66 and 67 to re-engage. The bimetal is then rapidly heated by the heater element 77 once more since contacts 73 and 74 are engaged. The bimetal is actuated at the predetermined high temperature out of the path of member 69 and the arrangement is then ready for another trip action. It will readily be observed that in this structure the same basic feature of utilizing the cooling time of an element is used for insuring an adequate period of redistribution of the clothes and its automatic return to high speed thereafter. Again, it is the movement of the bimetal element from one position to the other which causes the resetting of the unbalance switch which in this second embodiment includes member 69 and contacts 66 and 67.

It will be noted that in the embodiment of Figure 5 the main heater circuit may be omitted if the alternate circuit proves to move the bimetal out of the path of member 69 fast enough, and in that event the contacts 73 and 74 may be omitted, the bimetal then acting only as a heat sensitive control member rather than a switch.

It will be seen from the foregoing that both embodiments of my invention provide the desired result of effecting, through a highly economical bimetal and heater arrangement, a suitable timing sequence to provide an adequate period of redistribution for clothes in the machine 1 followed automatically by another attempt at high speed rotation of the basket. It will further be

seen that both arrangements utilize the cooling time of the bimetal to insure this adequate period of time: the first embodiment described utilizes both the heating and the cooling time while the last embodiment described utilizes the heating time alone.

While in accordance with the patent statutes I have described what at present are considered to be the preferred embodiments of my invention, it will be apparent to those skilled in the art that various changes and modifications, including but not limited to those mentioned above, 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: a clothes receptacle rotatableon a non-vertical axis; means for rotating said receptacle including electrical speed control means having an energized condition and an unenergized condition; an energizing circuit for said speed control means, said rotating means rotating said receptacle at a low clothes tumbling speed when said control means is in one of said conditions and rotating said receptacle at a high liquid extraction speed when said control means is in the other of said conditions; an unbalance switch in said circuit movable from a first position to a second position upon a predetermined magnitude of receptacle unbalance vibration resulting from high speed rotation; resistance heater means; an energizing circuit for said heater means; heat sensitive means controlled by said heater means having a first position when said heater means is at a lower temperature and a second position when said heater means is at a higher temperature; said speed control means circuit causing said speed control means to assume said one condition thereof when said unbalance switch assumes said second position and to assume said other condition when said heat sensitive means and said unbalance switch both move to their first positions, said heat sensitive means and said unbalance switch cooperatively controlling completion of said heater energizing circuit and causing de-energization of said heater means in response to operation of said unbalance switch to said second position thereof, movement of said heat sensitive means from one of its positions to the other causing it to engage said unbalance switch and move said unbalance switch to said first position thereof, the de-energization of said heater means causing cooling thereof and a consequent movement of said heat sensitive means to said first position thereof whereby both said unbalance switch and said heat sensitive means are eventually returned to their respective first positions.

2. In a laundry machine: a clothes receptacle rotatable on a non-vertical axis; means for rotating said receptacle including electrical speed control means having an energized condition and an unenergized condition; an energizing circuit for said speed control means, said rotating means rotating said receptacle at a low clothes tumbling speed when said control means is in an unenergized condition and rotating said receptacle at a high liquid extraction speed when said control means is energized; an unbalance switch in said circuit movable from a first position to a second position upon a predetermined magnitude of receptacle unbalance vibration resulting from high speed rotation; resistance heater means; an energizing circuit for said heater means; heat sensitive means controlled by said heater means having a first position when said heater means is at a lower temperature and a second position when said heater means is at a higher temperature; said speed control means circuit being opened when said unbalance switch assumes said second position and being completed when said unbalance switch and said heat sensitive means both move to their first positions, said heat sensitive means and said unbalance switch cooperatively controlling completion of said heater energizing circuit and causing de-energization of said heater means in response to operation of said unbalance switch to said second position thereof, movement of said heat sensitive means from one of its positions to the other causing it to engage said unbalance switch and move said unbalance switch to said first position thereof, the de-energization of said heater means causing cooling thereof and a consequent movement of said heat sensitive means to said first position thereof whereby both said unbalance switch and said heat sensitive means are eventually returned to their respective first positions.

3. In a laundry machine: a clothes receptacle rotatable on a non-vertical axis; means for rotating said receptacle including electrical speed control means having an energized condition and an unenergized condition; an energizing circuit for said speed control means, said rotating means rotating said receptacle at a low clothes tumbling speed when said control means is unenergized and rotating said receptacle at a high liquid extraction speed when said control means is energized; an unbalance switch in said circuit movable from a first position to a second position upon a predetermined magnitude of receptacle unbalance vibration resulting from high speed rotation; resistance heater means; an energizing circuit for said heater means; a heater switch controlled by said heater means having a first position when said heater means is at a lower temperature and a second position when said heater means is at a higher temperature; said unbalance switch in said second position thereof opening said speed control means circuit, said unbalance switch and said heater switch in their respective first positions completing said speed control means energizing circuit, said unbalance switch controlling completion of said heater energizing circuit and completing the same when in its second position, said heater switch being mechanically linked to said unbalance switch to move said unbalance switch to said first position thereof at a predetermined high temperature whereby movement of said heater switch to said second position in response to energization and heating of said heater means causes it to engage said unbalance switch and move said unbalance switch to said first position thereof, the de-energization of said heater means resulting from movement of said unbalance switch to said first position thereof causing cooling of said heater means and a consequent movement of said heater switch to said first position thereof whereby both said unbalance switch and said heater switch are eventually returned to their respective first positions.

4. In a laundry machine: a clothes receptacle rotatable on a non-vertical axis; means for rotating said receptacle including electrical speed control means having an energized condition and an unenergized condition; an energizing circuit for said speed control means, said rotating means rotating said receptacle at a low clothes tumbling speed when said control means is unenergized and rotating said receptacle at a high liquid extraction speed when said control means is energized; an unbalance switch in said circuit movable from a first position to a second position upon a predetermined magnitude of receptacle unbalance vibration resulting from high speed rotation; resistance heater means; an energizing circuit for said heater means; a heater switch controlled by said heater means having a first position when said heater means is at a lower temperature and a second position when said heater means is at a higher temperature, said heater switch being positioned to mechanically engage said unbalance switch so as to move said unbalance switch from said second position to said first position when said heater switch moves to said first position; said unbalance switch in said second position thereof opening said speed control means circuit and completing said speed control means energizing circuit when in said first

position thereof, said unbalance switch and said heater switch cooperatively controlling completion of said heater energizing circuit, said heater means being energized when at least one of said unbalance switch and said heater switch is in said first position thereof and being de-energized when said unbalance switch and said heater switch are both in said second positions thereof, said heater switch moving to said second position thereof in response to energization of said heater means, de-energization of said heater means in response to movement of said unbalance switch to said second position thereof causing cooling of said heater means and a consequent movement of said heater switch to said first position thereof, movement of said heater switch to said first position thereof moving said unbalance switch back to said first position thereof thereby to complete said speed control means energizing circuit.

5. In a laundry machine: a clothes receptacle rotatable on a non-vertical axis; means for rotating said receptacle including electrical speed control means having an energized condition and an unenergized condition; an energizing circuit for said speed control means, said rotating means rotating said receptacle at a low clothes tumbling speed when said control means is unenergized and rotating said receptacle at a high liquid extraction speed when said control means is energized; an unbalance switch in said circuit movable from a first position to a second position upon a predetermined magnitude of receptacle unbalance vibration resulting from high speed rotation; resistance heater means; an energizing circuit for said heater means; heat sensitive means controlled by



said heater means having a first position when said heater means is at a lower temperature and a second position when said heater means is at a higher temperature, said heat sensitive means being positioned to mechanically engage said unbalance switch so as to move said unbalance switch from said second position to said first position when said heat sensitive means moves to said first position; said unbalance switch in said second position thereof deenergizing said speed control means circuit and completing said speed control means circuit when in said first position thereof, said unbalance switch controlling completion of said heater energizing circuit, said heater means being energized when said unbalance switch is in said first position thereof and being de-energized when said unbalance switch is in said second position thereof, said heat sensitive means moving to said second position thereof in response to energization of said heater, de-energization of said heater means in response to movement of said unbalance switch to said second position thereof causing cooling thereof and a consequent movement of said heat sensitive means to said first position thereof, movement of said heat sensitive means to said first position thereof moving said unbalance switch back to said first position thereof thereby to complete said speed control means energizing circuit.

**References Cited** in the file of this patent

UNITED STATES PATENTS

2,311,545 Hurley et al. ---------- Feb. 16, 1943
2,311,924 Bassett ---------- Feb. 23, 1943