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(54) **Washing machine with means for preventing vibrations.**

(57) The present invention relates to a washing machine, in particular for clothes, comprising a drum, in which the garments to be washed are placed, made to rotate by means of an electric motor, fed by a regulation device, characterised by the fact that, said regulation device includes a control system , that in the presence of an uneven distribution of the load, provides for the synchronisation of the instant in which the spinning phase is started with the instant in which the uneven load is in such an angular position that the action of gravity favours the increase of the rotation speed of the drum.

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The present invention relates to a washing machine, in particular for clothes, comprising a drum, in which the garments are placed, made to rotate by means of an electric motor, fed by a regulation device. It is known that washing machines, and in particular those for clothes, present a problem that, in the presence of an uneven distribution of the the load to be washed, it can occur, during the spinning cycle, inconveniences such as noise, jumping movements of the machine, damage being made to the machine itself or to surrounding furniture, in as much that the machine is not able to reach the spin speed necessary.

Usually, so as to avoid these problems, a so called distribution phase is provided, after which the spinning phase takes place; this is not always sufficient however in avoiding an uneven distribution.

There are known protection devices, provided with a device for detecting uneven distribution, that cut the current supplied to the motor in cases of unbalancing (for example note French patent N° 2 289 384), or that reduce the tension of the current (for example note English patent N° 2 174 513).

Some manufacturers carry out two or three attemps to make the machine starte its spinning cycle; if these attemps result in being negative, the machine stops.

Naturally this is a serious inconvenience.

The invention is based on the knowledge of these facts; the aim of the present invention is to indicate a simple but efficient control system for avoiding the mentioned inconveniences.

In allowing for such aims the present invention has as its object a washing machine, in particular for clothes, comprising a drum, in which the garments are placed, made to rotate by means of an electric motor, fed by a regulation device, characterised by the fact that said regulation device includes a control system, that in the presence of an uneven distribution of the load, provides for the synchronisation of the instant in which the spinning phase is started with the instant in which the uneven load is in such an angular position that the action of gravity favours the increase of the rotation speed of the drum.

Further aims and advantages of the present invention will become clear from the detailed description that follows and from the annexed drawings provided as a non limiting example, wherein;

figure 1 represents the diagram of the device for the regulation of the motor speed of a washing machine, according to the invention;

figure 2 represents in detail the diagram of the anti-uneven distribution system of the control device represented in figure 1;

figure 3 represents the course of two voltages detected on the control circuit of figure 1;

in figure 4 the values detected on a known circuit have been filed, during the various phases of the cycle, along with the results of the sixteen tests of starting the spinning;

in figure 5 the values detected on the circuit according to the invention have been filed, during the various phases of the cycle, along with the results of the sixteen tests of starting the spinning. With reference to figure 1, in which the diagram of the device for the regulation of the motor speed of a washing machine, according to the invention is represented, it is to be noted:

- to the left a series of 12 joining terminals to the other parts of the machine, and in particular to the input line of the electrical network, to the turning motor (M) of the drum, to the dynamo tachometer (D) and to the programmer, or timer (T);
- to the upper right a triac (T1) that regulates the motor input, in accordance with the control signal that is received at its control electrode by means of the resistance R2;
- to the centre an integrated circuit (IC1), of the TDA 1085C type by the Motorola company, that has a control function, comparing the voltage received from the dynamo tachometer D and from a controlled resistance network of the timer T;
- to the centre again, below the integrated circuit, a block, distinguished with the symbol AS is noted, that encloses the anti-unbalancing system of the invention.

The timer T generates the commutations for changing the speed from washing to distribution (higher than that of the washing) and from distribution to spinning (even higher); this occurs substantially by varying the voltages to the pins 5 and 6 of the integrated circuit IC1. In particular for starting the spinning the relationship between the voltages of the pins 6 and 4 is important.

The circuit of figure 1 is not herein described in greater detail, in as much as it is part of block AS, of a conventional type and known to the man skilled in the art.

Figure 2 represents in greater detail the diagram of the anti-unbalancing system of the control device represented in figure 1; it is comprised of four operational amplifiers, distinguished with the symbols A, B, C and D; being equal between themselves and all contained in an integrated circuit of the LM 339 type.

To the left of the figure five terminals are visible, distinguished with the numbers 16, 5, 6, 8 and 9; these corrisponding to the pins of equal numeration of the C.I. TDA 1085C.

pin 8 is connected to the mass (negative pole) of the circuit; the continuous voltage of input is

present on pin 9, of approximately +15 Volt.

The out of balance signal is taken from pin 16 of the TDA 1085 (ring voltage control); in the case of an uneven load pin 16 is provided with a voltage oscillating component (note fig. 3) as the power required of the motor for overcoming the uneven weight varies according to the angular position of said load; during the phase in which the weight is in ascent, the power required is obviously greater than that required during the descent.

The out of balance signal is taken to the non inverting input of a stage amlifier formed by section B of the integrated LM 339, that serves as a pilot for the stage amplifier D of the same integration. Section D receives at its non-inverting input a fixed threshold voltage of 13,6 volt established by the potential divider made up from the resistences of 68k and 560k; and to its inverting input the output signal of section A.

The voltage levels in the presence of an unbalanced load are such that sections C and D are with a high output.

From the pin 5 of the TDA 1085C a signal is withdrawn that is taken to the inverting input of section A and compared to a fixed threshold voltage of 0,9 volt present on the non-inverting terminal of the amplifier itself, and established by the potential divider made up from the resistences 68K and 4,3K (this threshold serves in discriminating between washing phases, in which the voltage of pin 5 is lower than 0,9 V. and successive phases, in which it is greater). The output signal of section A comes from the inverting input of section C, while on the non inverting terminal of the same section the same threshold voltage of 0,9 volt is present.

The output voltage levels of sections C and D normally hold, in the distribution phase and in the presence of unbalancing, pin 6 of the integrated TDA 1085C at such a level that the motor can not be launched to the spinning speed; only during the moment in which the voltage of pin 16 is at its maximum, i.e. the instant in which the load is at its highest point (superior dead point), the stage amplifier D of the LM 339 goes with a low output and, working as an AND gate, and also pushes to zero the output of stage C; pin 6 of the TDA 1085 can as a consequence pass to a lower voltage level than that of pin 5, a result of which being that the motor can be launched into spinning.

The resistences of 10K, 15K and 27K on the output of the amplifiers, are "pull up" resistences, indispensable for the working of the comparator LM 339; the diode 1N4148 between the pins 2 and 5 of the LM 339 introduces a hysteresis, preventing the output of section A having influence on the input, but allowing for the opposite condition. The output of the amplifiers C and D are connected to the terminal T8 of the timer; for a clearer understanding of the the functioning, in figure 2 the resistence R19 has been represented using dotted lines, of the diagram of figure 1, by means of which the mentioned outputs result in being connected to pin 6 of the TDA 1085.

Figure 3 represents the course of two voltages detected on the control circuit of figure 1; to be more exact, the superior part of the figure represents the course of voltage on pin 16 of the TDA 1085, while the lower part of the same figure represents the course of voltage on pin 6 of the same.

Two instants are represented below the figure: the instant t1 corresponds to the instant in which the timer consents the spinning phase; the instance t2 corresponds to the instant of the effective beginning of such phase.

Infact it is noted that the voltage of pin 6 remains high even after instant t1, in as much that the voltage of pin 16 is low; only when the voltage of pin 16 (instant t2, load at upper dead point) the voltage at pin 6 can lower, thus starting the spinning phase. In figure 4 the time and voltage values and the revolutions of the motor have been filed, detected on a washing machine of a known type during the various phases of the cycle (washing, distribution, spinning), in three load conditions: zero load, a first load unevenly distributed (900 grms), a second load (1850 grms) unevenly distributed.

Below are also included the results of the sixteen tests of starting spinning, eight with the first load and eight with the second load; of the sixteen trials with an unevenly distributed load, only three had positive results.

In figure 5 the time and voltage values and the revolutions of the motor have been filed, detected on a washing machine incorporating the control system of unbalancing according to the invention, during the same phases of the cycle as in figure 4 and with the same three load conditions.

Below are also included the results of the sixteen tests of starting spinning, eight with the first load and eight with the second load; all of the sixteen trials with an unevenly distributed load had positive results.

The invention is based on the consideration that the inconveniences take place with an unbalanced load when the rotation speed is the same as the resonance speed of the system; the fact of starting the spinning the instant in which the load is at its highest obtains, with the aid of gravity, the facilitating of gaining the speed of the system, thus allowing to overcome the critical speed, taking advantage of the inertia of the unit.

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

From the description the practical advantages

of the washing machine, object of the present invention also become clear.

In particular, the described washing machine allows for the obtaining of a higher level of dependability in starting the spin phase, thus avoiding the risk of causing damage and having to repeat the operation several times.

It is also clear that numerous variants are possible to the washing machine described as an example, by the man skilled in the art, without however departing from the novelty principles inherent in the invention.

Claims

1. Washing machine, in particular for clothes, comprising a drum, in which the garments to be washed are placed, made to rotate by means of an electric motor, fed by a regulation device, characterised by the fact that said regulation device includes a control system (AS), that in the presence of a balancing of the load, provides for the synchronisation of the instant in which the spinning phase is started with the instant (t2) in which the uneven load is in such an angular position that the the action of gravity favours the increase of the rotation speed of the drum.

2. Washing machine, according to claim 1, characterised by the fact that in said instant (t2) the unbalanced load is to be substantially found at the upper dead point.

3. Washing machine, according to claims 1 or 2, characterised by the fact that said control system (AS) comprises means (A, B, C, D) that prevent the launching of the spinning phase until instant (t2) in which the unbalanced load is to be found in said angular position.

4. Washing machine, according to claim 3, characterised by the fact that said prevention means (A, B, C, D) keeps the voltage of control of the regulation device (IC1) at such a level that it does not permit the motor to reach the spin speed before said instant (t2).

5. Washing machine, according to claim 3, characterised by the fact that said prevention means comprise an AND gateand two inputs (C, D), to which indicative signals relating to the rotation speed (V5) and the angular position of the load (V16) are applied, so as that the passage to a speed higher than a determined value can take place only when the load is to be found in a determined angular position.

6. Washing machine, according to claim 5, characterised by the fact that said indicative signal of the angular position of the load (V16) is supplied by means (IC1) sesitive to the instantaneous load that the turning motor must undertake.

7. Washing machine, according to claim 3 or 4, characterised by the fact that said prevention means comprise operational amplifiers (A, B, C, D).

8. Washing machine, according to claim 1, characterised by the fact that said regulation device comprises an integrated circuit (IC1).

9. Washing machine, according to claim 7, characterised by the fact that said operational amplifiers (A, B, C, D) are contained in an integrated circuit (LM 339).

10. Washing machine, according to claim 9, characterised by the fact that said integrated circuit (IC1) is of the TDA 1085C type.

11. Washing machine, according to claim 7, characterised by the fact that the output of two of said operational amplifiers (C, D) remains high until said instant (t2) and therefore, after said instant (t2) passes low.

12. Washing machine, according to claim 7, characterised by the fact that the output of two of said operational amplifiers (C, D) are connected to pin 6 of said integrated circuit (TDA 1085C).

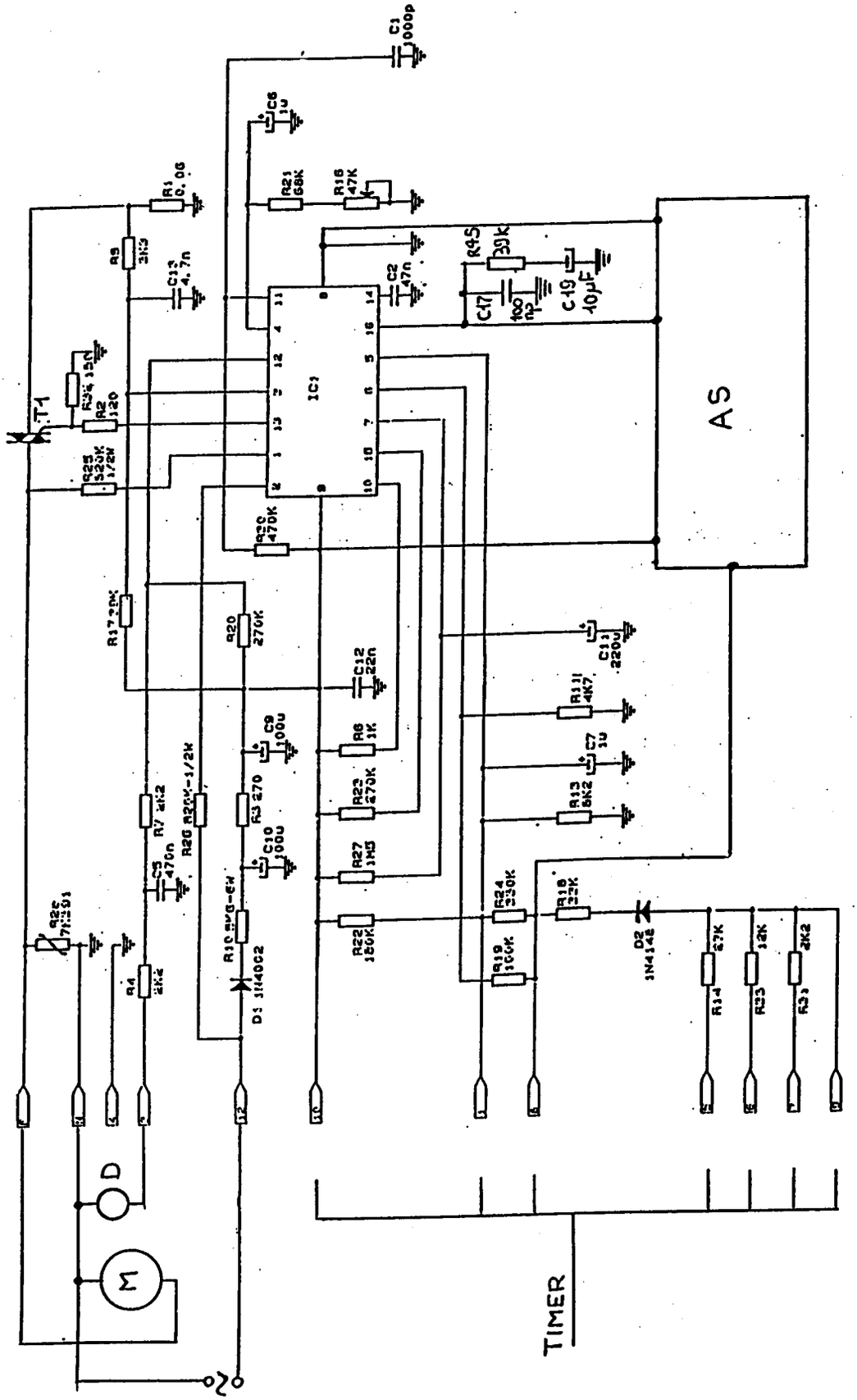
C1 1000p
C6 1u
R1 0.06
R21 68K
R16 47K
R5 3K3
C13 4.7n
C2 47n
R45 39k
C17 100 n2
C19 40µF
IC1
AS
T1
R34 15n
R2 120
R25 520K 1/2W
R30 470K
R17 22K
R20 270K
C12 22n
C11 220u
R11 4K7
C7 1u
R13 8K2
C9 100u
R6 1K
R23 470K
R3 270
C10 100u
R7 2K2
R26 R26K-1/2W
C5 470n
R27 1M5
R24 220K
R18 33K
R22 150K
R19 100K
D2 1N4148
R14 27K
R33 12K
R31 2K2
R4 2K2
R10 8K2-6W
D1 1N4002
R25 TH391
D
Σ
TIMER

Fig. 1

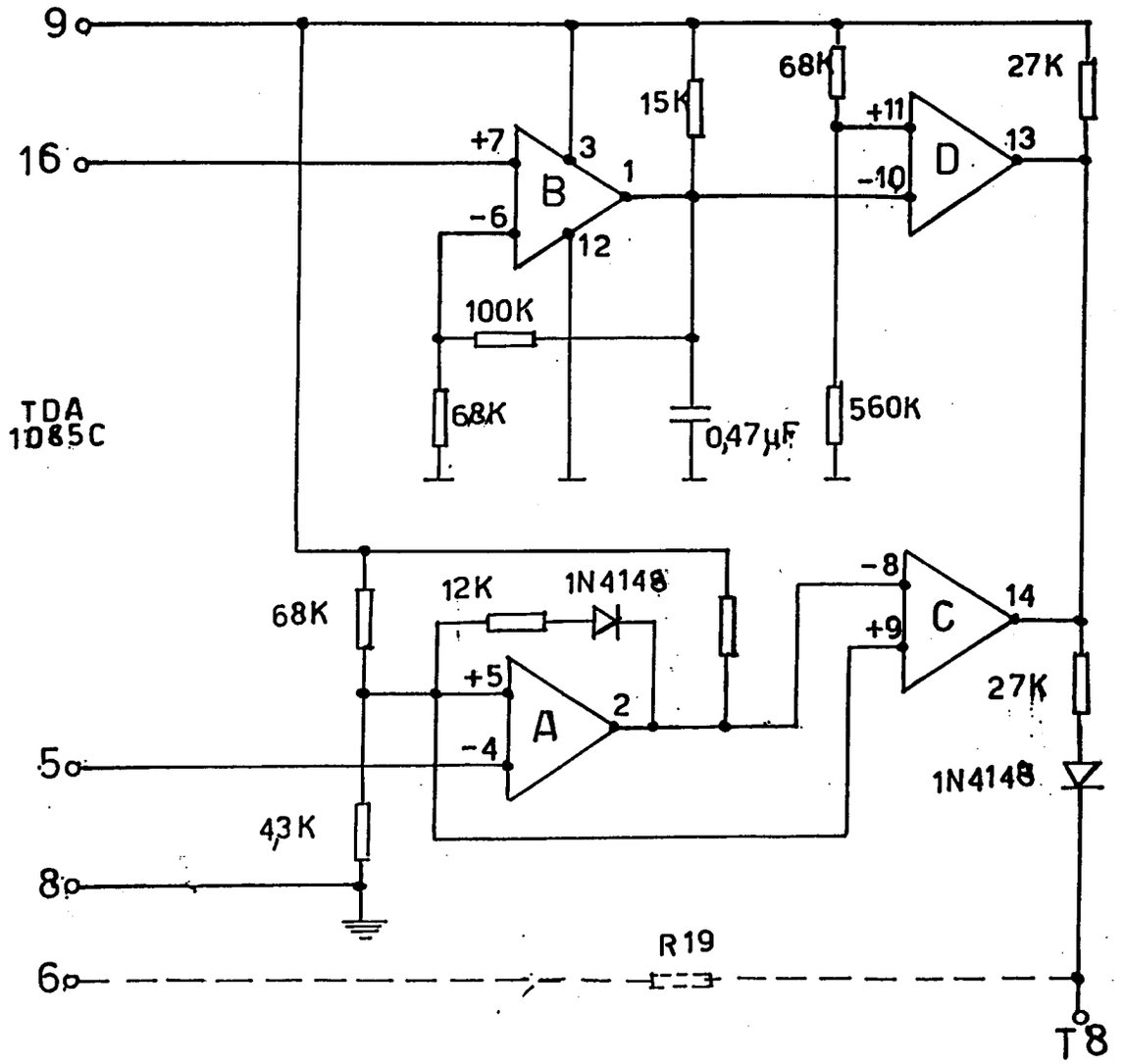
9
16
5
8
6
TDA
1085C
+7
-6
B
3
1
12
15K
68K
27K
+11
-10
D
13
100K
68K
0,47µF
560K
68K
12K
1N4148
+5
-4
A
2
-8
+9
C
14
27K
1N4148
43K
R19
T8

Fig. 2

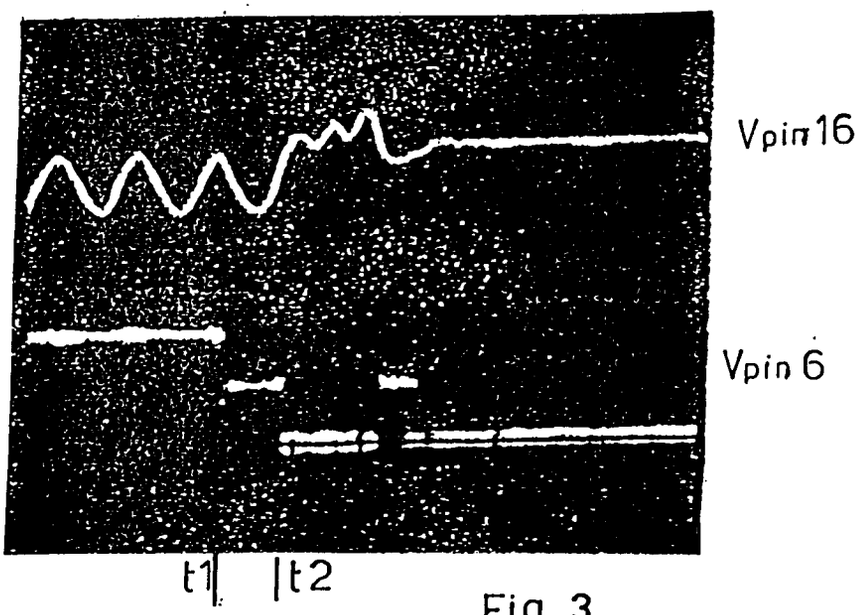
Vpin 16
Vpin 6
t1
t2

Fig. 3

	SENZA CARICO				CARICO 1				CARICO 2			
	V. 5	V. 6	T sec.	GIRI	V. 5	V. 6	T sec.	GIRI	V. 5	V. 6	T sec.	GIRI
LAVAGGIO	0,652	0,015		52,6	0,654	0,015		52,6	0,653	0,016		52,6
DISTRIBUZIONE	1,022	0,705	6	86	1,023	0,706	6	86	1,025	0,708	6	86
DISTRIBUZIONE/CENTRIF.	4,19	0,498	1	132	4,19	0,498	1	132	4,20	0,499	1	132
DA STOP A CENTRIFUG.	4,19	0,498	12	132	4,19	0,498	12	132	4,20	0,499	15	132

N°	ESITO PROVE LANCIO CENTRIFUGA	
1	NEGATIVO	POSITIVO
2	NEGATIVO	POSITIVO
3	NEGATIVO	POSITIVO
4	NEGATIVO	NEGATIVO
5	NEGATIVO	NEGATIVO
6	NEGATIVO	NEGATIVO
7	NEGATIVO	NEGATIVO
8	NEGATIVO	NEGATIVO

Fig. 4

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	SENZA CARICO				CARICO 1				CARICO 2			
	V. 5	V. 6	T sec.	GIRI	V. 5	V. 6	T sec.	GIRI	V. 5	V. 6	T sec.	GIRI
LAVAGGIO	0,657	0,015		52,6	0,657	0,015		52,6	0,657	0,015		52,6
DISTRIBUZIONE	1,027	0,708	5	86	1,027	0,708	5	86	1,027	0,709	6	86
DISTRIBUZIONE/CENTRIF.	4,16	0,391	2,5	132	4,16	0,392	0÷1	132	4,16	0,392	0÷1	132
DA STOP A CENTRIFUG.	4,16	0,391	12	132	4,16	0,392	7	132	4,16	0,392	8	132

N°	ESITO PROVE LANCIO CENTRIFUGA	
1	POSITIVO	POSITIVO
2	POSITIVO	POSITIVO
3	POSITIVO	POSITIVO
4	POSITIVO	POSITIVO
5	POSITIVO	POSITIVO
6	POSITIVO	POSITIVO
7	POSITIVO	POSITIVO
8	POSITIVO	POSITIVO

Fig. 5

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EUROPEAN SEARCH REPORT

Application Number

EP 92 10 0263

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)
X A	EP-A-0 349 798 (MIELE & CIE. GMBH.) * column 2, line 26 - line 32; figures * * column 4, line 25 - column 5, line 22 *	1,3-5 6-12	D06F37/20
A	GB-A-2 087 103 (BOSCH-SIEMENS HAUSGERATE GMBH)		
A,D	FR-A-2 489 384 (ESSWEIN SA.)		
A,D	GB-A-2 174 513 (HOOVER PLC)		
			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	09 APRIL 1992	COURRIER G.L.A.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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