(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 687 760 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
20.09.2000 Bulletin 2000/38

(51) Int Cl.[7]: **D06F 37/20**

(21) Application number: **95109302.0**

(22) Date of filing: **16.06.1995**

(54) **Method for verifying the laundry load conditions in a laundry washing and/or drying machine, and machine which implements such method**

Verfahren zum Prüfen des Wäschegewichts in einer Wasch- und/oder -Trockner-Maschine und Maschine die ein solches Verfahren verwendet

Procédé pour vérifier la charge du linge dans une machine à laver et/ou à sécher et machine utilisant un tel procédé

(84) Designated Contracting States:
DE ES FR GR

(30) Priority: **16.06.1994 IT TO940496**

(43) Date of publication of application:
20.12.1995 Bulletin 1995/51

(60) Divisional application: **99124780.0**

(73) Proprietor: **Merloni Elettrodomestici S.p.A.**
60044 Fabriano (AN) (IT)

(72) Inventor: **Mariotti, Costantino**
I-06028 Sigillo (PG) (IT)

(56) References cited:
EP-A- 0 236 857
DE-A- 3 416 639
DE-A- 4 038 178

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 0 687 760 B1

Printed by Jouve, 75001 PARIS (FR)

Description

[0001] The present invention refers to a method for verifying the laundry load conditions in a washing and/or drying machine and to a machine using said method.

[0002] It is known that washing and/or drying machines can include in their washing program one or more spinning cycles, i.e. phases of drum rotation gradually bringing the drum to a much higher speed than that normally foreseen during the actual washing cycles; in some types of machine, the drum can reach a speed up to 1100 rpm.

[0003] However, due to special requirements and applications, an increasing interest has recently developed for spin speeds in the order of 1400 rpm, i.e. by far higher than the one mentioned above. In view of this requirement, manufacturers have to face the problem of adapting their present production of washing machines reaching 1100 rpm speed to the new requirements, i.e. 1400 rpm speed.

[0004] If on one hand the motor and its relevant control system can be adapted in a relatively simple way to reach 1400 rpm, on the other hand this is rather more complex from a mechanical standpoint. As a matter of fact, it is clear that the mechanical stresses the machine is submitted to at 1100 rpm are by far lower than the ones a machine with the same structure has to withstand when reaching 1400 rpm, specially under severe and/or out-of-balance load conditions. In particular, to the purpose of this description a severe load defines a quantity of laundry in the drum approaching the maximum quantity of laundry the machine can wash, whereas an out-of-balance load defines an irregular distribution of the laundry inside the drum, which may cause significant oscillations and mechanical damages to the machine during high speed rotation.

[0005] By way of example, according to practical tests carried out on conventional structured machines with 5-kg drum capacity, it has been ascertained that a rotating speed over 1100 rpm may cause damages to the drum containing the laundry; drum failures typically occur already at 1200 rpm speed and 500 to 800 gram unbalance with loads over 80% the drum capacity (i.e. over 4 kg).

[0006] Said problem can obviously be solved by changing the mechanical structure of the machine, e.g.. by strengthening the drums and relevant hubs, but this would involve very high investments for the remaking of complete production lines.

[0007] Document DE-A-3 416 339 discloses a method for verifying the laundry load conditions in a washing machine where, as a first step, the load balance conditions are verified by using a device (U) that takes in account the rotation speed the motor. Said device operates in a determined range of speed. For carrying out a second step, an empirical table is stored in a microcomputer, said table containing predetermined values of load, supply voltage and related load balance. The decision about entering the spinning cycles is taken by comparing the measured values with the values stored in the table. Said method has the drawback of being performed at low speed, with a consequent long time to reach the high spin speed.

[0008] Document DE-A-4 038 178 discloses an unbalance measurement based on obtaining from the oscillations of the rotational speed during a speed ramp a relative measurement of the unbalance. As a consequence, an absolute measurement of the unbalance is computed by introducing also the measured load in the drum. The microprocessor chooses the corresponding spinning program on the basis of said absolute measurement. The inertia of the load in the drum is measured substantially by measuring a slowing time of the rotational speed of the drum, after switching off the motor.

[0009] Document EP-A-0 236 857 discloses a method for correcting the threshold unbalance values taking in account the quantity and type of clothes in the drum. The unbalance is measured by performing a measure of the oscillations of the rotational speed, while the information on the load inertia is substantially inserted by the user.

[0010] Accordingly, it is the object of the present invention to provide a control method for a machine of the above type, that allows to solve the above problem in a low-cost manner and with no substantial changes to the mechanical structure of the machine; accordingly, it is the main object of the present invention to indicate a control method through which it is possible to verify whether the laundry load contained in the drum of a washing machine exceeds a predetermined mass and is out of balance, thus allowing the machine drum to reach speeds over 1100 rpm only if there are no such dangerous conditions for the mechanical structure of the machine. Therefore, it is the object of the present invention to let a normally structured machine reach high spin speeds only under balanced load conditions, i.e. without any risk of mechanical failures.

[0011] To this purpose, it is the object of the present invention to provide a method for controlling the load in a washing and/or drying machine and a machine implementing such a method, incorporating the characteristics of the annexed claims.

[0012] Further characteristics and advantages of the present invention will be apparent from the following description and annexed drawings, which are supplied only as an explanatory and non limiting example, wherein :

- Fig. 1 shows a simplified block diagram of a section of the machine control circuit implementing the method according to the present invention;
- Figs. 2 to 5 show graphically some explanatory curves of the rotating speed analysis of the machine shown in Fig. 1, based on the method according to the present invention;
- Fig. 6 shows the block diagram of a section of the control logic circuit of the machine shown in Fig. 1,

implementing the method according to the present invention.

- Fig. 7 shows the block diagram of another section of the control logic circuit of the machine shown in Fig. 1, implementing the method according to the present invention.

[0013] The present invention will be further described with reference to a laundry washing machine equipped with all known elements for its operation; in particular said machine is assumed to have a standard mechanical structure, i.e. reaching a spin speed around 1100 rpm and a 5 kg capacity drum; however, said machine is equipped with a motor having a control system, in particular an electronic digital control system, which allows the drum to reach a rotating speed up to 1400 rpm.

[0014] Fig. 1 shows the simplified block diagram of a section of the machine control circuit implementing the method according to the present invention. In this figure M is the washing-machine motor generating the drum rotation in a known manner, by means of belts and pulleys; D is an electronic digital control module for the motor M; MP is an electronic microcontroller comprising a counter or internal clock, indicated with CLOCK, with associated permanent memory means, named ROM, and read-and-write memory means named RAM; in the embodiment shown by way of example said microcontroller MP is the one already available in the digital module D for motor M control.

[0015] In the ROM memory, the programs for handling the motor M in the various phases are codified, according to the different machine cycles, which can be selected by the user through proper control elements (e.g. electromechanical timer and/or selection keys). Module D controls motor M operation - in particular through microcontroller MP and associated ROM memory - based on the signals received by the above control elements and other machine components, such as a pressure switch, control keys, a speedometer dynamo, etc.

[0016] T indicates a device capable of generating a signal representative of the rotating speed reached by the drum during machine operation, and consequently by motor M; in the figure T is shown as a speedometer dynamo but other similar devices can obviously be used for the purpose of measuring the motor and consequently the drum rotating speed (e.g. a magnetic reed type sensor).

[0017] According to the invention, a suitable program in the ROM permanent memory of the microcontroller MP allows the microcontroller itself to decide whether the laundry load and/or its eventual out-of-balance extent should be considered dangerous for the mechanical structure of the machine in view of the spin speed to be reached; such decisions are taken by the microcontroller MP based on the data representative of the drum speed detected by speedometer T, and on the time required to reach given speed thresholds, detected by the speedometer T and the counter CLOCK.

[0018] In particular, according to the present invention, the control system of the motor M verifies during the high speed spinning phase and before reaching 1200 rpm (assumed as the threshold of a likely critical speed), whether the laundry load is either severe or out of balance. As mentioned above, to the purpose of the present invention severe load defines a quantity of laundry in the drum assumed to be potentially dangerous in view of an out-of-balance condition, e.g. over 80% drum capacity (over 4 kg in the example); whereas out-of-balance load defines an irregular weight arrangement of the laundry inside the drum, which could in fact getting the whole machine "out of balance" during the spinning cycles: in the embodiment shown by way of example this situation is assumed to be a critical one in case of 500 to 800 gram load unbalance.

[0019] According to the present invention, since motor M and drum characteristics are known, the entity of the laundry load is determined by measuring the time required to reach 900 rpm speed (hereafter called V2) from 150 rpm speed (hereafter called V1); said measurements is made by microcontroller MP through speedometer T and the counter CLOCK.

[0020] More specifically, it has been ascertained, based on practical tests, that if the time required for speed V1 to reach speed V2 is below a predetermined time TR of eight seconds, the laundry load is assumed not to be a severe one and consequently a non critical one: in this instance, after measuring speed V2, the microcontroller MP can give release to reach a maximum spinning speed of 1400 rpm apart from an eventual unbalance. Viceversa, if the time interval from V1 to V2 is higher than the predetermined time TR, then the load is a severe one, and potentially critical for the mechanical structure of the machine due to unbalance.

[0021] Therefore, if the laundry load is detected to be a severe one, its out-of-balance condition will be verified according to the invention; if no unbalance is detected (or in case of a fair non-critical unbalance, i.e. such not to jeopardize the machine from a mechanical standpoint), then the spinning speed can reach 1400 rpm.

[0022] Viceversa, if an out-of-balance condition over the established limit is detected, then microprocessor MP will provide for the necessary correction and decrease the maximum spinning speed to a lower value, e.g. only 1000 rpm, which is low enough to avoid jeopardizing the machine from a mechanical standpoint.

[0023] According to the invention, unbalance is detected by verifying the degree of the so-called over-elongation, i.e. a laundry load inertia entraining the drum at a higher rotating speed (VM) than a predetermined speed (VR). Also in this case, according to practical tests, it has been ascertained that the over-elongation entity is representative of the laundry distribution quality inside the drum.

[0024] According to the present invention, the verification of the over-elongation and consequently of the laundry distribution inside the drum, takes place as fol-

lows.

[0025] During speed rise, the microcontroller MP detects the speed reached by the motor M through the speedometer T, starting from 150 rpm for a predetermined time measured by the counter CLOCK (e.g. 40 secs); maximum speed VM reached during this time is temporarily stored in the RAM memory associated with the microcontroller MP (typically, the maximum speed is reached about 10-15 secs after exceeding 150 rpm).

[0026] Said maximum speed VM, stored in the volatile RAM memory, is compared with the predetermined speed VR in the permanent ROM memory of the microcontroller MP; the predetermined speed VR can be for example equal to 1000 rpm.

[0027] The difference between the predetermined speed VR and the detected maximum speed VM indicates the over-elongation entity. As mentioned, practical tests have indicated that within certain limits, the over-elongation is higher under very good load balance conditions; viceversa, no over-elongation or just a minimum over-elongation or the detection of a speed VM lower than the speed VR within predetermined time (40 secs) indicates an out-of-balance laundry load: as a matter of fact, it is evident how at high speeds an irregular laundry distribution in the drum may determine a braking effect.

[0028] Therefore, according to the invention, if the time from V1 to V2 is higher than TR (8 secs), the microcontroller MP verifies the presence of a predetermined over-elongation value, calculating the difference between VM and VR; if over-elongation is lower than a predetermined value, or if there is no over-elongation, then the microcontroller itself assumes an out-of-balance load condition: this means that there is a condition of severe and out-of-balance load, i.e. surely a critical and dangerous condition such to cause drum failures or damages to the machine structure; in this case the final spin speed is lowered to 1000 rpm, i.e. a value low enough not to jeopardize the machine from a mechanical standpoint. On the contrary, if over-elongation is higher than a predetermined value representative of a good load balance, the microcontroller MP will enable 1400 rpm final spin speed since due to its correct balance there is no mechanical risk for the machine also in the event of a severe load.

[0029] Figs. 2-5 show by way of example some curves representative of the analysis of the rotating speed of the machine motor according to the method object of the present invention. In said graphs the axis of the abscissas indicates time, whereas the axis of the ordinates indicates the value of the rotating speed of the drum and, consequently, of the washing-machine motor.

[0030] The graph in Fig. 2 shows an ideal operating condition of the machine according to the present invention. As it can be noted, in fact, in this case time T1-T2 required from speed V1 (150 rpm) to V2 (900 rpm) is below 8 secs, i.e. below the predetermined time TR, indicating the presence of a non severe load, so that the machine is enabled to reach its maximum spin speed MC (1400 rpm). In any case, the graph also indicates an over-elongation, since the maximum speed VM that has been reached, e.g. 1080 rpm, is higher than the predetermined 1000 rpm speed VR. Such an over-elongation of 80 rpm - which is higher than a predetermined threshold SS - indicates a balanced load, so that Fig. 2 shows a situation under ideal load conditions.

[0031] The graph in Fig. 3 also shows a very good operating condition of the machine according to the present invention. As it can be seen, in this case-time T1-T2 required from speed V1 to speed V2 is higher than 8 secs, i.e. higher than TR, indicating a severe load condition; therefore the microcontroller MP has to verify unbalance through the measurement of over-elongation. As it can be seen from the graph in Fig. 3, such an over-elongation is due to the fact that the maximum speed VM is higher than the predetermined speed VR. Such an over-elongation higher than the predetermined threshold SS indicates a good balanced load: thus, the machine has a severe but good balanced load and can be enabled to reach its maximum spin speed MC without any risk from a mechanical standpoint.

[0032] The graph in Fig. 4 indicates a non ideal but still acceptable operating condition of the machine according to the present invention. As it can be seen, time T1-T2 required from speed V1 to speed V2 is lower than TR, indicating a non severe load; thus, the machine is enabled to reach 1400 rpm spin speed. The graph also shows an over-elongation under threshold SS (as it can be seen the maximum speed VM is slightly over the predetermined speed VR). Such a minimum over-elongation indicates an out-of-balance load; however, such an out-of-balance but non severe load condition is not critical for the machine mechanical structure, so that the motor can reach 1400 rpm spin speed (MC); operating vibrations are acceptable because they are not dangerous for the machine mechanical structure.

[0033] Finally, the graph in Fig. 5 shows a non acceptable operating condition of the machine, according to the present invention. As it can be seen, time T1-T2 required from speed V1 to reach speed V2 is higher than TR, indicating a severe load; in this case the out-of-balance load needs to be verified by measuring its over-elongation. According to the graph in Fig. 5 there is a minimum over-elongation, below the predetermined threshold SS, since the maximum speed VM reached by the motor is slightly higher than the predetermined speed VR. This lack of over-elongation indicates as said an out-of-balance load, so that the situation shown in Fig. 5 is assumed highly critical for the machine mechanics due to the presence of a sever out-of-balance load; therefore the control system will decrease the spin speed to a predetermined value below MC, which is low enough not to jeopardize the machine from a mechanical standpoint.

[0034] Always by way of example, Fig. 6 shows a block diagram of a section of the logic circuit for the machine shown in Fig. 1 and in particular a program, by

way of example, contained in the microprocessor MP for the implementation of the method according to the invention.

[0035] In this program block 100 is the starting block yielding control to block 101, in line with the start of a gradual spinning phase reaching final 1400 rpm speed; block 101 transfers control to block 102, which is a test block; said block 102 measures the drum rotating speed; if said speed reaches 150 rpm (V1) control is transferred to the subsequent block 103; in the negative, control returns to block 102 itself.

[0036] Block 103 starts counting time T (point T1) and yields control to the subsequent block 104, which is a test block.

[0037] Block 104 takes a new measurement of the drum rotating speed; if said speed reaches 900 rpm (V2), then control goes on to the subsequent block 105; in the negative, it returns to block 104.

[0038] Block 105 stops time T count (point T2) and transfers control to the subsequent block 106; block 106 is a test block comparing the time T (or if preferred T2-T1 difference) with the stored time TR equal to 8 secs; if the time T (or T1-T2 difference) is below TR, then the control goes over to block 107; block 107 enables 1400 rpm spin and at the end of it control goes over to block 108, which is the end-of-operation block.

[0039] If time T (or T1-T2 difference) on block 106 is higher than TR, control is yielded to block 109, which is a test block and verifies the unbalance by controlling over-elongation as described above; if there is no out-of-balance condition, control is yielded to block 107 to enable 1400 rpm spin, then the program ends on block 108. If, on the contrary, there is an out-of-balance condition, control goes over to subsequent block 110.

[0040] Block 110 enables a decreased spin sequence, e.g. 1000 rpm, i.e. a speed low enough to avoid jeopardizing the machine from a mechanical standpoint.

[0041] The program will then end on block 108.

[0042] Fig. 7 shows the block diagram of a logic circuit section controlling the machine shown in Fig. 1, related to out-of-balance control, i.e. the phase substantially occurring on block 109 of the previous figure.

[0043] In said Fig. 7 block 201 indicates program start (which substantially coincides with block 101 of Fig. 6); control is yielded to block 202, which is a test block; said block 202 measures the drum rotating speed, if the speed reaches 150 rpm control goes over to subsequent block 203, whereas in the negative it goes back to block 202.

[0044] Block 203 starts counting a time TT and yields control to subsequent block 204; block 204 measures the drum rotating speed and stores the detected speed value in the RAM memory of the microcontroller MP.

[0045] Control is then yielded to block 205, which verifies if time TT has reached 40 secs; in the affirmative, control goes over to subsequent block 206, whereas in the negative it will return to block 204 for a new measurement of the drum rotating speed; if the new speed value is higher than the previously stored one, then the new value will replace the previously stored one in the RAM memory. Practically, blocks 204 and 205 detect drum speed on a cyclic base to reach the maximum speed value VM within the predetermined 40 secs stored in RAM memory.

[0046] Block 206 is a block comparing the maximum speed value VM stored in RAM memory with a maximum reference speed value VR for the predetermined 40 secs. If speed VM is higher than speed VR there will be an over-elongation indicating a balanced load condition, provided it exceeds a predetermined threshold (SS); on the contrary, if over-elongation over-elongation) is below the predetermined threshold (or no it means an out-of-balance load. Thus, according to the condition detected on block 206, the control system will either enable or inhibit 1400 rpm spin (practically as described with reference to blocks 109-107-108 or 109-110-108 of Fig. 6).

[0047] The characteristics of the method object of the present invention as well as its advantages are apparent from the given description.

[0048] Exhaustive testing has indicated how the present invention allows achievement of the intended purposes, i.e. a simple and low-cost method for a washing and/or drying machine to operate at high spin speed through a simple test method of the laundry load conditions, without any substantial changes to the machine mechanical structure and no risks for it.

[0049] It is obvious that many changes, adaptations, integrations and modifications - without prejudice to the protective claims of the present invention - are possible to the method and the machine described by way of non limiting example, without departing from the novelty spirit of the innovative solution, and it is also clear that in practical actuation of the invention the components may often differ in form and size from the ones described and may be replaced with technical equivalent elements.

[0050] As an example, it is evident that, upon detecting any critical conditions as shown in Fig. 5, the control system may be designed to incorporate a correction phase for the out-of-balance condition instead of enabling a decreased spin speed: this can be easily achieved through the program stored in the ROM memory associated with microcontroller MP; e.g. if a severe out-of-balance condition is detected, the microcontroller MP can stop the speed increase run, execute a re-balancing load step and attempt a new spinning cycle to reach the maximum 1400 rpm speed; this could take place even several times.

[0051] The same may be foreseen to solve non-critical conditions, however troublesome as shown in Fig. 4.

[0052] Moreover, it is also clear that the method used to detect unbalance as described herein - based on over-elongation measurement - may also be profitably used separately from time measurement from 150 to 900 rpm. Storage possibility for microcontroller MP of a considerable quantity of data based on experience in an

extremely compact format in ROM permanent memory, which can be processed even using low-cost devices (4 and 8 bit limited process capacity microcontrollers), allows development of the over-elongation based method also for an exact determination of out-of-balance extent. Thus, it is also obvious that other techniques are available for automatic load verification, i.e. the quantity of laundry in the washing-machine drum; reference is made e.g. to the Italian Patent Application for Industrial Invention no. TO93A000798 in the name of the same Applicant, describing and commenting several techniques for automatic load information, among which: method of the analysis of the duration time and number of the fluid level restorations in the washing tub, controlled by a first-level pressure switch; power measurement method (associated with torque) absorbed by the washing-machine motor to start the drum containing the laundry; measurement method for the energy required to switch over from a given inertial state as defined by a determined speed of the washing-machine drum to another inertial state, defined by a different drum speed.

Claims

1. A method for verifying the laundry load conditions in a washing and/or drying machine comprising a drum containing the laundry, rotated by a motor (M), wherein a high spin speed (MC) is gradually reached during an operation phase, characterized in that, before reaching said high spin speed (MC), the load entity is verified, and if the load exceeds a predetermined mass, also the load balance conditions are verified, and that, in order to avoid any risks for the machine mechanical structure, the achievement of the maximum spin speed (1400 rpm) is inhibited if a load exceeding said predetermined mass and an out-of-balance condition are detected.

2. A method according to Claim 1, characterized in that the laundry load entity is determined by comparing against a reference value (TR) the time (T2-T1) required for passing from a first predetermined speed (V1) to a second predetermined speed (V2) during the gradual spin speed increase.

3. A method, according to the previous Claim, characterized in that when said time (T2-T1) is higher than the reference value (TR), then the laundry load is assumed to be a severe one, i.e. higher than said predetermined mass.

4. A method according to Claim 1, characterized in that the load balance conditions are verified by testing the over-elongation, i.e. the laundry load inertia entraining the drum at a rotating speed (VM) higher than a predetermined theoretic speed threshold (VR).

5. A method according to the previous Claim, characterized in that the load balance conditions are verified by measuring the maximum speed (VM) reached by the motor (M) or by the machine drum during a predetermined time interval (40 secs) and comparing said maximum speed (VM) with a predetermined maximum theoric speed (VR) for said time interval, whereby the over-elongation extent is obtained by the difference between the predetermined maximum theoric speed (VR) and the measured maximum speed (VM).

6. A method according to Claims 4 or 5, characterized in that a balanced load condition is gathered when there is an over-elongation exceeding a predetermined threshold (SS) and an out-of-balance load condition is gathered when there is an over-elongation below a predetermined threshold (SS).

7. A method according to one or more of the previous Claims, characterized in that when the load is higher than said predetermined mass and an out-of-balance condition of said higher load exceeds a predetermined threshold, then the achievement of the maximum spin speed (1400 rpm) is inhibited and/or corrective actions are foreseen, such as at least an attempt to restore the load balance or the spinning at a lower speed (1000 rpm), which is low enough not to jeopardize the machine from a mechanical standpoint.

8. A method according to one or more of the previous Claims, characterized in that when a non severe load and a balanced condition of said load is detected, the motor (M) is enabled to reach the maximum spin speed (1400 rpm).

9. A method according to one or more of the previous Claims, characterized in that when a non severe load and an unbalanced condition of said load is detected, the motor (M) is equally enabled to reach the maximum spin speed (1400 rpm).

10. A method according to Claim 1, characterized in that the laundry load entity is determined by

- the analysis of the duration time and the number of the fluid level restorations in the washing tub, realized under control of a first-level pressure switch, and/or
- the measurement of the power absorbed by the machine motor to start the drum containing the laundry to be washed, and/or
- the measurement of the power required for passing from a first inertial state, being defined by a determined machine drum speed, to a sec-

ond inertial state, being defined by a different speed of same drum.

11. Laundry washing and/or drying machine, comprising all known operation elements, including a drum rotated by a motor (M), a device (T) generating a signal representative of the achieved motor (M) or drum speed and an electronic control device (D, MP), which implements the methods according to one or more of the previous claims.

12. Laundry washing and/or drying machine according to the previous Claim, characterized in that said electronic control device comprises a microcontroller (MP) to which permanent memory means (ROM) and read-and-write memory means (RAM) are associated.

Patentansprüche

1. Verfahren zum Prüfen der Beladungszustände in einer Wasch- und/oder Trocknermaschine mit einer Trommel zur Aufnahme der Wäsche, welche Trommel von einem Motor (M) gedreht wird, der während einer Betriebsphase eine hohe Schleuderdrehzahl (MC) allmählich erreicht,
dadurch gekennzeichnet, dass vor dem Erreichen der genannten hohen Schleuderdrehzahl (MC) die Ladung überprüft wird und bei Überschreiten einer vorbestimmten Masse die Ladungsverteilung ebenfalls überprüft wird, und dass zum Vermeiden jeden Risikos für den mechanischen Aufbau der Maschine das Erreichen der maximalen Schleuderdrehzahl (1400 U/m) verhindert wird, wenn die Ladung die genannte Masse überschreitet und eine Unwucht festgestellt wird.

2. Verfahren nach Anspruch 1,
dadurch gekennzeichnet, dass die Wäscheladung dadurch bestimmt wird, dass die während des allmählichen Anstiegs der Schleuderdrehzahl von einer ersten vorbestimmten Drehzahl (V1) zu einer zweiten vorbestimmten Drehzahl (V2) erforderliche Zeit (T2 - T1) mit einem Referenzwert (TR) verglichen wird.

3. Verfahren nach einem der vorhergehenden Ansprüche,
dadurch gekennzeichnet, dass dann, wenn die genannte Zeit (T2 - T1) den Referenzwert (TR) übersteigt, angenommen wird, dass eine große Wäscheladung vorliegt, also die vorbestimmte Masse übersteigt.

4. Verfahren nach Anspruch 1,
dadurch gekennzeichnet, dass die Ladungsverteilung dadurch geprüft wird, dass das momentane Überschießen der Drehzahl (auf einen Wert VM), d. h. das Mitreissen der Trommel durch die Trägheit der der Trommel folgenden Wäscheladung, über eine vorbestimmte theoretische Drehzahlschwelle (VR) ausgewertet wird.

5. Verfahren nach dem vorhergehenden Anspruch,
dadurch gekennzeichnet, dass die Ladungsverteilung überprüft wird, indem die vom Motor (M) oder der Maschinentrommel während eines vorbestimmten Zeitintervalls (40 s) erreichte Maximaldrehzahl (VM) gemessen und mit einer vorbestimmten theoretischen Maximaldrehzahl (VR) für den genannten Zeitraum verglichen wird, wobei das Ausmaß des Überschießens mit Hilfe der Differenz zwischen der vorbestimmten theoretischen Maximaldrehzahl (VR) und der gemessenen Maximaldrehzahl (VM) ermittelt wird.

6. Verfahren nach den Ansprüchen 4 oder 5,
dadurch gekennzeichnet, dass ausbalancierte Ladungsverhältnisse angenommen werden, wenn das Überschießen eine vorbestimmte Schwelle (SS) überschreitet, und unausgeglichene Ladungsverhältnisse angenommen werden, wenn das Überschießen eine vorbestimmte Schwelle (SS) nicht erreicht.

7. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche,
dadurch gekennzeichnet, dass, wenn die Ladung den genannten vorbestimmten Massewert übersteigt und ein unausgeglichener Zustand dieser größeren Ladung eine vorbestimmte Schwelle überschreitet, das Erreichen der maximalen Schleuderdrehzahl (1400 U/m) verhindert wird und/oder Korrekturmaßnahmen vorgesehen sind wie z. B. der Versuch, eine ausgeglichene Beladung herzustellen oder das Schleudern bei einer niedrigerer Drehzahl (1000 U/m) durchzuführen, die für die Maschine vom mechanischen Standpunkt aus keine Gefahr darstellen.

8. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche,
dadurch gekennzeichnet, dass dann, wenn keine hohe Beladung vorhanden ist und ausgeglichene Beladungsverhältnisse festgestellt werden, der Motor (M) für die maximale Schleuderdrehzahl (1400 U/m) freigegeben wird.

9. Verfahren nach einem oder mehreren der vorhergehenden Ansprüche,
dadurch gekennzeichnet, dass, wenn keine hohe Beladung vorhanden ist und unausgeglichene Beladungsverhältnisse festgestellt werden, der Motor (M) ebenfalls für die maximale Schleuderdrehzahl (1400 U/m) freigegeben wird.

10. Verfahren nach Anspruch 1, dadurch gekennzeichnet, dass die Wäscheladung bestimmt wird durch

- die Analyse der Zeitdauer und der Anzahl der Wiederherstellungsvorgänge des Flüssigkeitspegels im Waschbehälter, wie sie bei der Steuerung eines Druckschalters für einen ersten Pegel durchgeführt werden, und/oder
- das Messen der durch den Maschinenmotor aufgenommenen elektrischen Leistung beim Starten der die zu waschende Wäsche enthaltenden Trommel und/oder
- das Messen der elektrischen Leistung, die erforderlich ist, um von einem ersten Trägheitszustand, wie er durch eine bestimmte Trommelgeschwindigkeit der Maschine definiert ist, in einen zweiten Trägheitszustand zu wechseln, der durch eine davon unterschiedliche Geschwindigkeit derselben Trommel definiert ist.

11. Wäschewaschmaschine und/oder Wäschetrockner mit allen bekannten Betriebselementen, einschließlich einer von einem Motor (M) rotierten Trommel; einer Vorrichtung (T), die ein die erreichte Motor-(M) oder Trommeldrehzahl repräsentierendes Signal erzeugt; und einer elektronischen Steuervorrichtung (D, MP), die die Verfahren nach einem oder mehreren der vorhergehenden Ansprüche zur Ausführung bringt.

12. Wäschewaschmaschine und/oder Wäschetrockner nach dem vorhergehenden Anspruch, dadurch gekennzeichnet, dass die genannte elektronische Steuervorrichtung einen Mikroprozessor (MP) umfasst, dem Permanentspeichermittel (ROM) sowie Leseund-Schreib-Speichermittel (RAM) zugeordnet sind.

Revendications

1. Procédé permettant de vérifier les conditions de charge du linge dans une machine à laver et, ou bien, à sécher comprenant un tambour qui contient le linge et qui est entraîné en rotation par un moteur (M), où une vitesse d'essorage élevée (MC) est graduellement atteinte pendant une phase de fonctionnement, caractérisé en ce que, avant d'atteindre ladite vitesse d'essorage élevée (MC), l'entité relative à la charge est vérifiée et, si la charge dépasse une masse prédéterminée, alors les conditions d'équilibre de la charge sont également vérifiées, et en ce que, pour éviter tout risque pour la structure mécanique de la machine, on empêche que la vitesse d'essorage maximale (1400tr/min) soit atteinte si une charge dépassant ladite masse prédéterminée et une condition de déséquilibre sont détectées.

2. Procédé selon la revendication 1, caractérisé en ce qu'on détermine l'entité correspondant à la charge de linge en comparant, avec une valeur de référence (TR), le temps (T2-T1) nécessaire pour passer d'une première vitesse prédéterminée (V1) à une deuxième vitesse prédéterminée (V2) pendant l'augmentation graduelle de la vitesse d'essorage.

3. Procédé selon la revendication 2, caractérisé en ce que, lorsque ledit temps (T2-T1) est supérieur à la valeur de référence (TR), alors la charge de linge est supposée être une charge sévère, c'est-à-dire supérieure à ladite masse prédéterminée.

4. Procédé selon la revendication 1, caractérisé en ce que les conditions d'équilibre de la charge sont vérifiées par contrôle du sur-allongement, c'est-à-dire de l'inertie de la charge de linge entraînant le tambour à une vitesse de rotation (VM) qui est supérieure à un seuil de vitesse théorique prédéterminé (VR).

5. Procédé selon la revendication 4, caractérisé en ce que les conditions d'équilibre de la charge sont vérifiées par mesure de la vitesse maximale (VM) atteinte par le moteur (M) ou par le tambour de la machine pendant un intervalle de temps prédéterminé (40 s) et par comparaison de ladite vitesse maximale (VM) avec une vitesse théorique maximale prédéterminée (VR) pour ledit intervalle de temps, si bien que l'étendue du sur-allongement est obtenue par la différence entre la vitesse théorique maximale prédéterminée (VR) et la vitesse maximale mesurée (VM).

6. Procédé selon la revendication 4 ou 5, caractérisé en ce qu'une condition de charge équilibrée est remplie lorsqu'il existe un sur-allongement qui dépasse un seuil prédéterminé (SS) et une condition de charge déséquilibrée est remplie lorsqu'il existe un sur-allongement situé en deçà d'un seuil prédéterminé (SS).

7. Procédé selon une ou plusieurs des revendications précédentes, caractérisé en ce que, lorsque la charge est supérieure à ladite masse prédéterminée et qu'une condition de déséquilibre de ladite charge supérieure dépasse un seuil prédéterminé, alors on empêche que la vitesse d'essorage maximale (1400tr/min) soit atteinte et, ou bien, on prévoit des actions correctrices, telles qu'au moins une tentative pour restaurer l'équilibre de la charge ou un essorage à une vitesse inférieure (1000 tr/min), qui est suffisamment basse pour ne pas mette en danger la machine du point de vue mécanique.

8. Procédé selon une ou plusieurs des revendications précédentes, caractérisé en ce que, lorsqu'une

charge non sévère et une condition équilibrée de ladite charge sont détectées, le moteur (M) est autorisé à atteindre la vitesse d'essorage maximale (1400 tr/min).

9. Procédé selon une ou plusieurs des revendications précédentes, caractérisé en ce que, lorsqu'une charge non sévère et une condition déséquilibrée de ladite charge sont détectées, le moteur (M) est également autorisé à atteindre la vitesse d'essorage maximale (1400 tr/min).

10. Procédé selon la revendication 1, caractérisé en ce que l'entité relative à la charge de linge est déterminée par :

- l'analyse de la durée et du nombre de restaurations du niveau de fluide dans la cuve de lavage qui ont été réalisées sous commande d'un commutateur de pression d'un premier niveau, et, ou bien,
- la mesure de la puissance absorbée par le moteur de la machine pour lancer le tambour contenant le linge à laver, et, ou bien
- la mesure de la puissance nécessaire pour faire passer d'un premier état d'inertie, qui est défini par une vitesse déterminée du tambour de la machine, à un deuxième état d'inertie, qui est défini par une vitesse différente de ce même tambour.

11. Machine à laver et, ou bien, à sécher le linge, comprenant tous les éléments fonctionnels connus, notamment un tambour entraîné par un moteur (M), un dispositif (T) produisant un signal qui est représentatif de la vitesse atteinte par le moteur (M) ou le tambour, et un dispositif de commande électronique (D, MP), qui met en oeuvre les procédés selon une ou plusieurs des revendications précédentes.

12. Machine à laver et, ou bien, à sécher le linge selon la revendication 11, caractérisée en ce que ledit dispositif de commande électronique comprend un microrégisseur (MP) auquel sont associés un moyen de mémorisation permanente (ROM) et un moyen de mémorisation où l'on peut lire et écrire (RAM).

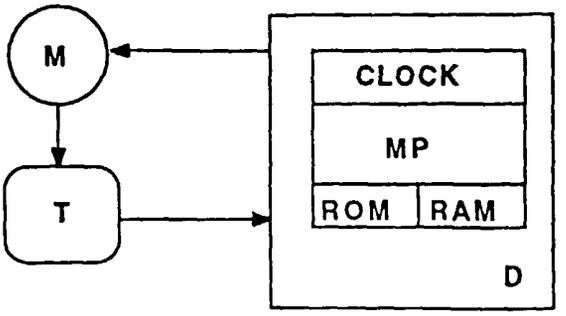


FIG. 1

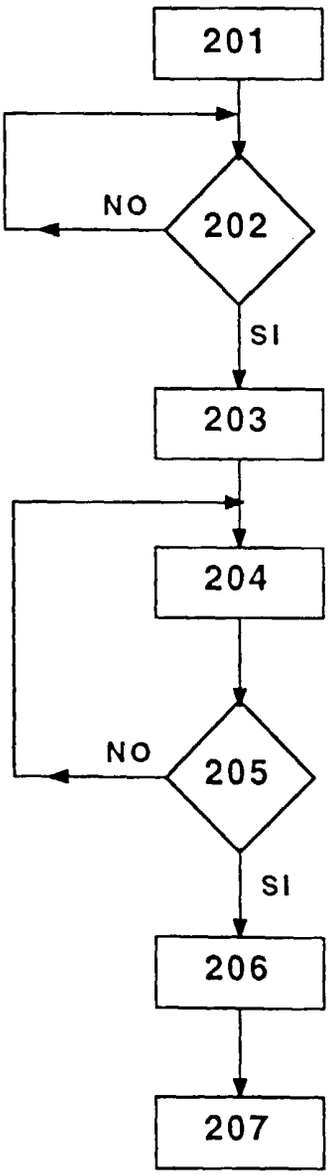


FIG. 7

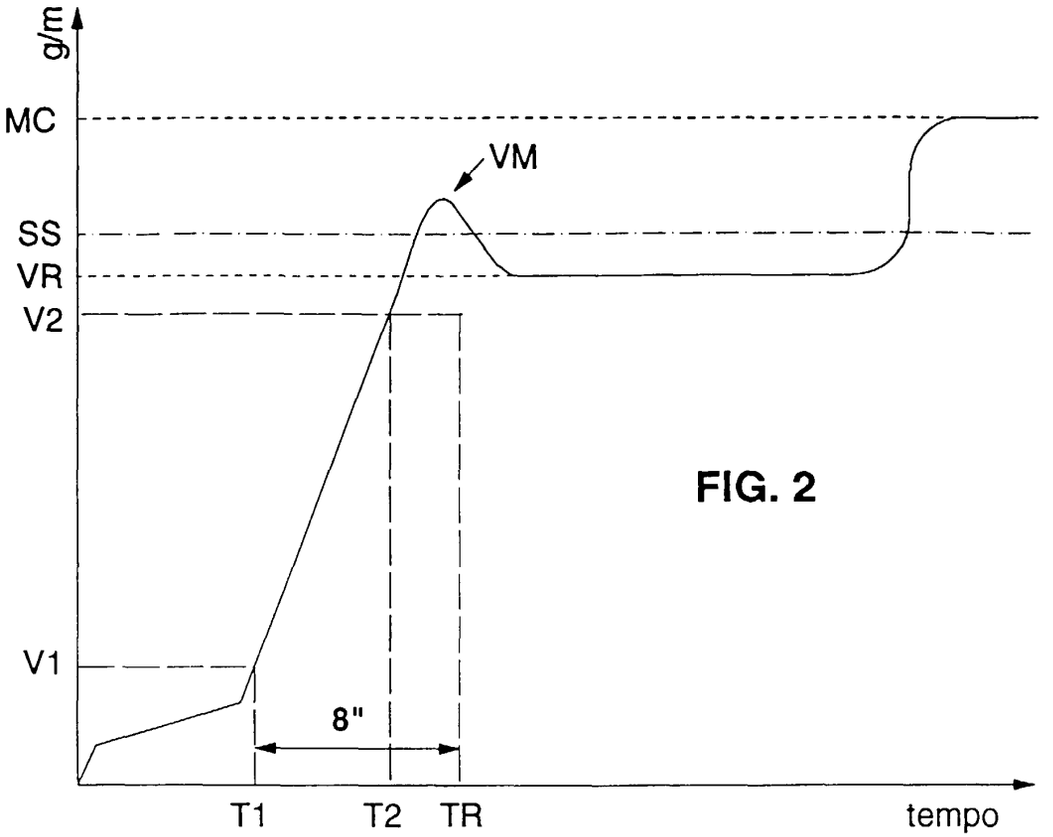

g/m
MC
VM
SS
VR
V2
V1
8"
T1
T2
TR
tempo

FIG. 2

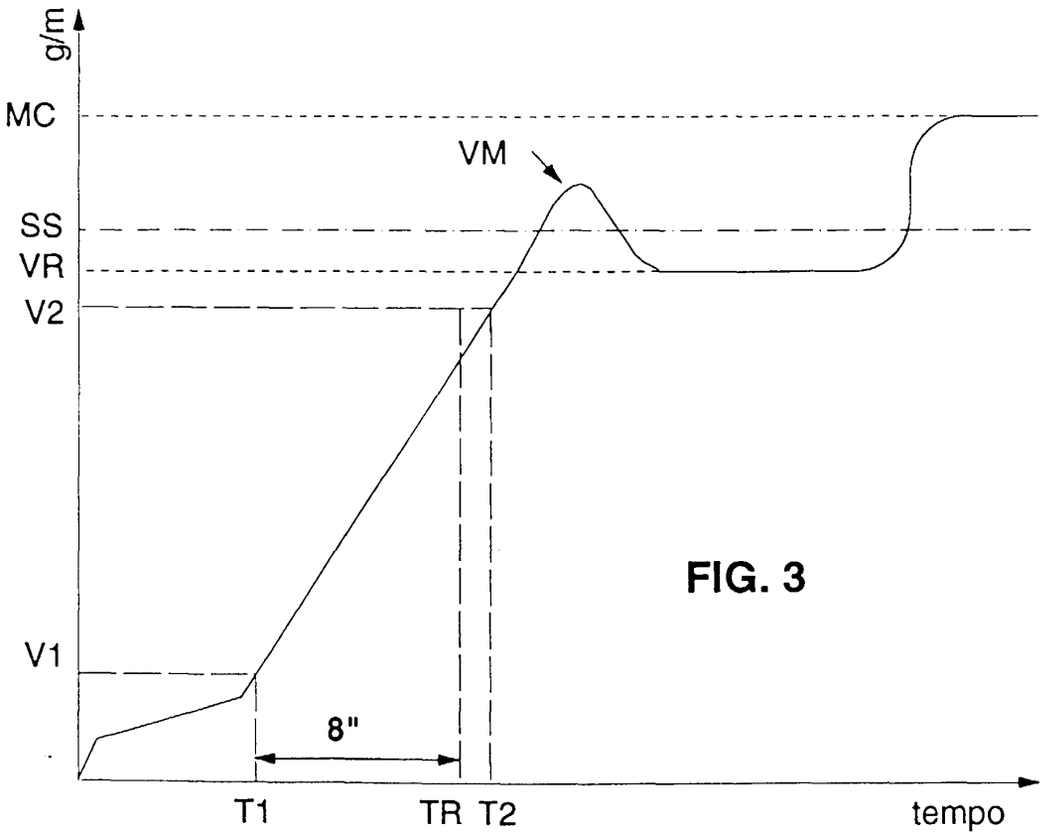

g/m
MC
VM
SS
VR
V2
V1
8"
T1
TR
T2
tempo

FIG. 3

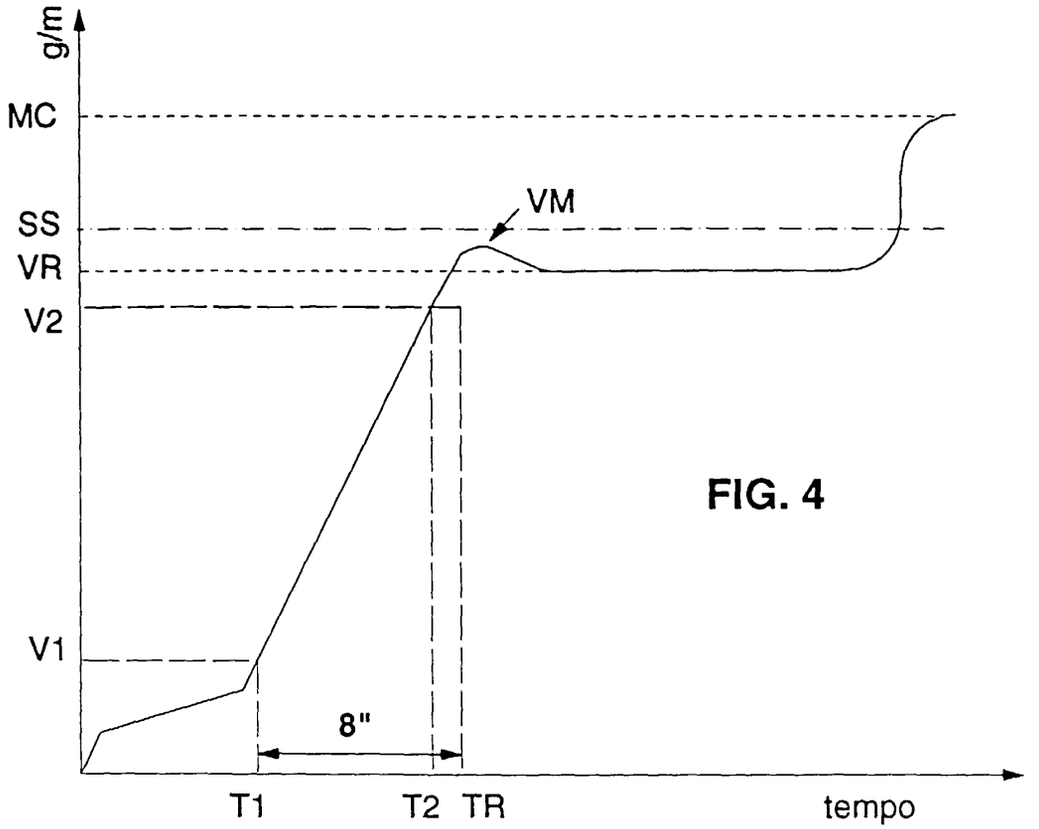

g/m
MC
SS
VR
V2
V1
VM
8"
T1
T2
TR
tempo

FIG. 4

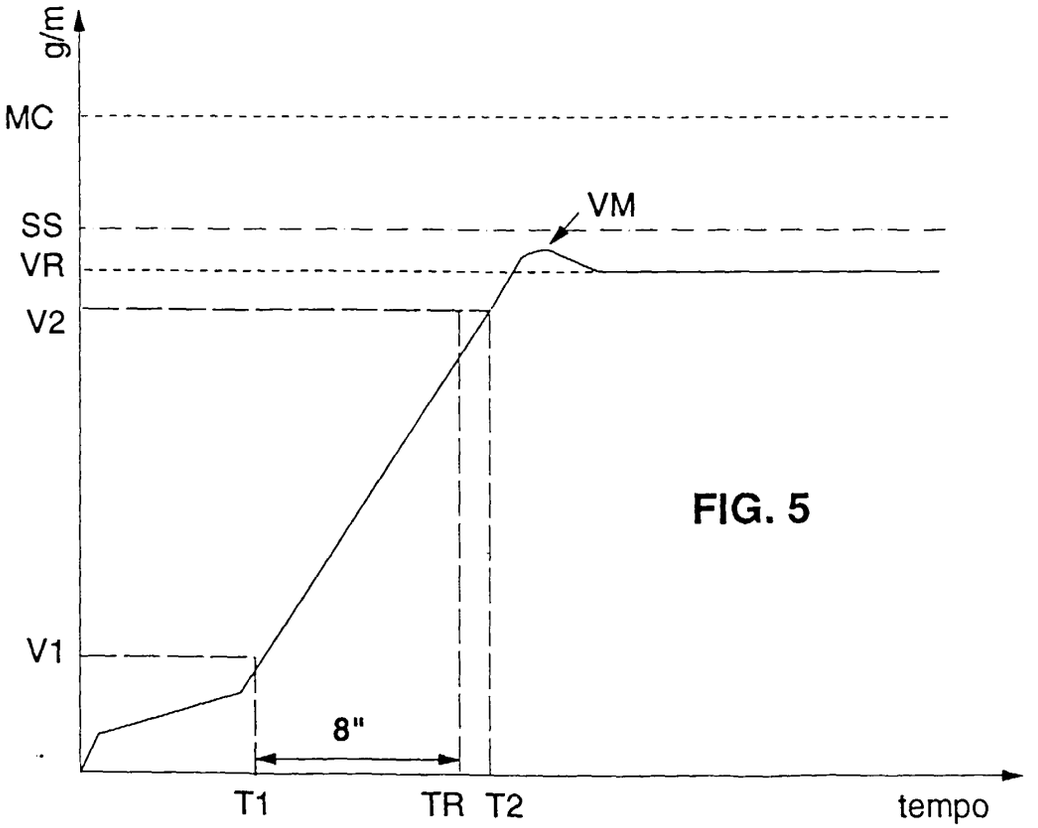

g/m
MC
SS
VR
V2
V1
VM
8"
T1
TR
T2
tempo

FIG. 5

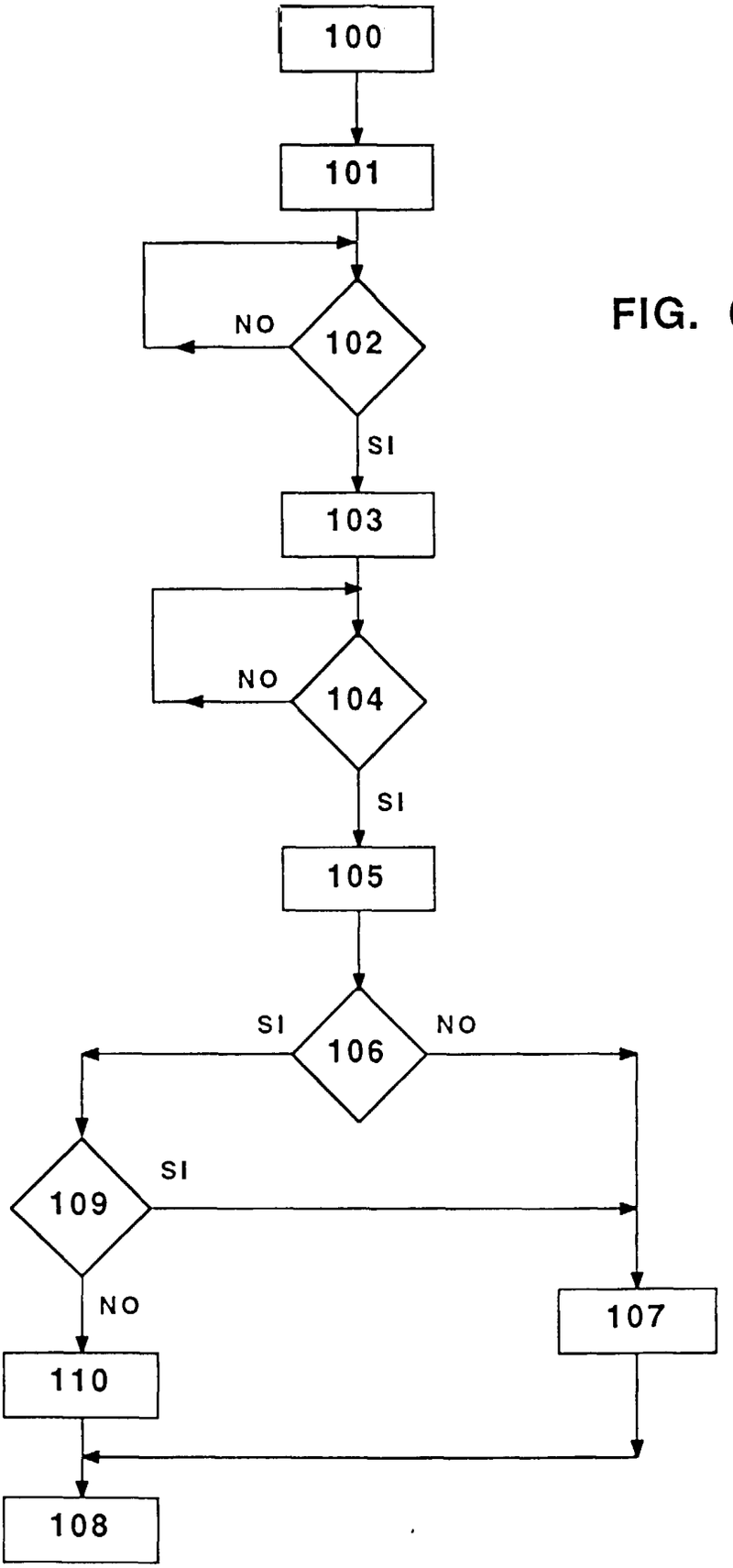


FIG. 6