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

(11) Publication number: **0 581 053 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **93110658.7**

(51) Int. Cl.5: **D06F 37/20**

(22) Date of filing: **03.07.93**

(30) Priority: **07.07.92 IT TO920568**

(43) Date of publication of application:
02.02.94 Bulletin 94/05

(84) Designated Contracting States:
DE FR GB

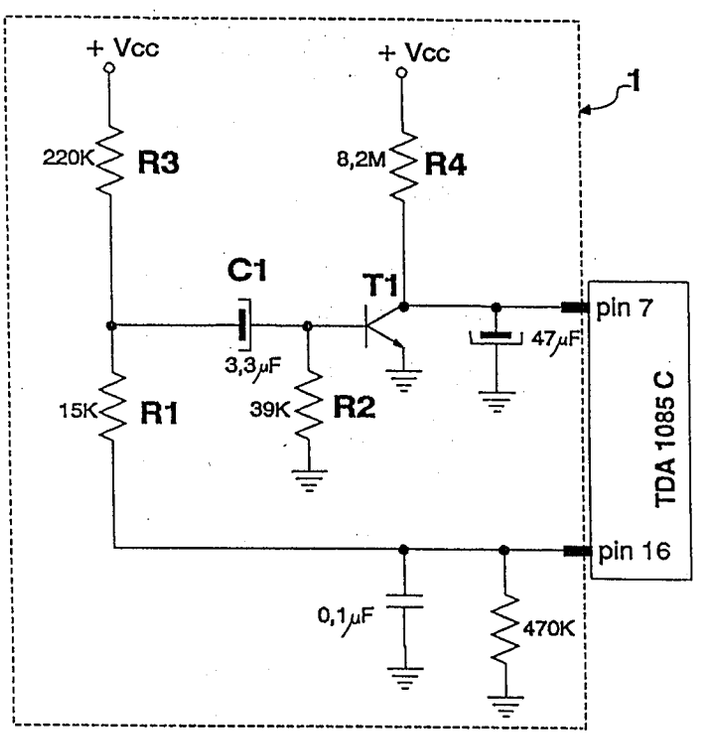
(71) Applicant: **MERLONI ELETTRODOMESTICI S.p.A.**
Viale Aristide Merloni, 45
I-60044 Fabriano (AN)(IT)

(72) Inventor: **Possanza, Mauro**
Via Dante 71/D
I-60044 Fabriano (AN)(IT)

(54) Washing machine with improved device for preventing vibrations.

(57) A washing machine is described, in particular a laundry washing machine, comprising a drum, in which the garments to be washed are arranged, made to rotate by means of an electric motor, supplied by a control device, including an active control block, comprising a signal amplifier circuit and a threshold comparator circuit, which in presence of an uneven distribution of the load, provides for reducing the rotation speed of the drum; the characterising principle of the invention is that said active block is realized with a single transistor (T1).

FIG. 2



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The present invention refers to a washing machine, in particular a laundry washing machine, comprising a drum, in which the garments to be washed are arranged, made to rotate by means of an electric motor, supplied by a control device, including an active control block, which comprises a signal amplifier circuit and a threshold comparator circuit, that in presence of an uneven distribution of the load, provides for reducing the rotation speed of the drum.

It is well known that washing machines, in particular laundry washing machine, have the problem that, in presence of an uneven distribution of the load to be washed, drawbacks can occur during the spinning phase, such as noise, jumping movements of the machine, damagings to the machine itself or to other surrounding furniture; for these reasons an inefficient spinning is obtained, inasmuch the machine is not able to reach the provided rotation speed.

Usually, so as to avoid these problems, a so-called distribution phase is provided, after which the spinning phase is launched; this is not always sufficient to avoid uneven distributions.

Protection devices are known, equipped with devices for revealing uneven distribution, that cut the current supplied to the motor in case of uneven distribution (for example see French patent n. 2 489 384), or that reduce the voltage of the current (for example see English patent n. 2 174 513).

These control devices normally include an integrated circuit, for example of the TDA 1085C type, that provides to electronically control the speed of the motor; for obtaining the protection against the uneven distribution, it is customary to take from such an integrated circuit, a signal, represented by a control voltage, that is of d.c. type, to which, in presence of uneven distribution, an alternate component (ripple) is overlapped, whose amplitude is proportional to the entity of the uneven distribution.

The alternate component of the taken signal is passed to an active block, comprising a signal amplifier circuit, a rectifier element and a threshold comparator circuit, whose threshold determines the intervention level of the system; a trimmer allows for defining the limit threshold of the uneven distribution, above which the system is active in reducing the speed.

For example, in such a way, during the distribution phase of clothes (that always occurs before any spinning phase) the uneven distribution is reduced by means of several actions of quick reduction of drum speed (typically from about 90 rev/min to about 45 rev/min) and immediate restoring actions, avoiding to carry out the subsequent spinning phase if the uneven distribution has not been brought under a certain acceptable maximum level.

The active block in question is usually realized utilizing two operational amplifiers, or some transistor, typically four, polarized in a way so as to realize the above mentioned amplifier circuit and threshold circuit.

The aim of the present invention is that of indicating an active block very simple, of reduced cost if compared to those known, but equally efficient.

For allowing such aims the present invention has as its object a washing machine, in particular a laundry washing machine, comprising a drum, in which the garments to be washed are arranged, made to rotate by means of an electric motor, supplied by a control device, including an active control block, which comprises a signal amplifier circuit and a threshold comparator circuit, that in presence of an uneven distribution of the load, provides for reducing the rotation speed of the drum, characterized in that said active block is realized with a single transistor.

Further aims and advantages of the present invention will result in being clear from the detailed description which follows and from the annexed drawings, given as a non limiting example, wherein:

- in figure 1 the diagram of the control device of a laundry washing machine is represented, being of a known type;
- in figure 2 the diagram of the control device of a laundry washing machine, according to invention, is represented.

The invention is based on the acknowledgement of the fact that, from exhaustive tests practically carried out, an active block, composed by only one transistor, and by some passive components, results in being fully sufficient to realize the required amplifier, detector and threshold comparator functions; furthermore, due to the circuit simplicity, it is avoided the necessity of providing the adjusting trimmer, for compensating the variability of the characteristics of the playing components; it can be stated that obviously a technical prejudice had existed, that has prevented since now the designers to recognize that a single transistor is sufficient for the needs.

With reference to figure 1, wherein the diagram of the control device of a laundry washing machine, of known type, is represented, four transistors (TA, TB, TC, TD), one diode, fifteen resistances, three capacitors and one adjusting trimmer can be noted, for a total of twenty-four components.

In figure 2, the diagram of the control device of a laundry washing machine, according to invention, is represented.

As it can be seen from figure 2, the circuit according to invention includes only one transistor (T1), five resistances and three capacitors, for a

total of nine components.

Both the circuits are connected between pin 16 and pin 7 of the integrated circuit TDA 1085C, that realizes the motor speed control functions.

For further information on the way of operating of such an integrated circuit, reference can be made to the "Data Sheet" published by the manufacturer.

As already said, on pin 16 a d.c. signal (control signal) is present, onto which an alternated signal (ripple) is overlapped, whose amplitude is proportional to the entity of the uneven distribution, said alternated signal being detected starting from the modulation present in the signal generated by a tachometric dynamo, also not represented in the figures, keyed on the motor shaft, said modulation being caused by the decelerations and accelerations of the washing-machine drum, caused by the eccentricity of the uneven distributed load. Such alternated signal represents the input signal of the active block represented in figure 2.

The output of the active block 1 acts on pin 7 of said integrated circuit, reducing the motor speed whenever the signal exceeds a determined threshold level.

The transistor T1 of the active block 1 according to invention is a silicon transistor of the type N-P-N (for example BC 238, or BC 338, or BC 550) and does not operate in linear conditions, but in on/off conditions, i.e. it operates simply as a switch; the comparator function is assured due to the characteristic of a silicon transistor to enter in conduction when its base is excited with a signal greater than about 600 millivolts.

The amplification function is included in the natural functioning of a transistor, when the transistor conducts, i.e. when the above indicated threshold is passed.

The input signal is taken from pin 16 of the integrated circuit TDA 1085C, by means of a signal divider, represented by two resistances R1 and R2, that ensures the correct signal amplitude, i.e. the correct intervention threshold of the transistor; the signal pass then through a differentiating circuit, formed by C1 and R2, for allowing the passage in the direction of the base of the transistor of the sole alternate component of the signal, which is that whose amplitude is proportional to the uneven distribution.

It has been experimentally verified that the normal tolerances of R2 and C1 (-20%, +50%) do not represent a critical factor (the threshold remains included between deviation values of 15% in more or in less).

Also the gain tolerances of the transistor are not critical (transistors with values of Hfe from a minimum of 53 to a maximum of 363 have been tested, with negligible variations of intervention; in fact the value of Hfe influences the speed but not the intervention threshold, that it is instead bound up to the conduction threshold, which has good repeatability characteristics).

The output of the active block according to invention is practically of the type "open collector", due to the high value of the resistance R4, and is connected to the cited pin 7 of the integrated circuit TDA 1085C.

The characteristics of the described washing machine are clear from the given description and from the annexed drawings.

From the given description are also clear the practical advantages of the washing machine object of the present invention.

In particular the described washing-machine allows for obtaining a noticeable reduction of costs if compared to those known, provided that it is able to carry out with a single transistor three functions.

It is clear that many changes are possible for the man skilled in the art, to the washing machine described as an example, without departing from the novelty principles inherent to the invention; all the components shown can be replaced with technical equivalent.

Claims

1. Washing machine, in particular a laundry washing machine, comprising a drum, in which the garments to be washed are placed, made to rotate by means of an electric motor, supplied by a control device, including an active control block, comprising a signal amplifier circuit and a threshold comparator circuit, that in presence of an uneven distribution of the load, provides for reducing the rotation speed of the drum, characterized in that said active block is realized with a single transistor (T1).

2. Washing machine, according to claim 1, characterised in that said transistor (T1) of the active block does not works in linear conditions, but in on/off conditions, i.e. it operates simply as a switch.

3. Washing machine, according to claim 1, characterised in that the comparator function is assured due to the characteristic of a transistor (T1) to enter in conduction when its base is excited with a signal greater than a defined threshold (600 millivolts).

4. Washing machine, according to claim 1, characterised in that said transistor is a silicon transistor (T1).

5. Washing machine, according to claim 1, characterised in that the input signal of for said active block is taken from a pin (16) of an integrated circuit (TDA 1085C) that realizes the function of controlling the motor speed, by means of a signal divider (R1,R2), that assures the correct signal amplitude, i.e. the correct intervention threshold of said transistor (T1).

6. Washing machine, according to claim 5, characterised in that said input signal reaches to the control electrode of said transistor (T1) through a differentiating circuit (C1,R2), for allowing the passage in the direction of said electrode of the sole alternate component of the signal.

7. Washing machine, according to claim 5, characterised in that said divider is represented by two resistances (R1,R2).

8. Washing machine, according to one or more of the previous claims, characterised in that said transistor (T1) is connected in common emitter configuration.

9. Washing machine, according to claim 5, characterised in that the output of said active block is connected to a pin (7) of said control integrated circuit (TDA 1085C), which is in particular of the TDA 1085C type.

10. Washing machine, according to claim 1, characterised in that said transistor (T1) of the active block also carries out the function of detector circuit.

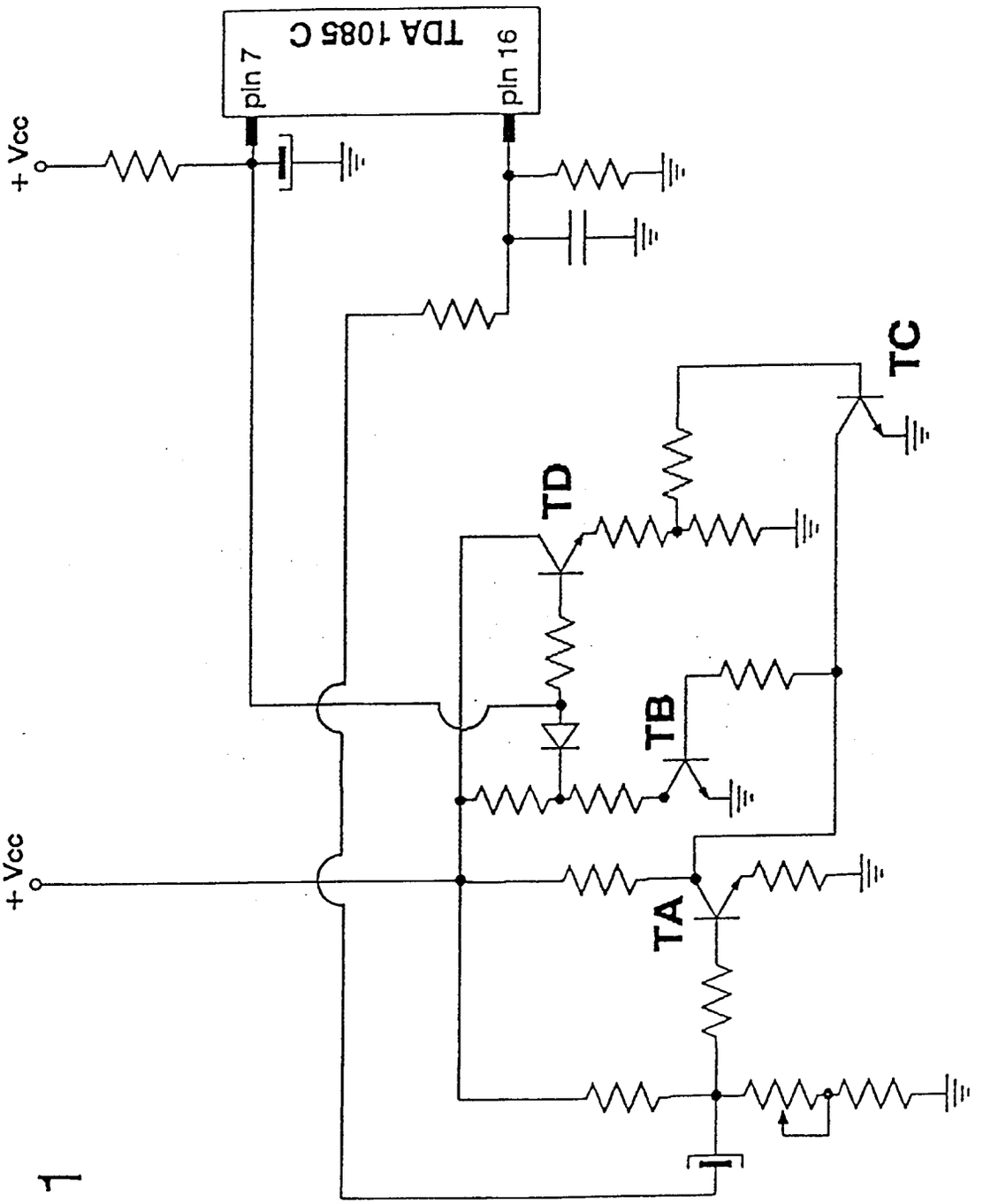

FIG. 1

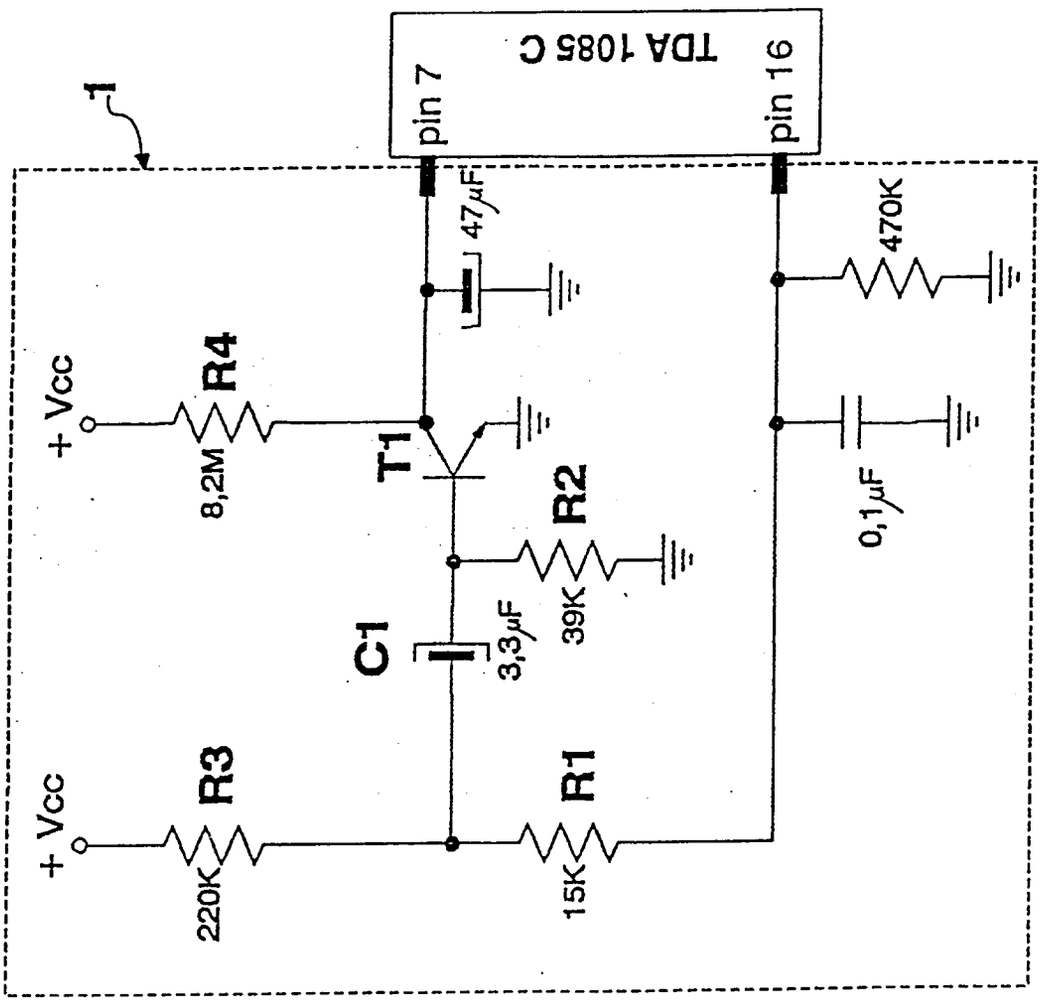
1
TDA 1085 C
pin 7
pin 16
47µF
470K
+ Vcc
R4
8,2M
T1
R2
39K
C1
3,3µF
0,1µF
+ Vcc
R3
220K
R1
15K

FIG. 2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 11 0658

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
A,D	FR-A-2 489 384 (ESSWEIN SA.) * claims 1-11; figures 1-3 *	1-10	D06F37/20
A	US-A-4 765 161 (AMERICAN LAUNDRY MACHINERY) * abstract; figures *	1	
A	FR-A-2 496 136 (CONSTRUCTIONS ELECTRO-MECANIQUES D'AMIENS) * claims; figures *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	20 October 1993	COURRIER, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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