UNBALANCE CONTROL FOR WASHING MACHINES

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Fig. 1.

TO SWITCH 20

TO UNBALANCE SWITCH LEVER 14

Fig. 2.

Fig. 3.

WITNESSES:

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UNBALANCE CONTROL FOR WASHING MACHINES

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The present invention relates to controls for washing machines and, more particularly, to unbalance control mechanisms for washing machines.

During the spin cycle of most automatic washing machines, the clothes within a spinner of washing basket within the washer are spun at a high speed in order to extract most of the water from the clothes. The clothes being spun at the high speed tend to redistribute themselves with the load eventually becoming unbalanced. Due to the unbalanced load, vibrations are set up in the washing machine which may become excessive as the unbalance is increased. Some of the vibration can be absorbed through springs or shock absorbers, and if the vibration due to the unbalanced movement becomes excessive, a lever may be tripped to turn off the machine. The clothes then must be redistributed by hand before it may be started again. Another device used on some washing machines is one in which, if excessive vibrations are obtained at spin speeds, a switch is tripped which will cause the machine to return to the wash speed, which is substantially lower than the spin speed. A time delay mechanism is provided which keeps the washing machine at the wash speed for fifteen to thirty seconds. During this time the clothes tend to redistribute themselves to obtain a more balanced load. After the time delay the spin cycle is again started with the machine being tripped back to the wash speed if the load is not sufficiently balanced. This cycle is repeated until a balanced load is reached. Both of the above methods described do not provide an efficient method of load redistribution. One requires that the machine be stopped and be hand redistributed; the other requires a rather slow cycle of operation to attain some semblance of a balanced load. It is therefore an object of the present invention to provide a new and improved washing machine having an efficient unbalance control.

It is a further object of the present invention to provide a new and improved washing machine having unbalance control which redistributes the load without stopping the machine or interrupting the washing or spin cycle of the machine. It is a further object of the present invention to provide a new and improved washing machine having unbalance control and offering more flexible design and usage by being capable of reversing the direction of wash and spin cycles of the machine.

Generally, the above-cited objects are accomplished by providing in a washing machine a vibration sensing device which in response to an excessive vibration of the washing machine trips a reversing switch to change the direction of rotation of the driving motor of the washing machine and thereby redistributes the load of the washing machine by changing directions of rotation of the basket of the machine when load unbalance occurs.

These and other objects and advantages of the present invention will become more apparent when considered in view of the following specification and drawings, in which:

FIGURE 1 is a front view of a washing machine as set up to utilize the present invention;
FIG. 2 is a schematic diagram showing the switch and windings of the motor as utilized herein; and
FIG. 3 is a schematic diagram showing another embodiment of the present invention.

Referring to FIG. 1, a front view of a washing machine is shown having an outer frame 2 with a cylindrically shaped tub 4 disposed within the enclosure of the frame 2. Four springs 6 are connected from the corners of the frame 2 and attached to the tub 4 to act as vibration absorbers for the washing machine. Disposed within and concentrically to the tub 4 is a spinner or washing basket 8. The spinner basket 8 may be driven in either the clockwise or counterclockwise direction about the center axis 10 of the washing machine. The basket 8 is driven by an electrical motor in the usual manner. The only difference is that the motor is a reversible one as will be explained below.

A vibration sensing device is shown schematically enclosed within the dotted box 12. This device acts to sense the vibration of the tub 4 at the various operating conditions. An unbalance switch lever 14 is disposed adjacent to the tub 4 and is pivoted about the axis 16. Upon a sufficient vibration of the tub 4, which is indicative of an unbalanced load within the basket 8, the unbalance switch lever 14 trips to give a mechanical output sufficient to activate an external electrical switch. Vibration sensitive devices and unbalance switch levers are well known in the art and for this reason are only shown schematically herein.

Now referring to FIG. 2, a permanent split capacitor motor is shown having a main winding 17 and an auxiliary winding 19. In series with the auxiliary winding is a capacitor 21. A mechanical connection shown by the dash-dot line 18, from FIG. 1 to FIG. 2, connects the unbalance switch lever 14 to a double pole double throw switch 20, enclosed within the dotted box so indicated. The mechanical connection 18 is connected to the throw arm 22 of the switch 20. The throw arm is connected to center contacts 24 and 26, respectively. The double throw, double pole switch 20 is connected in the input circuit to the driving motor of the washing machine at a pair of input terminals 28 and 30. An input source, which may be 60 cycle a.c. usually available locally, is connected to the terminals 28 and 30. These terminals are in turn respectively connected to the contacts 24 and 26 of the switch 20. The main winding 17 is connected across the input terminals 28 and 30 and the terminals 24 and 26. The switch 20 has two other pairs of contacts 34-36 and 38-40. The contacts 34 and 40 are connected electrically and the contacts 36 and 38 are connected electrically in the usual double pole double throw fashion. The auxiliary winding 19 is connected in series with the capacitor 21. The other end of the auxiliary winding 19 is connected to the contacts 36 and 38 while the other side of the capacitor 21 is connected to the contacts 34 and 40 of the switch 20.

Assuming initially that the basket 8 is rotating in a clockwise (CW) direction during the spin cycle, the throw arm 22 would engage the contacts 38 and 40 to complete the circuit to the auxiliary winding 19 and the capacitor
3. Under these conditions the currents in the main and auxiliary winding have such a vector and phase relationship to produce the clockwise rotation of the spinner basket. Assume now, due to a load unbalance within the spinner basket, that excessive vibration is transmitted through the trip 4 to trip the unbalance switch lever 14 and thereby cause the double pole double throw switch 20 to switch to its other position, that is, with the throw arm 22 engaging the contacts 34 and 36. With the switch 20 now in this position, the vector and phase relationship of the current in the auxiliary winding in 19 with respect to the current in the main winding 17 would be changed and thereby establish the conditions for the opposite direction of rotation, the counterclockwise (CCW) direction of rotation. Thus, the permanent split capacitor motor would reverse and now drive the basket 8 in the counterclockwise direction, which would cause the clothes within the basket 8 to redistribute and thus eliminate the unbalance condition.

If at a later time the clothes should become unbalanced again to trip the unbalance switch lever 14 the switch 20 would be tripped to its clockwise position with the contacts 38 and 40 being contacted by the throw arm 22. This would cause the motor to change to a counterclockwise rotation with the clothes being redistributed again in response to the changed direction of rotation.

Other types of A.C. motors could be used as well as the permanent split capacitor motor. For instance a split phase capacitor start motor could be used. A capacitor start motor arrangement is shown in the embodiment of FIG. 3.

In FIG. 3 a capacitor start motor is shown having a main winding 52 and an auxiliary winding 54 which is connected in series with a capacitor 56. The direction of rotation of the capacitor start motor is controlled by a reverse switch 58 and a triple pole double throw switch 60, enclosed within the dotted box so designated.

The reverse switch 58 is actuated by a rotating member which is mounted on the motor shaft. The rotating member presses against the movable contact 64 when the motor is stopped. The operation of this type of switch is such that when the driving motor is stationary contacts 62, 64 and 66 are all together forming an electrical circuit therewith. When the motor is starting centrifugal force operates the rotating member and the part that is pressing against contact 64 pulls away to cause an open circuit between either the contact 62 or 66 depending on the direction of rotation. When the driving motor is rotating in a counterclockwise rotation the contacts 64 and 66 are separated while the contacts 62 and 64 form an electrical circuit therewith. Conversely, when the motor is rotating in the clockwise direction the contacts 62 and 64 are forced apart while the contacts 64 and 66 engage each other to form an electrical circuit therewith. Input power is supplied through the terminals 68 and 70. The input source may be a 60 cycle A.C. source usually available locally.

Assume initially that the direction of basket rotation is in the counterclockwise direction. Operating under these conditions the throw arm 72 of the switch 60 would connect contacts 74, 76, 78 with contacts 80, 82 and 84, respectively, of the switch 60. The main winding 52 then would be energized from the input contact 68, the contact 90, the lead 86, to the main winding 52, the lead 88, the contacts 78 and 84, to the terminal 70 to complete the circuit. At this time with the motor rotating in the counterclockwise direction it should be noted that the capacitor 56 and auxiliary winding 54 are out of the circuits since the contacts 64 and 66 are open circuited thereby providing an open circuit to the capacitor 56 and auxiliary winding 54.

Assume now that the load within the basket 8 becomes unbalanced to such an extent that the unbalance switch lever 14 of the vibration sensing device 12 is tripped. This causes the throw arm 72 to switch from the contacts 74, 76 and 78 to contacts 90, 92 and 94 at the other throw position of the switch 60. With the switch 60 now in this position a circuit is provided to energize the auxiliary winding 54 and to utilize the capacitor 56 to provide starting torque in the opposite or clockwise direction of rotation. The circuit thus provided is from the input terminal 80, the lead 90, the contact 62 and 64, the lead 98, capacitor 56, the auxiliary winding 54, the contact 74, the lead 102, the contact 92, contact 82, to the other input terminal 70. Thus, starting torque is provided in the other direction and not rotate the driving motor in the clockwise direction. When the motor reverses and starts to rotate in the clockwise direction the rotating member which actuates the reverse switch causes the electrical connection between contacts 62 and 64 to be broken thereby taking the capacitor 56 and auxiliary winding 54 out of the circuit. The contacts 64 and 66 now make an electrical contact but have no effect upon the operation of the motor in the clockwise direction since the throw arm 72 is in the clockwise throw position.

If an unbalance condition now should occur with the basket 8 rotating in the clockwise direction, the unbalance switch lever 14 of the switch 60 would be tripped to the other throw position of the switch 60 back to the counterclockwise position. Since now the contacts 66 and 64 are in the circuit torque is provided to the motor to change its direction of rotation. This circuit is provided from the input terminal 68, the contact 80 and 74, the lead 100, the auxiliary windings 54, the contact 56, the lead 98, the contact 64, the contact 66, the lead 104 the contact 76, the contact 82, to the other input terminal 70. It should be noted the phase relationship between the current flow in the main winding and auxiliary winding have been changed with respect to the input terminals 68 and 70 for the counterclockwise direction as compared to the clockwise direction so that starting torque is provided in the opposite direction for the two cases of operation.

The two embodiments discussed above show an efficient method of redistributing loads within a washing machine without the necessity of hand moving the clothing or requiring costly time delay and switching circuits to change from the spinning speed to the wash speed. Another advantage should be noted in that by providing a reversible motor with the washing machine the direction of rotation during the wash cycle could also be reversed if desired for an improved washing cycle.

Although the present invention has been described with a certain degree of particularity, it should be understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction and combinations and arrangements of parts may be resorted to without departing from the scope and the spirit of the present invention.

What is claimed is:

1. In a washing machine the combination of, a washing basket rotatably mounted for receiving a load, a reversible electric motor for rotating said basket in either direction, vibration sensitive means to provide a signal indicative of load unbalance within said basket, and switching means for said motor to reverse the direction of rotation of said reversible electric motor and said basket in response to a signal from said switching means and thereby rebalance the load within said basket.

2. In a washing machine the combination of, a washing basket rotatably mounted for receiving a load to be washed, a reversible electric motor for rotating said basket in either a clockwise or counterclockwise direction, an unbalance switch operative to change its output condition in response to a load unbalance within said basket, and a reverse switch for said motor operative to reverse the direction of rotation of said motor and accordingly reverse the direction on said basket in response to the changed output condition of said reverse switch and thereby rebalance the load within said basket.
3. In a washing machine the combination of, a washing basket rotatably mounted for receiving a load to be washed, an electric motor having its mechanical output operatively connected to rotate said basket in either the clockwise or counterclockwise direction, an unbalance switch disposed in a position to be tripped by excessive vibrations of said machine indicating a load unbalance within said basket, and reverse switch means operatively connected in the electrical input to said electric motor and being operative to switch the electric input connections to said electric motor and thereby reverse the direction of rotation of said motor and said basket in response to the tripping of said unbalance switch to rebalance the load within said basket.

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