

March 10, 1970

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3,499,534

PROGRAM-SELECTING DEVICES FOR AUTOMATIC WASHING MACHINES

Filed Feb. 23, 1968

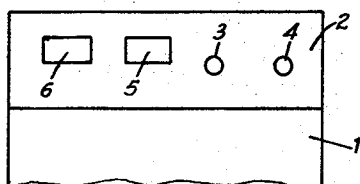


Fig. 1

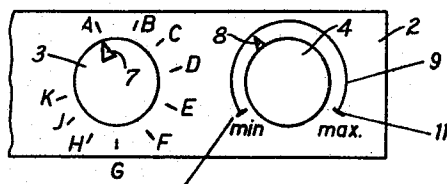


Fig. 2

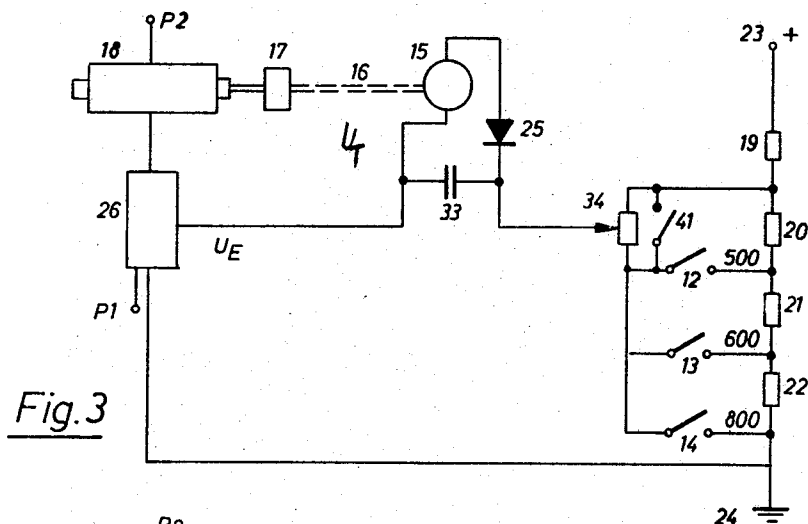


Fig. 3

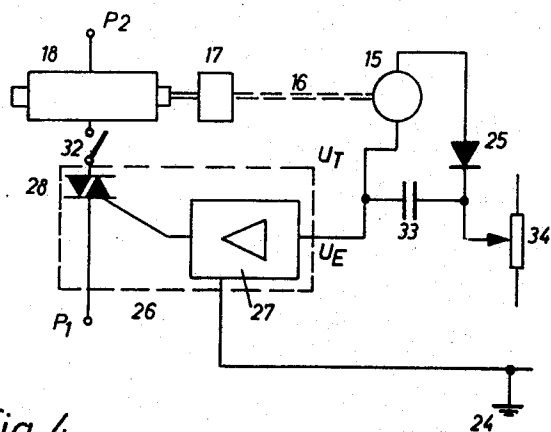


Fig. 4

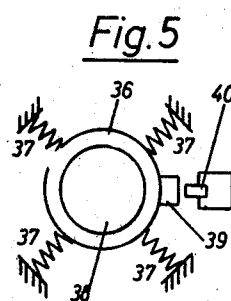


Fig. 5

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3,499,534

PROGRAM-SELECTING DEVICES FOR AUTOMATIC WASHING MACHINES

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Filed Feb. 23, 1968, Ser. No. 707,861

Claims priority, application Germany, Feb. 22, 1967, H 61,919

Int. Cl. B01d 35/06, 33/00

U.S. Cl. 210—144

6 Claims

ABSTRACT OF THE DISCLOSURE

A control for accurately setting and maintaining the spin speed of a washing machine tub. A selector switch is provided for enabling the selection of any one of a number of voltages, each of which represents a particular maximum rotation speed. A control potentiometer is further provided to precisely adjust the selected voltage to a desired voltage within a limited range below the selected value. The selected voltage is compared with a voltage in accordance with the actual spin speed of the tub and the motor speed controlled in response to the difference therebetween.

This invention relates to program-selecting devices for automatic washing machines.

Known program-selecting devices, by means, of a program-selecting switch, make possible the setting up of different washing programs to suit, for example, white articles, coloured articles, delicate articles and so on. It has also been possible with these known program-selecting devices additionally to vary the washing temperatures for the pre-selected program, the temperature allocated to a given program being variable within certain limits by the actuation of additional keys or regulators. It was necessary to provide the possibility of regulation because an individual adjustment of the washing temperature was still desirable to suit the degree of soiling of the wash, the composition of the wash and the laundering habits of the user. Hitherto, also, the speed of rotation of the drum could be varied within certain limits during the laundering operation or, if the specific laundering operation was made more or less intensive by appropriate dwells between the respective drivings of the drum of the washing machine in the one or the other direction, it could be regulated by adjustment of these dwells. However, it has not so far been possible to adjust the speed of rotation of the centrifuge according to the nature of the articles being laundered. There was only the possibility hitherto, with the program-selecting switch, to select that speed of the centrifuge which was allocated to the selected program. It is, however, even more important to provide further regulation possibilities here because a more or less large centrifugal action can affect the laundered articles to an extraordinary degree. Thus adjustments in the speed of the centrifuge cannot be made at the will of the user in the same way as the washing temperature or the washing intensity can be left to the choice of the user. Dependent upon the degree of filling of the drum of the washing machine and upon the weight of the articles being washed and, especially, upon the critical speeds of rotation of the centrifuge, arbitrary interference for the purpose of regulating the speed of the centrifuge can lead to serious damage of the washing machine if the centrifuging drum mounted in the resiliently suspended washing tub attains a rotational speed (critical speed or resonant speed) which will cause the whole system to vibrate and the washing tub to execute oscillations of such

great amplitudes that, in certain circumstances, the washing machine may be destroyed.

The invention has for its object to make provision to meet this difficulty so that it shall be possible for the user to regulate the speed of the centrifuge within certain limits but only in such a way that damage to the wash due to too high a speed of the centrifuge and damage to the washing machine due to the speed of the centrifuge falling within the critical speed-range will both be prevented.

According to the invention a program-selecting device for automatic washing machines in which a selector switch, which permits the pre-selection of the individual programs simultaneously determines a rotational speed of the centrifuge for the program concerned is characterised in that the centrifuging speed pre-selected by the program-selecting switch is the maximum permissible rotational speed and an additional manually adjustable rotational-speed regulator permits a reduction of this centrifuging speed.

By this means the centrifugal effect can be suited to the individual composition of the wash. Since the centrifugal action varies as the square of the rotational speed, even comparatively small changes in the rotational speed of the centrifuge suffice to produce a substantially different centrifugal effect.

It is further essential that the smallest value to which the speed of rotation can be adjusted by means of the rotational speed regulator shall lie above the critical rotational speed of the drum of the washing machine.

The last mentioned provision is to ensure that the washing machine shall not suffer damage if, somewhat inexpertly, a rotational speed of the centrifuge should be selected which lies in the critical speed-range for the system comprising the washing tub, the washing drum, the spring suspension of the washing tub and the masses in motion.

This rotational-speed regulator may take many forms. In a preferred embodiment the regulator is a continuously adjustable potentiometer which varies the input potential of an electronic rotational-speed regulating circuit.

The combination of this rotational-speed regulator with an electronic regulating circuit affords further advantages. An electronic regulation of the speed of rotation can be carried out in such a manner that a rotational speed of the centrifuge, once set, will be maintained with but small variations. This provision is important if it should be desired to regulate downwards into the neighbourhood of the critical rotational speed by means of this hand-operated rotational-speed regulator. With this novel constructional arrangement it is now possible to centrifuge, for example, synthetic articles of the wash, nylon articles and the like at such a low speed rotation of the centrifuge that creasing will not occur but rather that a considerably improved drying effect will be achieved compared with taking such washed articles, as hitherto, out of the washing drum or centrifuging drum in the wet state and hanging them out to dry. With this embodiment, therefore, it is assumed that the wash will be centrifuged in the drum in which it was laundered. It will be understood that the invention may also be employed in those cases where separate drums are provided for laundering and centrifuging purposes.

It is also possible to construct the rotational-speed regulator with press keys instead of as a continuously adjustable potentiometer, which keys influence the input potential of an electronic rotational-speed regulating circuit by switching resistors. This provision thus makes it possible additionally to adjust the centrifuging speed in a similar manner to that in which the temperature has hitherto been influenced by press keys.

A particularly preferred embodiment is one in which the selector switch influences the input potential of an electronic regulating circuit by the switching of resistors which each correspond to an intended rotational speed, this circuit receiving for comparison purposes, that potential corresponding to the actual rotational speed which is produced by a tacho-generator that is driven from the motor of the centrifuge.

This provision ensures that, by the adjustment of the rotational speed of the centrifuge, the critical speed-range will not be reached or, by a corresponding choice of the resistors, will be passed through so rapidly that a shaking of the tub of the washing machine into damaging oscillations cannot arise.

A further safety measure exists in the fact that there is provided a bridging contact for the resistor of the rotational-speed regulator, which contact closes upon the resiliently suspended washing tub reaching too large an amplitude of oscillation.

This safety measure will prevent the occasion of any damage to the washing machine in that the adjustment which in some way brought the oscillatable system into the neighbourhood of the critical rotational speed will immediately be removed, in the present case, by the short-circuiting of this arbitrarily adjustable rotational-speed regulator.

In the case of the provision just mentioned it is suitable that the bridging contact be a tumble switch which can be moved back to its starting position by hand.

By reason of this additional feature of the bridging contact i.e. the choice of this particular form of safety switch, it will be achieved that the critical rotational-speed range will not be reached repeatedly. The operator has to restore the bridging contact to the initial position by hand and is thus made aware of the fact that he has wrongly operated the washing machine, either by a wrong choice of rotational speed or by an incorrect loading, in such a way that otherwise, in the absence of this safety device, the machine would have been damaged.

Embodiments of the invention are shown in the accompanying drawings, from which and the relevant description further features of the invention will appear.

In the drawings:

FIG. 1 shows diagrammatically, in elevation, a control panel of an automatic washing machine;

FIG. 2 shows to a larger scale and also in elevation, the program-selecting switch with the manually adjustable rotational-speed regulator according to the invention;

FIG. 3 shows the input circuit for an electronic rotational-speed regulating circuit in which the invention is embodied and which permits the maintenance of an adjusted rotational speed;

FIG. 4 is a diagram showing the circuit of the motor of the centrifuge included in the regulating circuit; and

FIG. 5 shows diagrammatically the use of a press switch as a bridging contact to respond as a safety device to excessive amplitude of oscillation of the tub of the washing machine.

In FIG. 1 is shown the housing 1 of an automatic washing machine which exhibits on its front face a control panel 2. A program-selecting switch 3 is provided on the control panel and a manually operated rotational-speed regulator 4 according to the invention is arranged, for example, adjacent to this selecting switch. The rectangles 5, 6 may be openings to be employed for the pouring in of laundering media or they may be indicating surfaces or further switches.

The program-selecting switch (see FIG. 2) comprises, in known manner, an indicator 7 which is adjustable to the individual program indicated by the letters A-K. The rotational-speed regulator 4 also has an indicator 8 which moves over the scale 9, the one end point 10 of which represents the minimum value of the adjustable speed of rotation whereas the other end point 11 corresponds to the maximum value of the adjustable speed of rotation.

This maximum value of the rotational speed corresponds to the rotational speed which is set by the program-selecting switch for the program which has for the time being been selected.

In FIG. 3 it is the program contacts 12, 13, 14, which correspond, for example, to rotational speeds of the centrifuge of 500 r.p.m., 600 r.p.m., and 800 r.p.m. These speeds of the centrifuge are allocated, for example, to the programs A, B, and C. The supervision of these pre-set intended speeds of rotation is effected by means of a tacho-generator 15 which is connected to the motor 18 of the centrifuge by way of the shaft 16 and, if necessary, a speed-increasing or speed-reducing gearing 17. It will be understood that this tacho-generator 15 may alternatively be driven from the drum of the centrifuge itself or through any other intermediate members. The resistors 19, 20, 21, 22, constitute a potential divider which is connected, on the one hand, across a constant voltage source of electric current 23, 24 and is connected, on the other hand, through the potentiometer 34, and the diode 25 (or another rectifying circuit) to the tacho-generator output potential U_T . In this way the potential at the slider of the potentiometer 34 is compared with the potential U_T of the tacho-generator.

Dependent upon the difference potential U_S arising from the comparison of the potential U_T with the potential developed at the slider of the potentiometer 34 due to the closing of one of the switches 12-14, there is produced an input potential U_E at the input of an electronic rotational-speed regulating circuit 26. This electronic circuit 26 comprises an output gate which is connected in series with the motor 18 of the centrifuge between the main terminals P_1 , P_2 .

In FIG. 4 there is shown diagrammatically that this electronic regulating circuit 26 comprises a known threshold-value amplifier 27 (only diagrammatically indicated) and employs a known gate-controlled semi-conductor switch 28 as the output gate, this switch being one designed for A.C. power control and such that with phase-control of the gate signal the load-current can be varied over a range from 5% to 95% of full power. According to the manner in which the input potential U_E varies, the threshold-value amplifier 27 shuts off or opens the output gate 28 so that the motor 18 of the centrifuge can receive more current when the potential U_T tends to become smaller than the potential at the slider of the potentiometer 34 and is deprived of some current when the potential U_T tends to become greater than that at the slider. A program contact 32 ensures that the motor of the centrifuge can receive current only during those sections of the program which provide for centrifuging. Those other contacts, for temperature, pre-selection and so on, actuated by the program-selecting switch 3 at the same time as the contacts 12-14 and 32 are not shown since they form no part of this invention. The capacitor 33 is for the smoothing of the tacho-generator potential.

The resistance value of the potentiometer 34 is so selected that the lower critical rotational-speed range cannot be reached for any intended rotational speed which may be switched in. The potentiometer 34 of FIG. 4 is also connected in circuit with the potential divider 19-22 as shown in FIG. 3.

To illustrate a desirable safety provision, the wash tub 36 is shown diagrammatically in FIG. 5 as resiliently supported by springs 37 in known manner, within the housing 2 or within a suitable framework. In the critical rotational speed range the drum of the centrifuge will impart to the wash tub such an amplitude of oscillation that, for example, the abutment 39 connected to the wash tub 36 actuates the press switch 40. This press switch 40 then closes its bridging contact 41 (shown in FIG. 3) and thereby short-circuits the resistor 34 or interrupts its operation. The press switch 40, once operated, must then be re-opened by hand.

The invention, it will be seen, is broadly concerned

5

with making provision in automatic washing machines of means whereby a pre-selected speed of rotation of the centrifuge may additionally be manually adjusted, within limits, when desired.

What I claim is:

1. A device for selecting and controlling the spin speed of a washing machine tub, comprising:
 means for generating a voltage in accordance with the actual speed of rotation of said tub;
 means for generating a plurality of voltages, each of said voltages representing a particular maximum desired rotation speed;
 switch means for selecting one of said voltages representing a desired maximum rotation speed;
 means for adjusting the selected voltage to set the rotation speed to a value below the maximum speed;
 means for comparing the adjusted selected voltage with the voltage in accordance with the actual speed of rotation and generating a control signal in accordance with the difference therebetween; and
 means for driving said tub in response to said difference control signal whereby said tub is maintained in rotation at a precisely desired speed at or below the maximum selected speed.

2. The device according to claim 1 wherein said voltage selecting and adjusting means are adapted to provide voltages representing only rotation speeds above a critical rotation speed of the tub.

3. The device according to claim 1 wherein said means

6

for generating a plurality of voltages comprises a voltage source and a voltage divider connected to said source and having a plurality of taps each of which provides one of said plurality of voltages.

4. The device according to claim 3 wherein said adjusting means comprises a potentiometer, said selecting means connecting said potentiometer to predetermined taps of said voltage divider.

5. The device of claim 4 wherein said means for driving said tub comprises a drive motor and electronic control means for controlling said drive motor.

6. The device of claim 4 and further including switch means for short circuiting said potentiometer when the tub oscillates at above a predetermined amplitude.

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U.S. Cl. X.R.

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