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(54) Method for determining the quantity and/or the type of fabric introduced in a laundry washing machine, and laundry washing machine implementing such a method.

(57) A method is described, for determining the quantity and/or the type of fabric introduced in a laundry washing machine and a washing machine implementing such a method. The main feature of the described method consists in the fact that the quantity and/or the type of fabric are detected by monitoring the interventions for restoring the washing liquid level in the laundry washing machine controlled by a level sensor, in particular an electromechanical first level pressure switch.

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The present invention refers to a method for determining the quantity and/or the type of fabric introduced in a laundry washing machine, and to a laundry washing machine implementing such a method.

It is known to indirectly verify the quantity of clothes to be washed by measuring, with a turbine flow meter (of the type based on the Hall effect or infrared rays) being associated to a microprocessor, the quantity of water introduced in the laundry washing machine.

Said partial solution however has the drawback of requiring at least one costly additional components, with respect to those normally present in a laundry washing machine, with the consequent increase in cost.

Other known methods for measuring the weight of clothes in a laundry washing machine are the following:

- method of measuring the electric current (that is in relation with the torque) absorbed by the motor of the laundry washing machine, in order to place the basket with the clothes to be washed in motion;
- method of measuring the energy necessary for passing from a certain inertial state, being defined by a certain speed of the basket of the laundry washing machine, to another inertial state, being defined by a different speed of the same basket.

The measuring of the weight realised with said methods however have the drawback of being uncertain, due to the basket mass (which are of the same order as the clothes), the features of the means for transmitting the motion from the motor to the basket (i.e. the belt tension and its elastic and geometric features) and by the high dispersion of the characteristics of the motors used. Said systems therefore require the use of a motor having high features (i.e. which assures that the exerted torque is in fact proportional to the weight of the clothes) and means able to measure the current absorbed, with the consequent necessity of equipping the machine with a complex electronic control system.

Thus, in other words, said methods also have the drawback of being expensive, complex and not always reliable.

The aim of the present invention is that of indicating a method for determining the quantity and/or the type of fabric introduced in a laundry washing machine, being characterised by a great manufacturing simplicity and the absence of additional components in respect of the laundry washing machines according to the prior art.

Such an aim is reached, according to the present invention, by a method for determining the quantity and/or the type of fabric introduced in a laundry washing machine, having the characterising features of the annexed claim 1.

Further characteristics and advantages of the present invention will result in being clear from the detailed description which follows and from the annexed drawings, which are supplied purely as an explanatory and non limiting example, wherein:

- figures 1A, 1B an 1C represent the operational principle of an electromechanical pressure switch, being of common use in laundry washing machines;
- figure 2 represents a typical example of an electric circuit with places in relation the pressure switch with other components of a laundry washing machine, in particular with the water supply electrovalve and the heating resistance;
- figures 3A and 4A relate to the procedures of the "water-level-renewal operations", respectively in the case of towelling and cotton fabrics, and represent the sum of the times of the water-level-renewal operations, carried out by the first-level pressure switch (being expressed in seconds), in function of the quantity of clothes (being expressed in kg);
- figures 3B and 4B relate respectively to towelling and cotton fabrics and represent the normalised Gauss function of experimental data relating to the total sum of the times of the water-level-renewal operations carried out by the first-level pressure switch, being associated to different quantities of clothes;
- figure 5 represents the composition of figures 3A and 4A on a same scale of ordinates and abscissas, for allowing the comparison;
- figures 6 and 7 relate respectively to towelling and cotton fabrics and represent the distribution over time of different water-level-renewal operations of the first-level pressure switch or, in other words, the water supply procedure in function of time;
- figures 8, 9 and 10 relate respectively to towelling, cotton and synthetic fabrics and represent the dynamics over time of the water absorption by the clothes introduced in the laundry washing machine;
- figure 11 is a comparison of the initial portion of the curves of the water absorption over time, relating to towelling, cotton, synthetic fibres and wool fabrics;
- figure 12 illustrates the link existing between the type of fabric and the time interval between the end of the first water supply and the start of the first water-level-renewal operation;
- figure 13 represents the normalised Gauss function of experimental data relating to the average duration of the water-level-renewal operations being associated to two pressure switches being of different calibration.

The present invention is based on the acknowl-

edgement of the fact that, on the basis of exhaustive practical tests carried out, a method being excellent for determining the type and the quantity of fabrics introduced in a laundry washing machine consists in obtaining the necessary information from the observation, or monitoring, of the behaviour over time of the contact being associated to the first level electromechanical pressure switch of a laundry washing machine.

In particular, according to the present invention, said information is associated to the operations for restoring the water level carried out by the first level pressure switch during the first phase of each washing cycle: said operations for restoring the water level, which in the following will be more simply indicated with *renewal* or *restoring operations*, are the direct consequence of the water absorption process by the clothes, which causes a progressive lowering of the level of the washing liquid and the consequent commutation of the contact of the pressure switch in the empty state.

To said purpose, it should be remembered that the first level pressure switch of a laundry washing machine typically has the task of maintaining the water level constant, during the first phase of any washing program, with the double intent of ensuring the heating of the same, in a safe condition (i.e. with the heater being always immersed in the water) and to ensure the presence of a minimum liquid quantity, being necessary for carrying out an effective wash.

Such maintenance function of the water level, realised by the pressure switch, consists in supplying water (by means of the activation of the suitable electrovalve) until restoration of said level is obtained (which depends upon the calibration characteristics of the pressure switch), at any time that the same lowers beyond a certain quantity (being expressed in mm-H2O and being known as *differential or hysteresis* of the pressure switch) due to the effect of the absorption of the washing liquid by the clothes being present inside the laundry washing machine.

Before describing in the detail the characteristics and the advantages of the present invention, it is useful, for reasons of clarity, to describe the operation of the device, i.e. an electromechanical pressure switch of a substantially known type, on which the invention itself is based.

In fig.1A the different parts realising a typical electromechanical pressure switch for a laundry washing machine are schematically represented.

Such parts are:

- an air trap 1, communicating with the tank 2 of the washing machine;
- a pressure chamber 3;
- a small plastic tube 4, connecting the air trap 1 to the pressure chamber 3;
- a diaphragm-actuator body 5;
- a calibration spring 6;
- an electric contact 7.

The water which enters the tank 2 of the laundry washing machine tends to rise through the small plastic tube 4, but is prevented in doing so by the air being present in the air trap 1; upon the increase of the water level within the tank 2, the air of the trap 1 is progressively compressed and the pressure generated in this way is transmitted to the pressure chamber 3 through the plastic tube 4.

Such pressure is typically expressed in water millimetres (mm-H2O) and acts on the surface of an elastic diaphragm being present in the body 5, thus producing a force which is proportional to the level of water present within the tank 2 of the laundry washing machine; such force, acting on said diaphragm, counteracts, by means of a suitable actuator (figures 1B and 1C), the resistant force of the calibration spring 6.

Any pressure switch is characterised by its own calibration (calibration of the level of the pressure switch), being expressed in mm-H2O, which is associated to the resistant force of the calibration spring.

Single pressure switches exist in commerce, being characterised by only one level, and also multiple pressure switches, being characterised by several levels; in figures 1B and 1C a double pressure switch is schematically represented, as a pure example, being characterised by two distinct levels having different calibrations, and in particular the mechanism is illustrated in detail, which allows the change of state of the two switches being associated to said levels.

Referring for example to the pressure switch with a lower calibration, which is described in the upper part of the aforementioned figures 1B and 1C, we have, when the force transmitted by the actuator, indicated with 5A, which is integral with the diaphragm shown with 5B, exceeds the resistant force of the calibration spring 6, the common electric contact 9 is moved from the rest position 10, called *empty position*, to the other position 11, called *full position*.

In particular in fig. 1C it can be noticed that the pressure switch being illustrated in the lower part, needs, if compared to that being described in the upper part, a further pressure to commute its common contact 9 from the empty state (10) to the full (11).

On the contrary, in order to allow the contact of a pressure switch to pass from the full position to the empty one, it is necessary that the pressure exercised on the membrane is reduced by a determined value under the calibration value: such pressure value is typically expressed in mm-H2O and, as already said, is known as differential, or hysteresis, of the pressure switch.

The two positions electric contact (the empty one and the full one), that usually characterises electromechanical pressure switches for laundry washing machines, is typically able to commute currents up to a maximum of 16 resistive ampere, supplied with 220

Vac.

In a laundry washing machine, the empty contact usually supplies an electrovalve provided for the supplying water to the tank, while the full contact enables the current flow to the heating resistor of the same water.

This is schematically represented in figure 2, wherein the common contact 9 of the pressure switch can assume the empty position 10 or the full position 11, on the basis of the value of the pressure exercised by the water level present in the tank.

When the common contact 9 is in the empty position 10 and the command contact 15 of the control system (electromechanical or electronic timer) is closed, the electrovalve 13 is supplied through the mains voltage and allows to load water to the inside of the tank of the laundry washing machine, until the generated pressure reaches the calibration value of the pressure switch, thus causing the commutation of the common contact 9 in the full state (11).

On the contrary, when the common contact 9 is in the full position 11 and the contact 14 of the control system of the temperature of the washing water is closed, the water heating resistor 12 is supplied through the mains voltage and produces heat in safe conditions (by virtue of the presence of water assured by the full state of the pressure switch).

As previously mentioned, the renewal operation of the pressure switch is the direct consequence of the water absorption process by the clothes, which causes a progressive lowering of the washing liquid level and the consequent commutation of the contact of the first level pressure switch to the empty state.

Such a commutation, in accordance with the electric diagram of figure 2, produces the recall of further water, through the electrovalve 13, until the contact of the pressure switch once again assumes the full state (11).

The information extracted from the observation of the water level renewal processes of the first level pressure switch of a laundry washing machine according to this invention, are described in graphic form in the following figures.

In particular, figures 3A and 4A, which refer respectively to towelling and cotton fabrics, describe the relation which exists between the quantity in weight (being expressed in kg) of fabric introduced in the laundry washing machine and the total time (expressed in seconds) associated to the different renewal operations carried out by the first level pressure switch during the first phase of the washing cycle, until the absorption process of water by the clothes has not reached saturation.

As can be easily ascertained from the graphs in figures 3A and 4B, the total duration of the water level renewal phases, i.e. the sum of the duration of the single renewal operations, (which is directly proportional to the water quantity supplied, supposing the electrovalve flow rate as being constant) is linked to the weight of the clothes to be washed by a simple linear relation.

In fact, as it can be imagined, the greater the quantity of clothes introduced in the laundry washing machine, the greater the quantity of water that the clothes subtract from the washing chamber due to absorption and, consequently, the greater is the water quantity that must be "recalled" in the tank.

The fact that distinguishes towelling fabric from cotton is only that of the different slope of the two straight lines, as is better illustrated in figure 5; thus, in other words, the speed of the water absorption differs for the two kinds of fabric (in particular it is greater for cotton than towelling).

From what has been explained above, it is clear that, once the type of fabric has been detected, (for example in the way that will be described in the following) and knowing the sum of the duration of the single renewal operations, also its quantity may be determined, as shown from the figures 3A, 4A and 5.

The values being represented in figures 3A and 4A are average values, derived from a high number of experimental tests carried out with different fabric loads. The quality of the information being associated to such average values is made evident by the low dispersion shown by figures 3B and 4B, which relate respectively to towelling and cotton and represent the normalised Gauss function of the sums of the times of the renewal operations being associated to the different cloth quantities placed under observation.

Figures 6 and 7 represent the result of two experimental surveys, which refer respectively to a washing load of 4 kg of towelling and cotton fabrics; such figures make evident the dynamics of the renewal operations over time and express in a more intuitive way the quality of the information being associated to the operation of the electromechanical first level pressure switch; for example, it is possible to detect

- the different number of renewal operations (twelve for towelling and nine for cotton),
- the different distribution over time of the renewal operations associated to a same quantity of towelling and cotton fabrics,
- the different total duration of the renewal operations depending upon the type of fabric,
- the different duration of the pause elapsing between the first water supply and the first renewal operation of the level of the same, carried out by the pressure switch, depending upon the type of fabric,

this information allows to manage the machine and the method according to the invention, as will be better understood in the following of the present description.

The figures 3, 4, 5, 6 and 7 that have just been examined mainly illustrate the stationary situation which is reached at the end of the water absorption

process by fabrics, and highlight the fact that the quantity of clothes and the type of fabric are functions both of the sum of the times of the renewal operations and their number.

However, such relations are not independent from each other, because in practice they describe the same phenomenon by different parameters.

In order to have further information, being necessary for extracting in an independent manner the value of the quantity of clothes and the type of fabric, the dynamic evolution of the water absorption process by the fabrics has been examined in greater detail.

The result of such an experimental survey is reported in figures 8, 9, 10, 11 and 12.

In particular, figures 8, 9 and 10 represent the relation of the exponential type (which is typical for processes being characterised by saturation) that describes the quantity of water absorbed over time by different quantities of fabrics, with regards respectively to towelling, cotton and synthetics.

On the ordinates axis the water quantity is shown (being expressed in litres), supplied during the water level renewal phases of the pressure switch, and on the abscissas axis the sum of times (being expressed in seconds) is reported of the pauses elapsing between one renewal operation and another, i.e. the speed with which the clothes absorb the washing liquid.

From an examination of such figures we can detect that the initial proceedings of the curves being associated to the different quantities of clothes is practically independent from the quantity itself and mainly depends upon the type of fabric, as it is better explained in fig. 11, wherein the slopes of the absorption curves of the different fabrics have been reported (figures 8, 9 and 10), being calculated in the area of the cartesian axes origin.

Even if the validly of the proceedings reported in fig. 11 is limited to a area being restricted to the origin, they evidence however a very important aspect: the fact that it is possible to deduce the type of fabric from the observation of the behaviour of the pressure switch in the first phase of the water supply and, in particular, by the simple measure of the duration of the pause elapsing between the first water supply and the first operation of renewal of the water level carried out by the pressure switch (thus, once the type of clothes has been obtained in such a way, as a consequence its quantity is also identified, as shown in the above described figures 3A, 4A and 5).

This is even better explained by fig. 12 (which links the proceedings in the area of the origin of the fig. 11 to the real physical phenomenon of the water absorption controlled by the pressure switch), wherein on the ordinates axis the value (being expressed in litres) of the water supplied in occasion of the first renewal operation is reported, which is practically independent from the type of fabric, and on the abscissas axis the value (being expressed in seconds) of the pause elapsing between the end of the initial water supply and the beginning of the first renewal operation of the water level carried out by the pressure switch is shown.

The water supplied in occasion of the first renewal operation (ordinates axis) has the aim to restore up to the initial value (that referring to the instant wherein the first supply ends) the level of the washing liquid, thus exactly compensating the quantity absorbed by the clothes in the time interval between the end of the first supply and the beginning of the first renewal operation itself (abscissas axis).

From the examination of figure 12 the different slope is evident, that characterises the different kinds of fabrics and that physically expresses the different speed of the water absorption by the same.

From what has just been described with regards to figures 11 and 12, it therefore appears clear how it is possible to recognise the type of fabrics introduced in the laundry washing machine, by the simple measure of the duration of the pause which elapses between the first water supply and the first renewal operation of the level of water carried out by the pressure switch; as already said, once the type of fabric has been obtained in such a way, as a consequence its quantity is also identified (figures 3A, 4A and 5).

The fact should also be considered that the data reported in figure 12, even if it has the important advantage of being independent from the quantity of clothes introduced in the laundry washing machine, depend however upon the characteristics of the pressure switch, and in particular from the value of its differential or hysteresis: for such a reason, it is necessary to know the differential of the first level pressure switch, which is therefore an imposed parameter. In other words, the pressure switch differential is a parameter initially encoded inside the microcontroller's permanent memory of the control units of the laundry washing machine according to the invention; to such a parameter a part of the information describing the links which exist between the values derivable from the monitoring of the pressure switch is then correlated, this latter information also being encoded in the non volatile memory of the microcontroller.

It should however be considered that the laundry washing machine according to the invention is in itself able to obtain the effective value of the pressure switch differential: such a value is in fact directly proportional to the average duration of the renewal operations, which may be obtained by dividing the sum of the times being associated to the different renewal operations for their number.

Figure 13 in fact shows the different average value of the duration of the renewal operations associated to two different laundry washing machines (shown in the figure as machine A and machine B) being characterised by two pressure switches having a

differential respectively of 23 mm-H2O (machine A) and 20 mm-H2O (machine B).

Thus, with an opportune programming of the microcontroller, the laundry washing machine is in the condition of measuring constantly, automatically and with precision the differential, or hysteresis, of the pressure switch: in the case of calibration loss of the latter (and therefore in the case of discrepancies between the initially imposed hysteresis value and the effective values successively detected), the microcontroller can provide the updating, according to suitable criteria derived from modern learning software techniques (learning algorithms), of the hysteresis value initially imposed as a parameter in a non volatile memory, for instance of the EEPROM type (Electrically Erasable Programmable Memory).

From what has been described above it is clear that, by suitably elaborating the information taken from the observation of the behaviour of the first level pressure switch of a laundry washing machine, it is possible to derive the value of the quantity of clothes to be washed introduced in the machine and to recognise their type (and, of course, knowing the volume of water supplied).

The above described method for determining the quantity and/or the type of clothes is based on the observation of "natural" renewal operations of the pressure switch, i.e. those renewal operations of the level being caused directly by the closure of the empty contact of the pressure switch, which allows to excite the water supply electrovalve.

A possible variation of such a method, that provides analogue results, consists in considering the case of the observation of "forced" renewal operations of the water level, by using the empty contact of the pressure switch solely for sending a criteria to the control system, rather than for directly exciting the water supply electrovalve, which will be managed by the same control system through a suitable actuator (e.g.. a relay).

Therefore the control system, after having carried out the first water supply keeping the clothes steady, will begin to suitably rotate the basket of the laundry washing machine (for favouring the water absorption by the clothes) and will maintain steadily this situation for an established time T, the duration of which will be such as to allow the pressure switch to reset, i.e. its passage from the full state to the empty state.

Once said time interval T has elapsed, the control system will provide to excite the water supply electrovalve until the water level is restored, i.e. until the pressure switch passes from the full state to the empty state.

The quantity of water that the system must load to restore the initial level will represent the liquid quantity that the fabrics have absorbed during the pause T, i.e. it will provide information about the kind of water absorption by the clothes, and therefore on the type of fabric. Such a variation to the method according to the invention therefore has the advantage of being independent from the characteristics of the pressure switch, in particular from its differential.

As previously said, an excellent method for encoding in a compact form the great quantity of information that the control unit has to deal with, is that supplied by the control technology based on the fuzzy logic, which is already widely used in the field of consumer products and, in particular, in the field of household appliances.

The knowledge basis of the method according to the invention, obtained by experts in the field of washing and by way of experimental surveys, are encoded, inside of the permanent memory of the microcontroller in the form of "rules" (IF...THEN rules) by means of the fuzzy logic techniques. Considering that almost all modern laundry washing machines are equipped with a microcontroller (for instance machines with an electronic timer or with a digital motor control), it appears evident that the latter, once appropriately programmed, can carry out the monitoring of the pressure switch and obtain, in the above described ways and without any increase in cost, the required information.

Said information on the quantity and the type of clothes introduced in the laundry washing machine can therefore be used for managing the operation of the machine, for instance in order to determine the detergent dosage being optimal for carrying out a correct washing, thus avoiding wastage and reducing as far as possible the polluting substances contained in the drainage water. To this purpose the invention could be advantageously used for managing the operation of a device for the automatic dosage of the washing agents.

From the above description the characteristics of the method according to the invention are clear, on the basis of which the quantity and/or the type of clothes introduced in a laundry washing machine are obtained by monitoring the renewal operations carried out by the first level pressure switch, which due to normative and safety reasons is practically always present on a laundry washing machine.

The advantages of the described method are also clear, being mainly represented by the fact that the same laundry washing machine is able to determine the quantity and/or the type of fabrics loaded, in a simple and economic way, without the necessity of any additional components.

It is finally clear that several variants are possible to the described method, without departing from the novelty principles inherent in the inventive idea.

Claims

1. Method for determining the quantity and/or the type of fabric introduced in a laundry washing machine, characterised in that the quantity and/or the type of fabric are detected by monitoring the interventions for restoring the washing liquid level in the laundry washing machine controlled by a level sensor, in particular an electromechanical first level pressure switch.

2. Method, according to claim 1, characterised in that the monitoring of the restoring operations controlled by the pressure switch is carried out during the first phase of each washing cycle.

3. Method, according to claim 1 or 2, characterised in that said monitoring provides for a count of the number of restoring operations carried out by the pressure switch and/or the detection of the distribution over time of the restoring operations carried out by the pressure switch and/or the measurement of the sum of the restoring times of the operations, that occur during the phase of supplying washing liquid in the laundry washing machine.

4. Method, according to claim 3, characterised in that the information pertaining to the type of fabric introduced is obtained through measuring the pause elapsing between the first supply of the washing liquid in the laundry washing machine and the first operation for restoring the liquid level carried out by the pressure switch, in particular by measuring the pause elapsing between the end of the initial supply of the washing liquid and the beginning of the first restoring operation by the pressure switch.

5. Method, according to claim 3, characterised in that the information pertaining to the quantity of clothes introduced is obtained through measuring the total time of the different restoring operations, carried out by the pressure switch in the first phase of the washing cycle, and on the basis of the type of fabric.

6. Method, according to at least one of previous claims, characterised in that the information pertaining to the quantity and/or the type of fabric introduced is obtained by taking into account the characteristics of the pressure switch, in particular its differential value, or hysteresis.

7. Method, according to the previous claim, characterised in that the differential, or hysteresis, of the pressure switch can be determined in direct relation with the average duration of the restoring operations, said average duration being obtained by dividing the sum of times associated to the different restoring operations by their number.

8. Method, according to one or more of the previous claims, characterised in that the information (knowledge base) which describes the links between the values which can be derived by monitoring the pressure switch (number of restoring operations, total time, distribution over time, pauses of restoring operations, hysteresis of the pressure switch, etc.) are encoded within the permanent memory of a microcontroller, in particular in the form of "rules" (IF...THEN).

9. Method, according to the previous claim, characterised in that the values derived by monitoring the pressure switch are elaborated by said microcontroller with said information (knowledge base) according to the control technology based on the fuzzy logic.

10. Method, according to claim 8 or 9, characterised in that said microcontroller is a microcontroller already present in the laundry washing machine, in particular making up part of a programmer (timer) or a device for the control of the laundry washing machine motor.

11. Method, according to at least one of previous claims, characterised in that the information concerning the quantity of clothes introduced in a laundry washing machine and their type is used for managing the operation of the laundry washing machine, in particular for determining the detergent dosage and/or for managing the operation of a device for the automatic dosage of washing agents.

12. Method, according to claims 8 and 9, characterised in that a part of said information (knowledge base) being encoded in the permanent memory of said microcontroller is correlated to a hysteresis value of the pressure switch which is initially imposed as a parameter and encoded in the permanent memory of said microcontroller, in that said microcontroller provides to determine, in direct relation to the average duration of the restoring operations, the effective value of the differential, or hysteresis, of the pressure switch, and in that, in the case of discrepancies between the initially imposed hysteresis value and the effectively determined hysteresis values, said microcontroller provides for updating the hysteresis value initially imposed as a parameter.

13. Method, according to one or more of the previous claims, characterised in that, after the first supply

of the washing liquid, the rotation of the basket of the laundry washing machine is started for a prefixed time (T), the duration of which is in particular able to allow the passage of said pressure switch from its full state to the empty state.

14. Method, according to the previous claim, characterised in that, once said prefixed time (T) has elapsed, a supply electrovalve of the washing liquid is opened, until the level of the liquid does not determine the passage of said pressure switch from its empty state to the full state.

15. Method for the control of a washing machine, in particular a laundry washing machine, comprising a microcontroller, non volatile memory means (EEPROM) associated to said microcontroller, at least one sensor means (pressure switch) able to obtain information relative to the operating conditions of the machine, whereby within said non volatile memory means (EEPROM) the operational rules (IF ... THEN rules) are encoded, through which said microcontroller elaborates the information obtained from said sensor means (pressure switch) in order to manage the correct operation of the washing machine, characterised in that:

- said operational rules (IF ... THEN rules) are correlated with one or more basic parameters (hysteresis of the pressure switch), being initially encoded in said non volatile memory means (EEPROM) and being representative of theoretic functional characteristics of said sensor means (pressure switch);
- said microcontroller, through information obtained from said sensor means (pressure switch) and the contents of said non volatile memory means (EEPROM), is able to determine values being representative of the real functional characteristics of said sensor means (pressure switch);
- and in that, upon the need, in the case of significant and/or repeated discrepancies between the value of said basic parameters (hysteresis of the pressure switch) and said real values effectively determined, said microcontroller provides for the modification of said operational rules (IF ... THEN rules), in particular by way of updating the value of said basic parameters (hysteresis of the pressure switch) and/or operational rules (IF ... THEN rules), in said memory means (EEPROM).

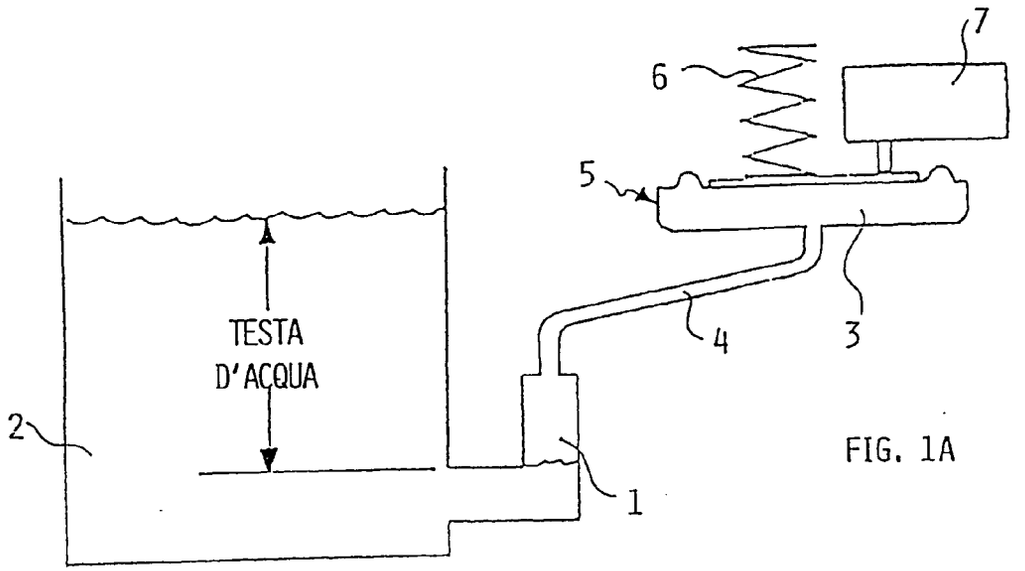


FIG. 1A

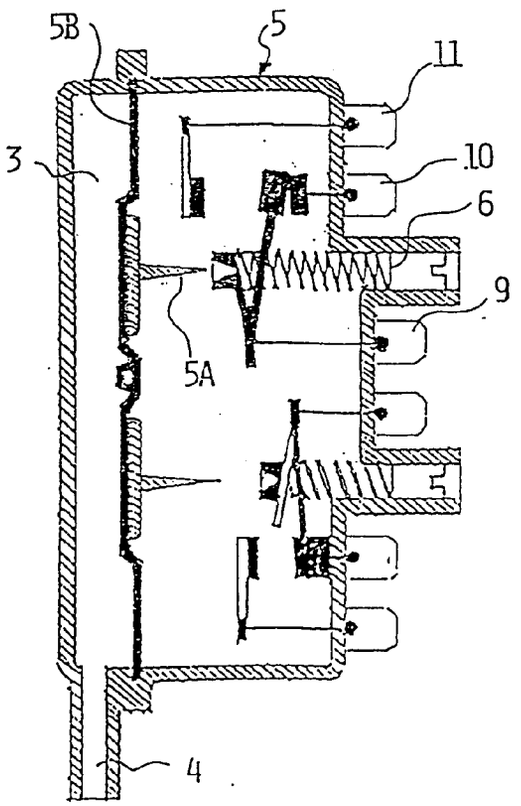


FIG. 1B

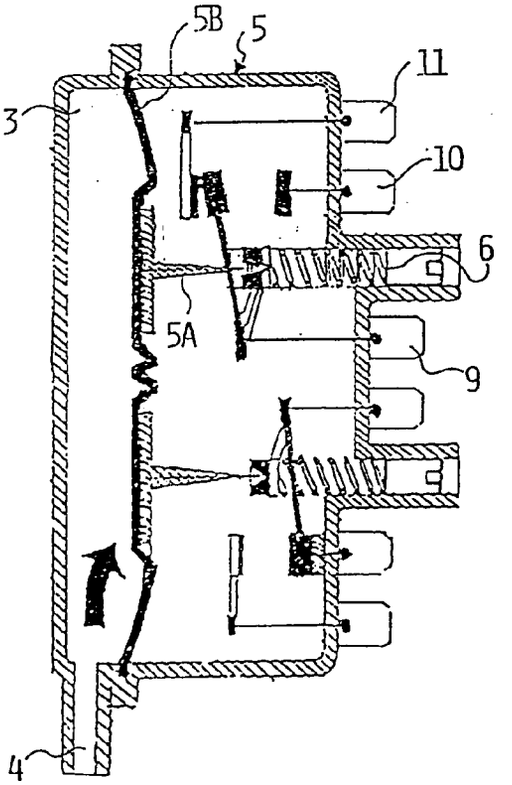


FIG. 1C

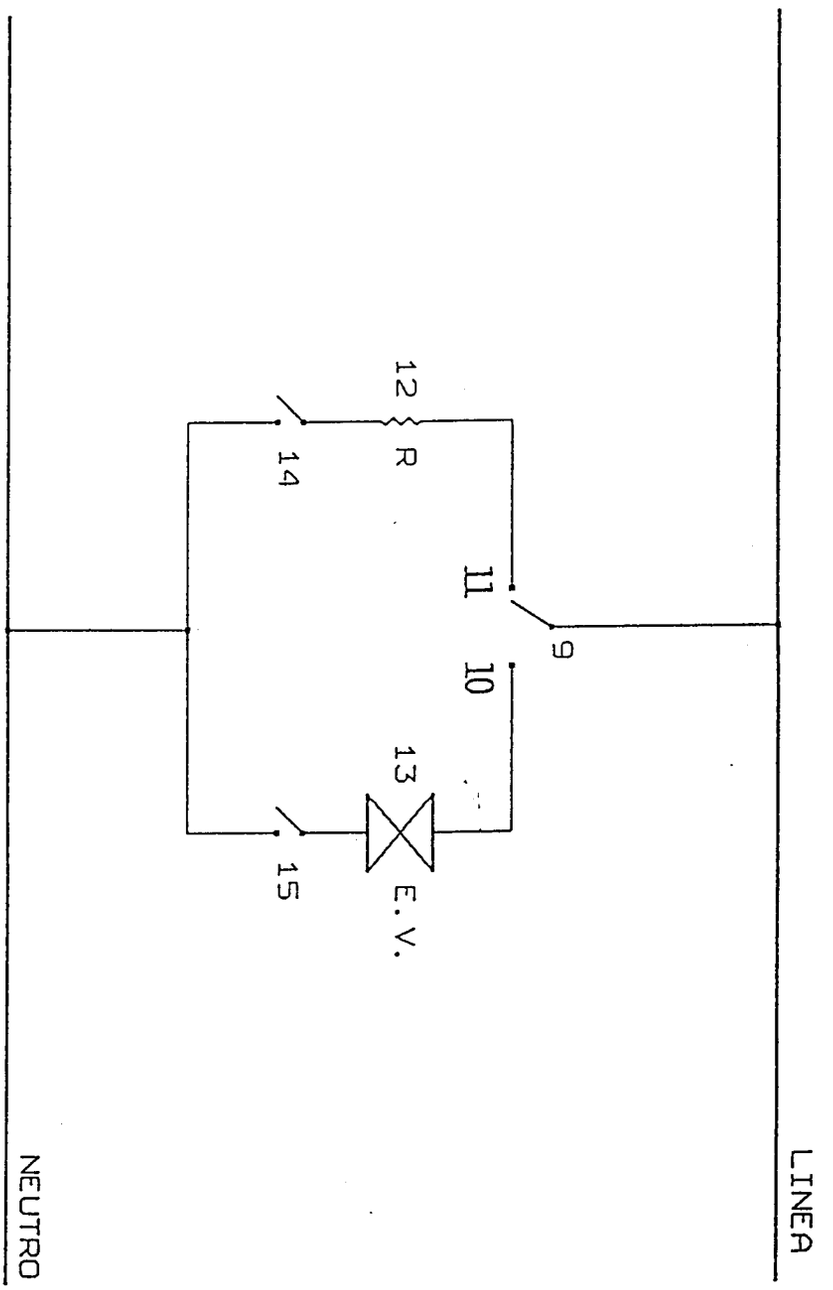


FIG. 2

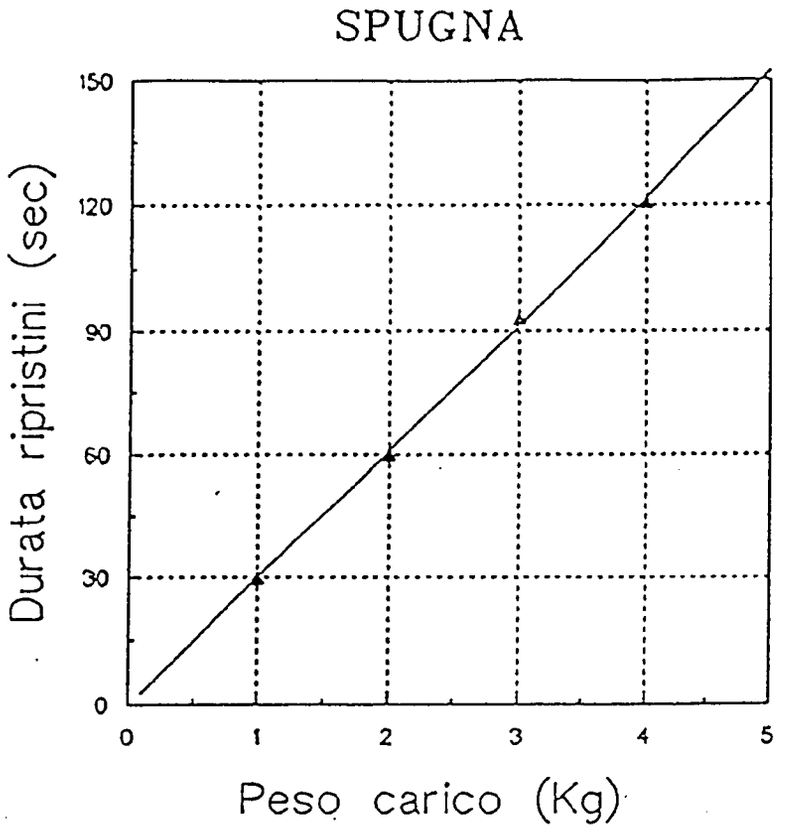

SPUGNA
Durata ripristini (sec)
150
120
90
60
30
0
0
1
2
3
4
5
Peso carico (Kg)

FIG. 3A

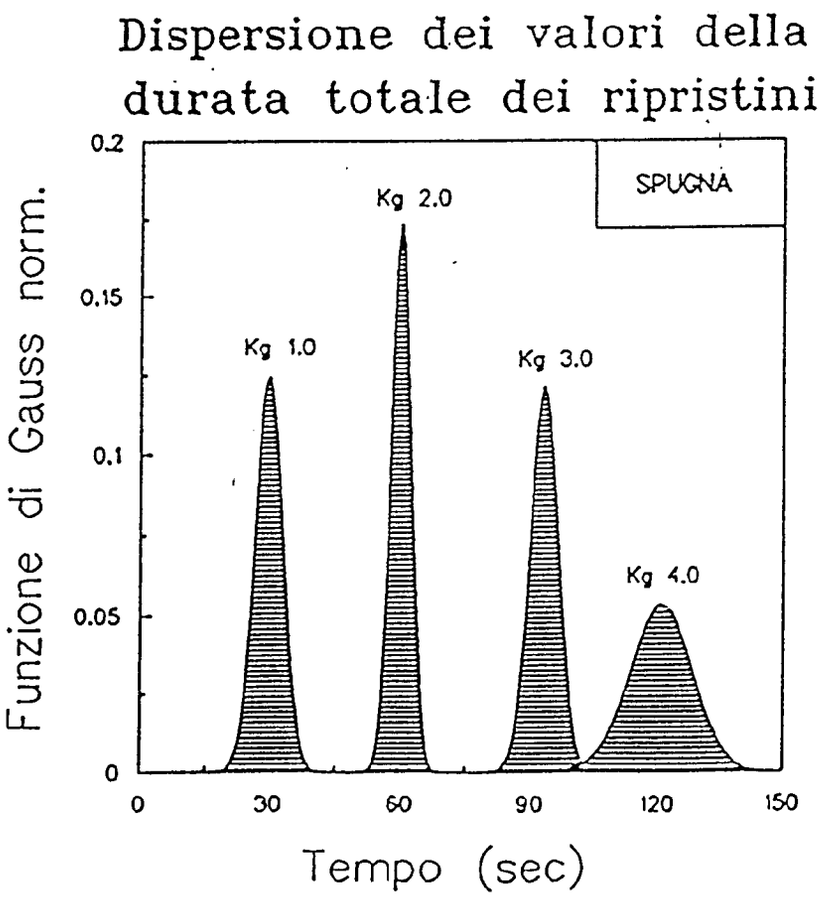

Dispersione dei valori della durata totale dei ripristini
SPUGNA
Kg 1.0
Kg 2.0
Kg 3.0
Kg 4.0
Funzione di Gauss norm.
0.2
0.15
0.1
0.05
0
0
30
60
90
120
150
Tempo (sec)

FIG. 3B

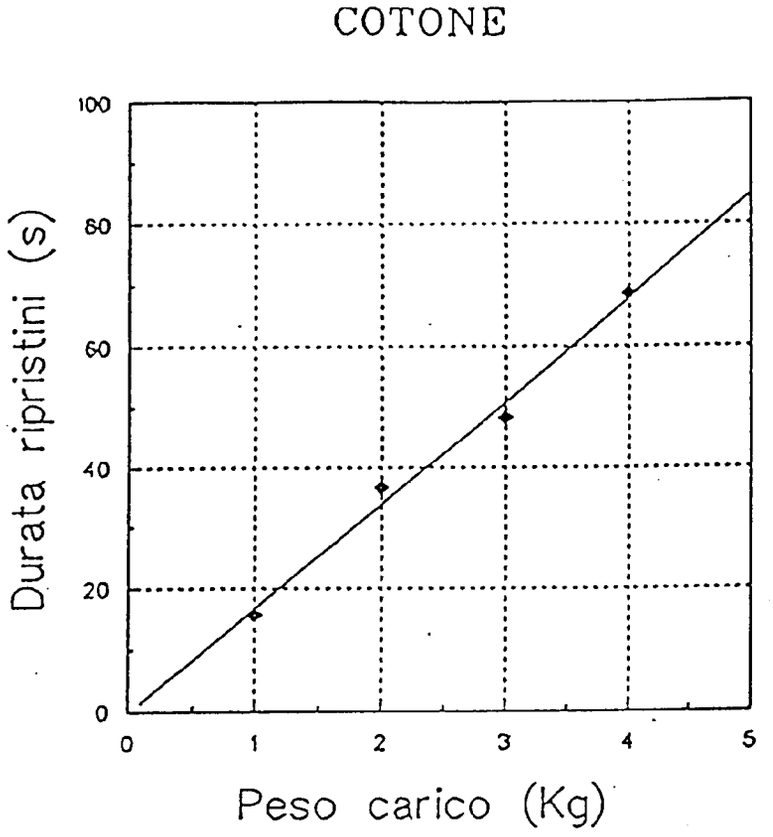

COTONE
Durata ripristini (s)
100
80
60
40
20
0
0
1
2
3
4
5
Peso carico (Kg)

FIG. 4A

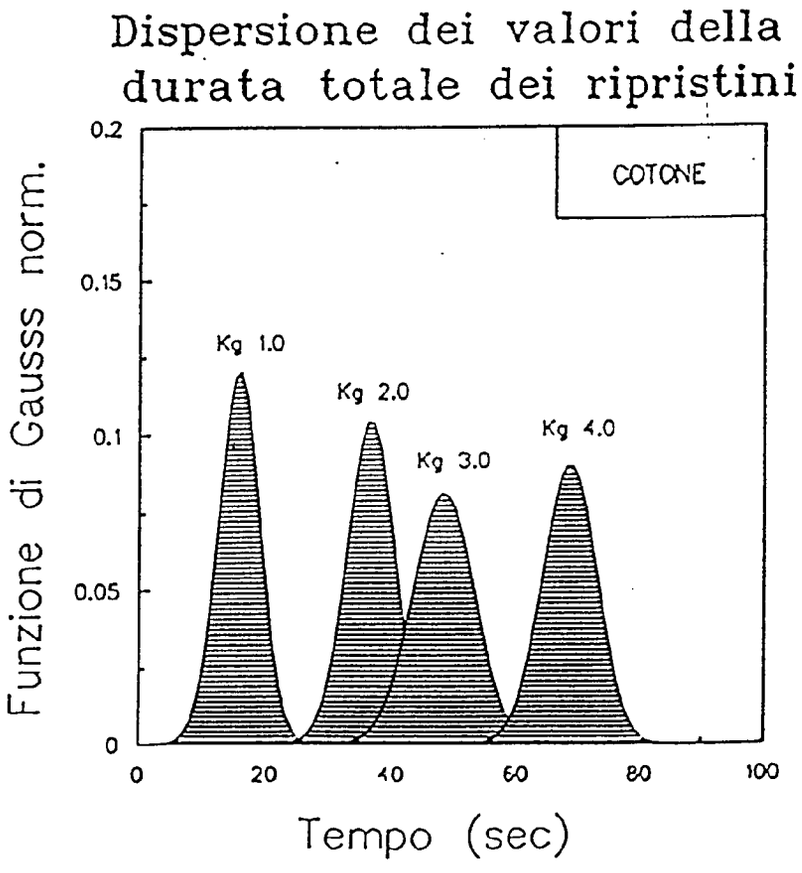

Dispersione dei valori della durata totale dei ripristini
COTONE
Funzione di Gausss norm.
0.2
0.15
0.1
0.05
0
Kg 1.0
Kg 2.0
Kg 3.0
Kg 4.0
0
20
40
60
80
100
Tempo (sec)

FIG. 4B

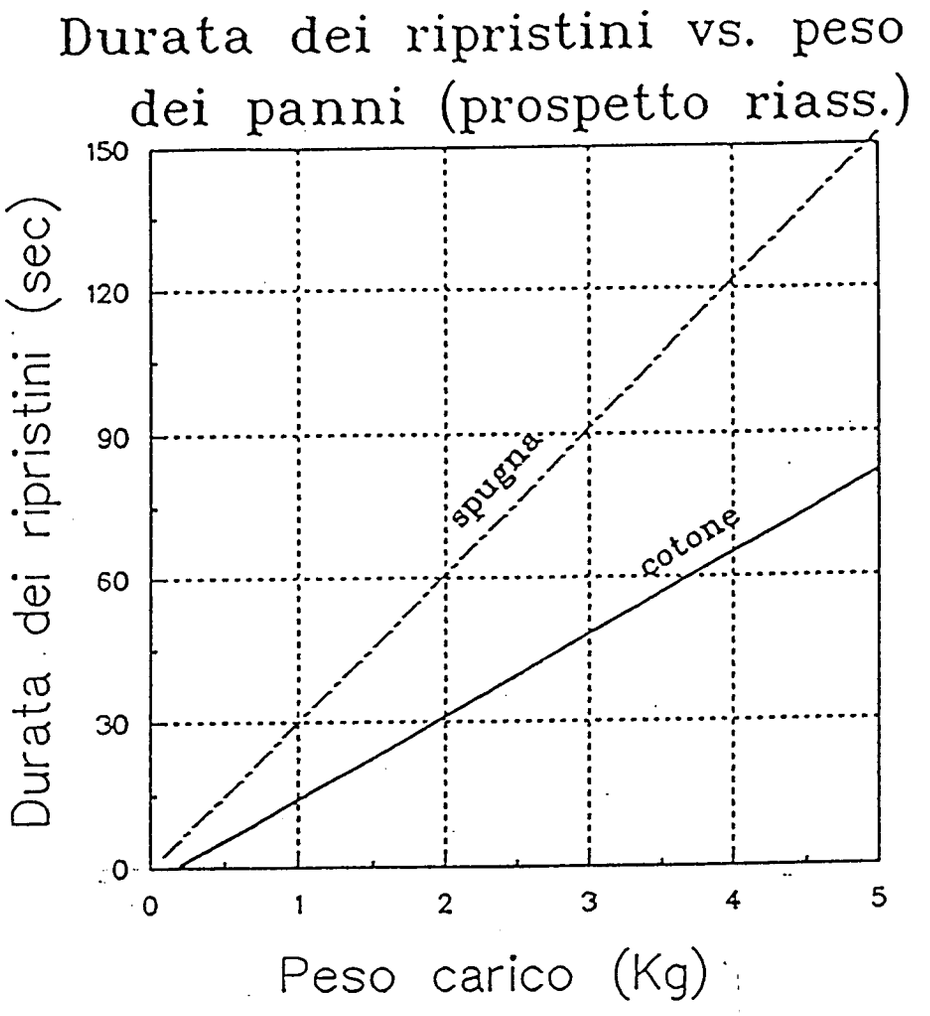

Durata dei ripristini vs. peso dei panni (prospetto riass.)
Durata dei ripristini (sec)
150
120
90
60
30
0
spugna
cotone
0
1
2
3
4
5
Peso carico (Kg)

FIG. 5

TIPO/COLORE TESSUTO: SPUGNA PRESSIONE ACQUA: 2 bar
QUANTITA' DI PANNI: 4.0 Kg

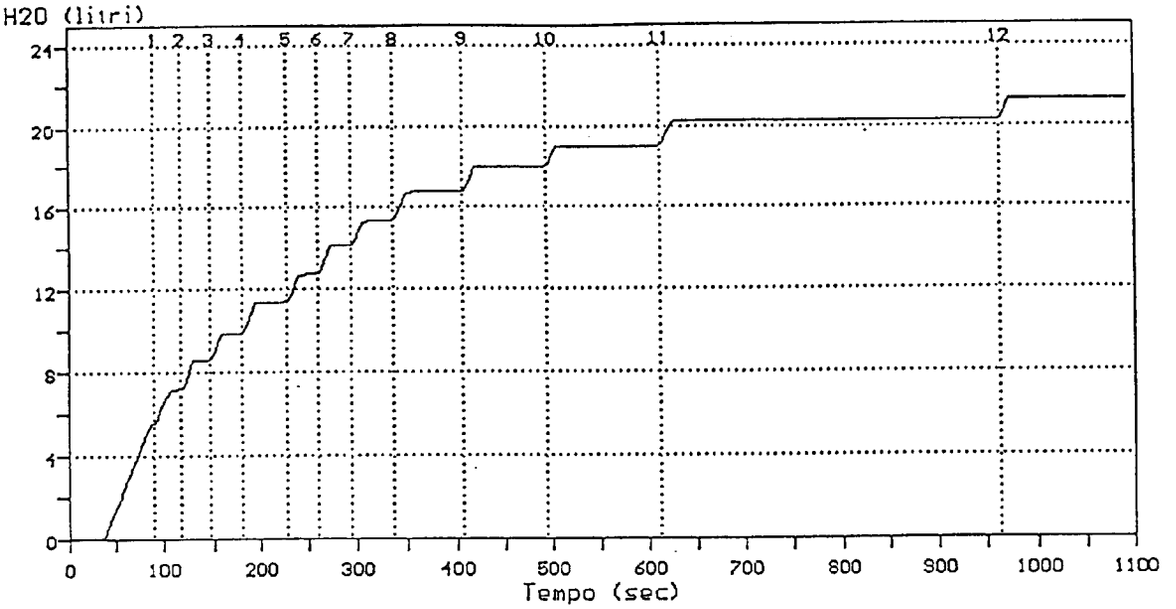


FIG. 6

TIPO/COLORE TESSUTO: COTONE PRESSIONE ACQUA: 2 bar
QUANTITA' DI PANNI: 4.0 Kg

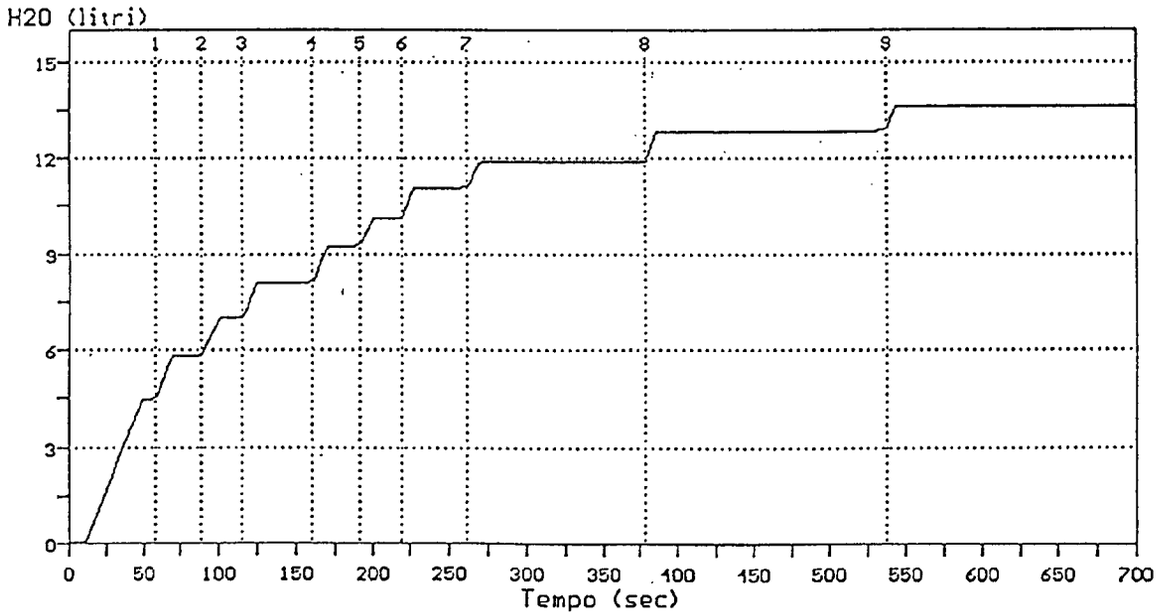


FIG. 7

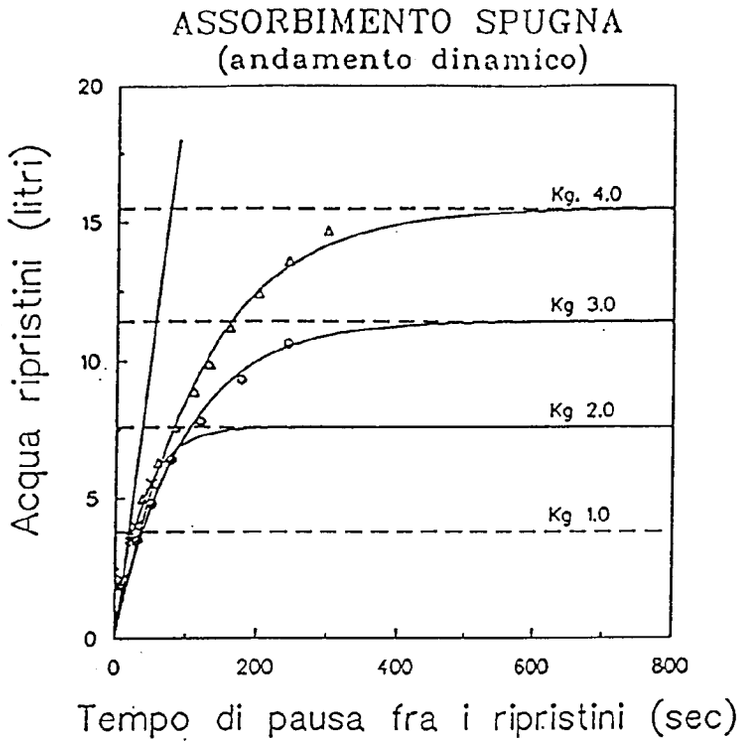

ASSORBIMENTO SPUGNA
(andamento dinamico)
Acqua ripristini (litri)
20
15
10
5
0
Kg. 4.0
Kg 3.0
Kg 2.0
Kg 1.0
0
200
400
600
800
Tempo di pausa fra i ripristini (sec)

FIG. 8

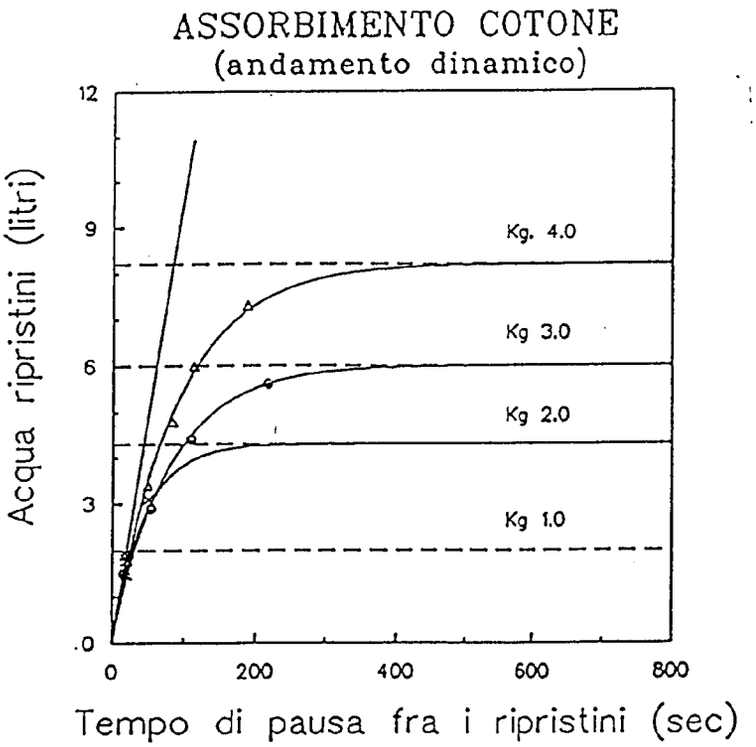

ASSORBIMENTO COTONE
(andamento dinamico)
Acqua ripristini (litri)
12
9
6
3
.0
Kg. 4.0
Kg 3.0
Kg 2.0
Kg 1.0
0
200
400
600
800
Tempo di pausa fra i ripristini (sec)

FIG. 9

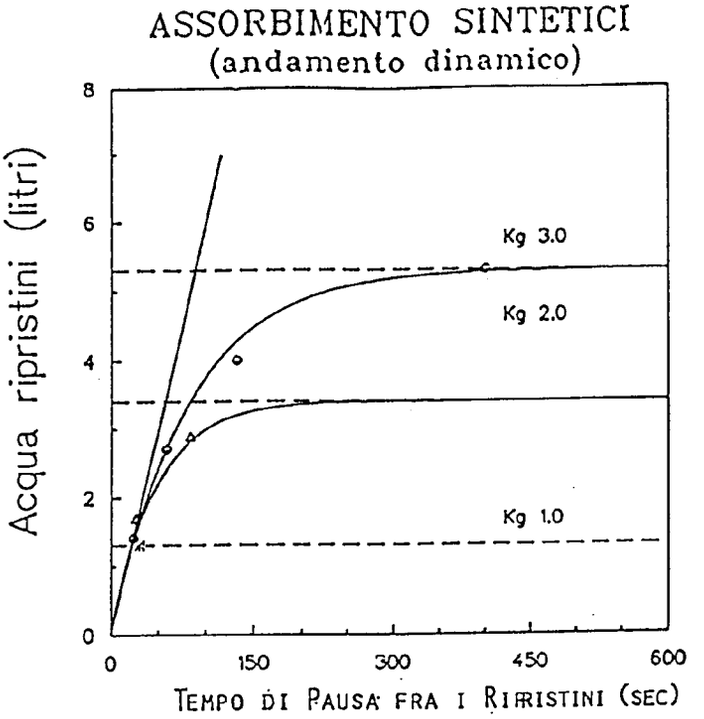

ASSORBIMENTO SINTETICI
(andamento dinamico)
Acqua ripristini (litri)
8
6
4
2
0
Kg 3.0
Kg 2.0
Kg 1.0
0
150
300
450
600
TEMPO DI PAUSA FRA I RIPRISTINI (SEC)

FIG. 10

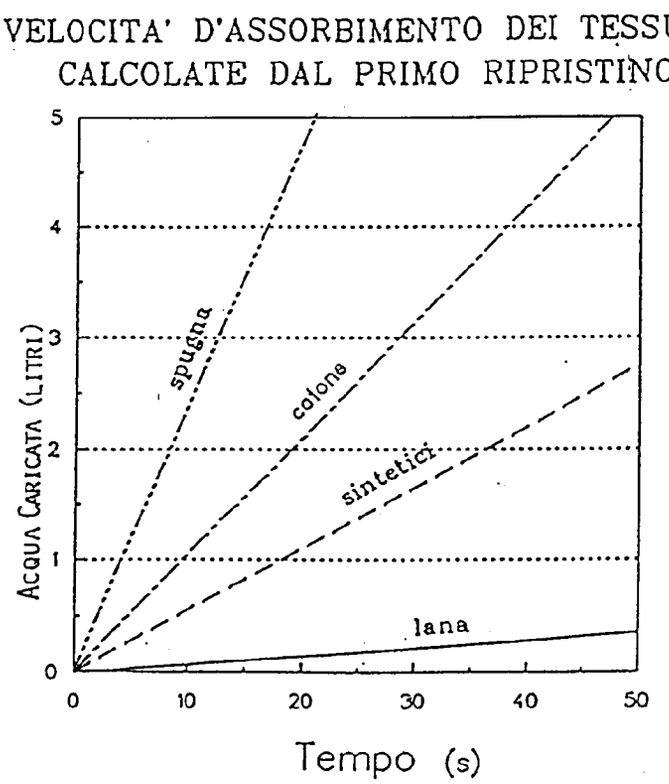
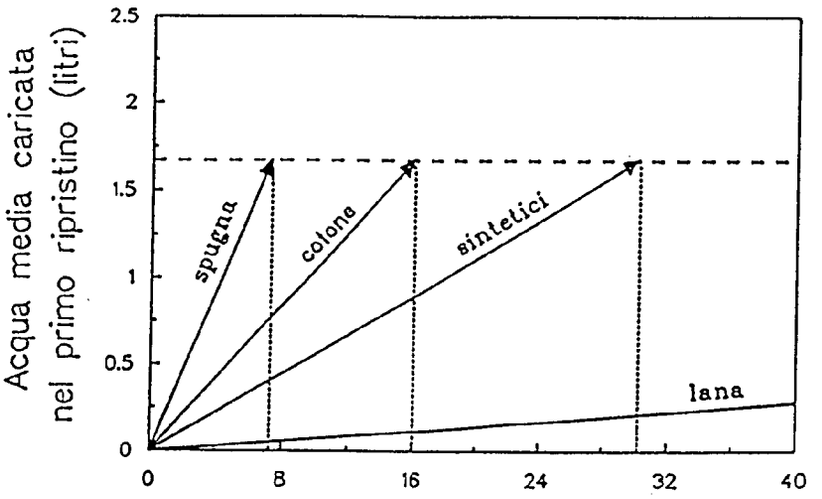

VELOCITA' D'ASSORBIMENTO DEI TESSUTI
CALCOLATE DAL PRIMO RIPRISTINO
ACQUA CARICATA (LITRI)
5
4
3
2
1
0
spugna
colone
sintetici
lana
0
10
20
30
40
50
Tempo (s)

FIG. 11

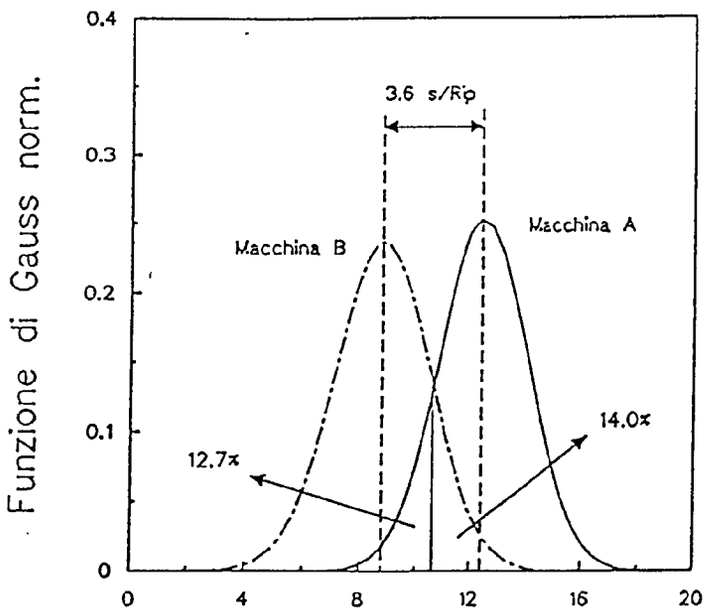
CALCOLO DELLA VELOCITA' D'ASSORBIMENTO
DEI TESSUTI DAL PRIMO RIPRISTINO



Tempo di pausa tra la fine del caricamento iniziale e l'inizio del primo ripristino (sec)

FIG. 12

DISTRIBUZIONE DATI TEMPO MEDIO
DI DURATA DI UN RIPRISTINO



Durata media di un ripristino (sec/Rip)

FIG. 13

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 11 6744

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.6)
X	DE-A-41 22 307 (LICENTIA PATENT-VERWALTUNGS-GMBH)	1-5, 8-11,13	D06F39/00
A	* the whole document *	15	
X	FR-A-2 474 547 (MIELE & CIE. GMBH.)	1-3,5,8, 10,11	
A	* the whole document *	15	
X	DE-A-34 46 288 (LICENTIA PATENT-VERWALTUNGS-GMBH)	1-3,8,11	
A	* the whole document *	15	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 January 1995	Courrier, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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