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(54) **HAIRDRYER INCLUDING A SAFETY DEVICE**

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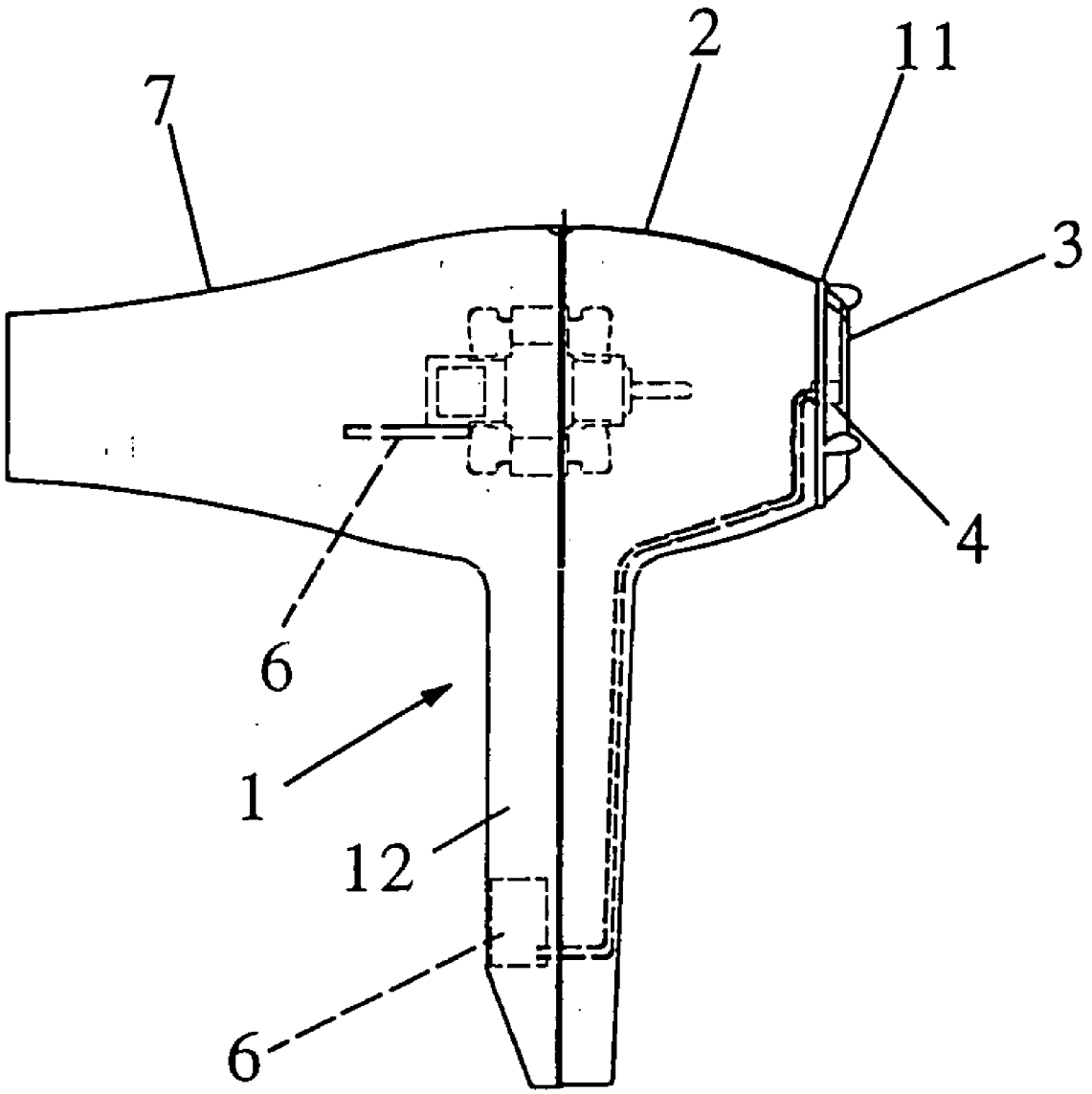
(57) **ABSTRACT**

A hairdryer including a safety device is characterized in that the safety device is designed for detecting a jamming, even partial, of the hairdryer air suction fan.



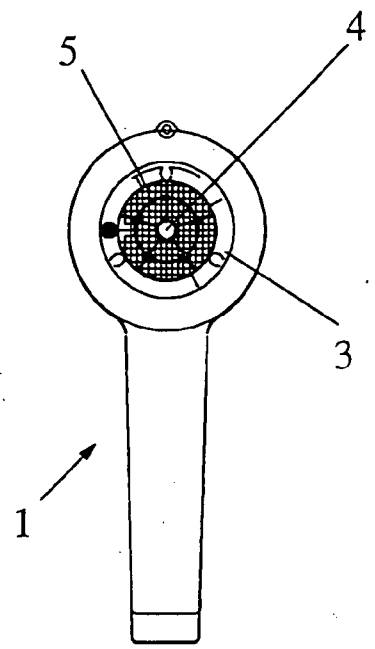


FIG. 2

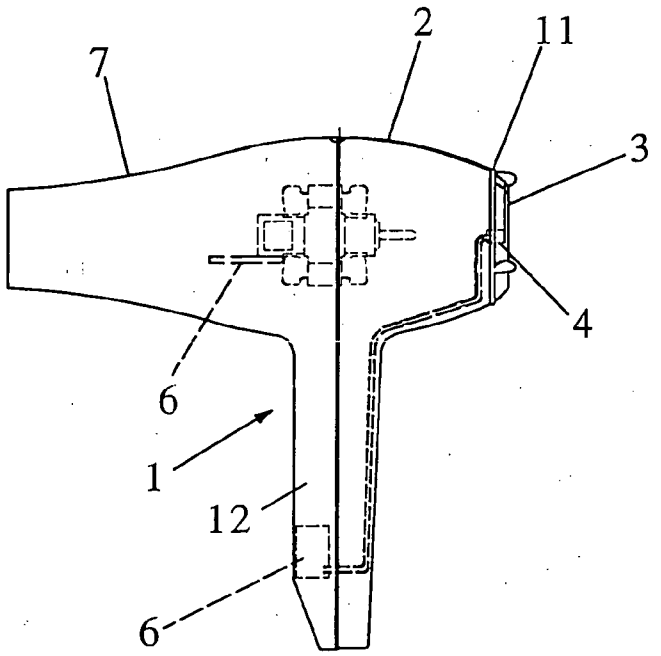


FIG. 1

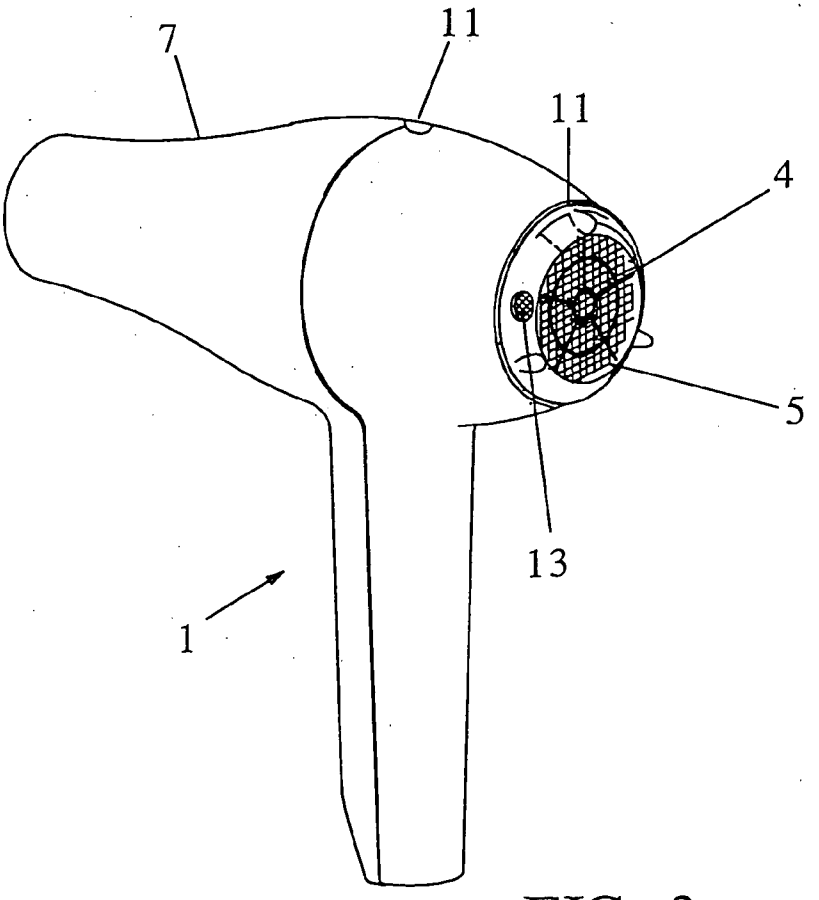
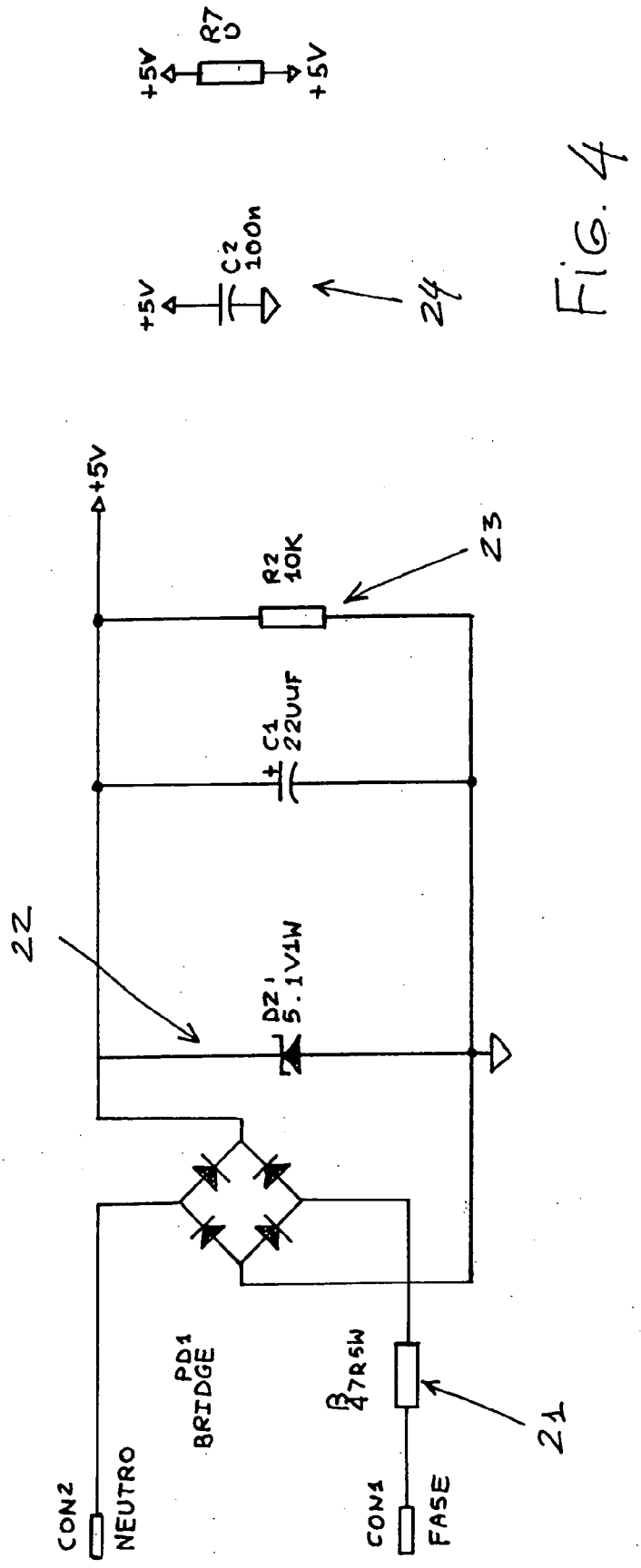


FIG. 3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0
+5V
+5V
C2
100n
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24
+5V
R2
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23
C1
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5.1V1W
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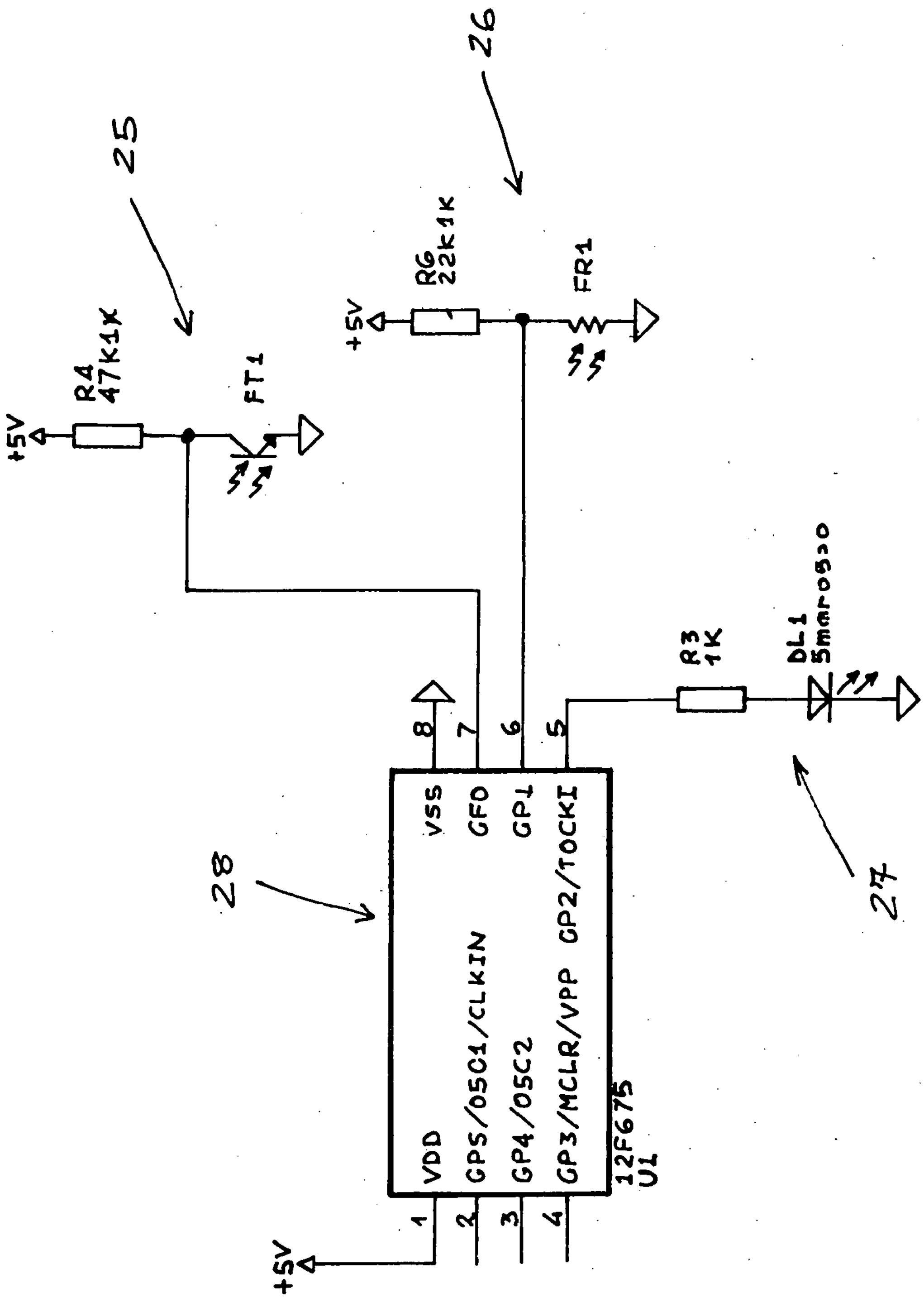
CON2
NEUTRO
CON1
FASE

Fig. 4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GP2/TOCKI
VDD
GP5/OSC1/CLKIN
GP4/OSC2
GP3/MCLR/VPP
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FIG. 4A

HAIRDRYER INCLUDING A SAFETY DEVICE

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a hairdryer including a safety device.

[0002] As is known, the air inlet filter of a hairdryer must be always held in a perfectly cleaned condition to provide a maximum efficiency of the apparatus and to prevent failures and overheating from occurring.

[0003] In fact, air residues, mixed with powder and fixing or adhesive substances, and being sucked during the operation, are easily deposited up to fully close the air passage, thereby overheating the hairdryer operating motor.

[0004] Moreover, the hairdryer heating resistance cannot be properly cooled, thereby the thermostatic switch of the hairdryer is compelled to continuously operate while providing alternately excessively cold or hot air.

[0005] In such a condition, the apparatus does not properly operate and it is susceptible to failures and safety problems.

[0006] Up to now, the hairdryer filter and cleaning thereof were performed by the user by merely seeing the filter condition.

[0007] Such a visual detection, however, depends of the user, and does not meet the minimum efficiency requirements imposed by the hairdryer maker for a safe operation of the hairdryer.

[0008] The above mentioned problems are further compounded in a professional use by hair processing operators.

[0009] In fact, in hair shops, where skilled but also non skilled operators are present, the filter is rarely examined and cleaned, with a consequent failure of the related hairdryer.

SUMMARY OF THE INVENTION

[0010] Accordingly, the aim of the present invention is to provide a hairdryer including a safety device designed for overcoming the above disclosed drawbacks.

[0011] Within the scope of the above aim, a main object of the invention is to provide such a hairdryer including a detecting device designed for safely detecting a possible jamming of the hairdryer filter.

[0012] Another object of the present invention is to provide such a hairdryer including a safety device designed for switching off the operation of the hairdryer or designed for providing a failure signal, as the filter is jammed or clogged beyond a safety threshold set by the hairdryer maker, to allow the operator to timely clean the filter.

[0013] Yet another object of the invention is to provide such a safety device for hairdryers which has a very small size, to be easily housed in the hairdryer and which allows the hairdryer to always properly operate, and this by using constructional materials and technique as commercially available.

[0014] According to one aspect of the present invention, the above mentioned aim and objects, as well as yet other objects, which will become more apparent hereinafter, are achieved by a hairdryer including a safety device, characterized in that said safety device is adapted to detect a clogging or jamming, even partial, of the air inlet filter applied at the air inlet opening of the hairdryer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] Further characteristics and advantages of the present invention will become more apparent hereinafter from the following detailed disclosure of a preferred, though not exclusive, embodiment of the invention, which is illustrated, by way of an indicative, but not limitative example, in the accompanying drawings, where:

[0016] FIG. **1** is a schematic side elevation view, as longitudinally cross-sectioned, of a hairdryer including a safety device according to the present invention;

[0017] FIG. **2** is a rear elevation view of the hairdryer shown in FIG. **1**;

[0018] FIG. **3** is a further perspective view of that same hairdryer; and

[0019] FIGS. **4** and **4**A show a diagram of the electronic control circuit.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0020] With reference to the number references of the above mentioned figures, the hairdryer according to the invention, which has been generally indicated by the reference number **1**, comprises a box-like body, including a rear shell **2** and a front shell **7** and designed for holding therein an operating motor and heating means comprising a heating resistance or the like, in a per se known manner.

[0021] The rear shell **2** comprises an opening or port, to which a screen or mesh filter **5** adapted to be locked by a filter ring nut **3**, is applied.

[0022] In a per se known manner, said filter **5** is adapted to operate as a dirt barrier for preventing dirt present in environment air from entering the hairdryer.

[0023] According to the present invention, the hairdryer further comprises a safety device for detecting a jamming or clogging, even partial, of the filter **5**.

[0024] As shown, the safety device comprises a photosensor **4**, for sensing the light intensity through the filter **5**.

[0025] As said light intensity decreases because of the clogging of the filter mesh, by said dirt material, the sensor **4** will send a signal which, through a suitably designed electronic circuit **6** will operate a light indicating element **11**, or other signaling means, which will be switched on with an intermittent or continuous light.

[0026] Said electronic circuit **6** can also be used for other applications, such as, for example, a moisture sensor.

[0027] The light indicating element **11** may be arranged between the rear shell **2** and the filter ring nut **3**, as shown in FIG. **1**, or between the two front and rear shells, as shown in FIG. **3**, or in any other suitable positions.

[0028] The light photosensor **4** can be arranged at the center of the filter ring nut **3**, and being spaced, therein inside, from the mesh or screen filter **5**.

[0029] The electronic circuit **6** can be arranged in the hairdryer handle **12** or any other region inside the hairdryer body.

[0030] Said safety device can comprise an automatic switch for switching off the fan motor and heating resistance, as said sensor detects that the filter is clogged beyond a preset threshold level.

[0031] Advantageously, the safety device further comprises an environment light detector, to allow said safety device to also operate as the environment light changes.

[0032] The environment light detector, comprising a resistor and generally indicated by the reference number **13**, can be arranged on the hairdryer body, for example at the air inlet thereof.

[0033] Said electronic circuit substantially comprises an electronic card, shown in FIG. **4**, including a single surface printed board thereon are assembled the operating components and, on the outside thereof being moreover provided a phototransistor, a photoresistor, and a power supply assembly.

[0034] The safety device operates as follows.

[0035] The electronic card is arranged inside the body of the hairdryer.

[0036] To said card are electrically coupled said electric power supply, phototransistor **4** and photoresistor **13**.

[0037] The phototransistor, as suitably arranged, will read the light amount passing through the mechanical filter of the hairdryer.

[0038] The photoresistor, arranged at a different position from that of the phototransistor, will read the environment light amount.

[0039] The light amount read out by the phototransistor will define the condition of clean filter or dirty or clogged filter and, more precisely, based on a value x.

[0040] If this values x is exceeded, then the filter is considered as dirty or clogged.

[0041] The light amount read out by the photoresistor will set the environment light amount and, depending on this value, a feed back to the value read out by the phototransistor will be performed, by proportionately translating the dirty filter values.

[0042] The card further includes herein a LED diode of a red color.

[0043] This diode will be held in a switched off condition if the filter is in a cleaned condition.

[0044] It will be switched on only as the card is power supplied and the filter is considered as dirty.

[0045] As the power supply to the card is switched off, said LED will be also switched off and, as it is switched on again, the light amounts on the photodetectors will be read again, while switching on the red LED depending on this read-out.

[0046] The card will be power supplied simultaneously with the fan motor, while controlling the light amount on the phototransistor and on the photoresistor, the operation of the card being that which has been above disclosed up to its switching off.

[0047] The photodetectors are read out after about a second from the power up of the card, since the signals must be stabilized, and the other subsequent read-outs will be repeatedly performed at even intervals up to the switching off of said card.

[0048] A dirty filter signal will be considered as valid only after some consecutive seconds with the same result; the same thing occurs for the clean filter signal.

[0049] This allows to remove false read-outs due to noise and the like.

[0050] As the dirty filter condition is detected, the red LED will be switched on and switched off again, if a new cleaned filter condition is detected, with the above disclosed procedure or exclusively as the card is switched off.

[0051] The electronic circuit is preferably made as hereinafter disclosed, with reference to FIG. **4**.

[0052] All the components connected downstream of the power supply operate under a low voltage.

[0053] From a starting AC middle voltage, a low voltage of about 5 Vcc has been obtained.

[0054] The reference number **21** shows a resistor Ri designed for providing a potential difference at the ends thereof, to provide a low voltage due to a resistive loss.

[0055] The high value of this component and its rated power also operate to eliminate the surge type noises which could arrive from the power supply net and provide failures to the electronic card.

[0056] The reference number **22** indicates the components PD**1**, DZ**1** and C**1**, downstream of the resistor Ri.

[0057] PD**1** is a diode bridge operated to modify the voltage waveshape from an alternating one with a positive half wave and a negative half wave inside a fiftieth second to two positive half waves in a fiftieth 50° of second.

[0058] DZ**1** is a zener diode operating to stabilize the voltage at a value of 5.1V.

[0059] An electrolytic capacitor for filtering the voltage and transform it from an impulsive or pulse voltage to a DC voltage is moreover provided.

[0060] A resistor **23** operates to quickly discharge the energy stored by the capacitor C**1**.

[0061] If a failure of the power supply occurs, this operation will allow the microprocessor reset circuit to operate in a proper time and manner, while allowing a proper restarting and performing of the program instructions, as the power supply voltage is reset.

[0062] The reference number **24** shows a filter ceramic capacitor, arranged near the microprocessor power supply pins.

[0063] The ceramic capacitor **24** operates to provide a higher immunity to the burst type of noises.

[0064] The reference number **25** shows a circuit branch designed for reading out, through the microprocessor analogic digital input, the signal sent by the phototransistor FT**1**.

[0065] The level of this signal will be changed based on the light amount impinging on the phototransistor, so as to increase or decrease its conductivity toward the ground.

[0066] The fixed reference at +5 is obtained through the resistor R**4**.

[0067] The variable reference is just provided by the phototransistor.

[0068] The reference number **26** shows a circuit branch operating to read out, through the microprocessor analogic digital input, the signal sent by the photoresistor FR**1**.

[0069] The level of this signal will be changed depending on the light amount impinging on the photoresistor, to increase or decrease the resistive value thereof toward the ground.

[0070] The fixed reference at +5 is obtained through the resistor R**6**.

[0071] The variable reference is just given by the photoresistor.

[0072] The microprocessor, through an output pin thereof, will enable the switching on or off of the red color LED diode DL**1**.

[0073] The current is limited by the series resistor R**3**.

[0074] The LED DL**1** and the resistor R**3** have been generally indicated by the reference number **27**.

[0075] The component **28** is a flash type of microprocessor, the core of the system, with its on board software operating said electronic card.

[0076] In addition to the power supply, only three other pins will be used, to provide as input and one as output.

[0077] The microprocessor operates at 4 Mhz and comprises an inner oscillator and brown-out.

[0078] It has been found that the invention fully achieves the intended aim and objects.

[0079] In fact, the invention provides a hairdryer including a safety device adapted to generate a signal signaling to the user that the filter is excessively clogged, for allowing the hairdryer to properly and safely operate.

[0080] An advantage of the present invention is that the safety limits are specifically preset by the maker, in designing the hairdryer, for providing a timely cleaning operation.

[0081] Further advantages of the present invention are related to the fact that the device has a very reduced size and accordingly can be easily housed in a hairdryer, without occupying a lot of space which could hinder its proper operation and that it is made by easily available materials and methods.

[0082] In practicing the invention, the used materials, as well as the contingent size and shapes, can be any, depending on requirements and the status of the art.

1. A hairdryer including a safety device, characterized in that said safety device is adapted to detect a clogging, even partial, of a filter applied to the hairdryer fan air inlet.

2. A hairdryer, according to claim **1**, characterized in that said safety device comprises a photosensor adapted to detect the light passing through the filter.

3. A hairdryer, according to claim **1**, characterized in that, as the light amount decreases because a clogging of the filter, jammed by dirty, said sensor will send a signal which, through an electronic circuit, will operate a signaling means.

4. A hairdryer, according to claim **1**, characterized in that said signaling means comprise a light indicating element which is switched on either with an intermittent or continuous light.

5. A hairdryer, according to claim **1**, characterized in that said hairdryer comprises a moisture sensor driven by said electronic circuit.

6. A hairdryer, according to claim **1**, characterized in that said filter comprises a filter mesh screen made of a processed metal, plastic material or TNT.

7. A hairdryer, according to claim **1**, characterized in that said photosensor is arranged in a rear portion of the body of the hairdryer and under the suction filter.

8. A hairdryer, according to claim **1**, characterized in that said hairdryer comprises a signaling light indicating element arranged on the body of the hairdryer, and being visible from the outside of said body.

9. A hairdryer, according to claim **1**, characterized in that said hairdryer comprises an electronic control circuit, which can be arranged at any region of the hairdryer.

10. A hairdryer, according to claim **1**, characterized in that, as a clogging, even partial, of the fan air inlet filter is detected, said safety device automatically causes said hairdryer to be switched off.

11. A hairdryer, according to claim **1**, characterized in that said safety device comprises an environment light detector allowing said safety device to properly operate even if the environment light is changed.

12. A hairdryer, according to claim **1**, characterized in that said electronic circuit comprises an electronic card including a single surface printed board thereon are mounted the components necessary for operating said electronic circuit, a phototransistor, a photoresistor and a power supply being arranged outside thereof.

13. A hairdryer, according to claim **1**, characterized in that said phototransistor, as suitably arranged, reads out the light amount passing through the mechanical filter of said hairdryer; said photoresistor, arranged at a different position than that of said phototransistor, reads out the environment light amount; the light amount being read by said phototransistor defining a condition of clean filter or dirty filter and, more precisely, beyond a value x, said filter being considered as dirty or clogged; the light amount read out by said photoresistor defining the environment light amount and, depending on this value, being performed a feedback to the value read out by the phototransistor, by proportionately translating the dirty filter values.

14. A hairdryer, according to claim **1**, characterized in that said card comprises thereon a red color LED; said red color LED being held in a switched off condition if said filter is clean; said red color LED being switched on only if the card is power supplied and only as the filter is considered as dirty; as the card is powered down, said LED being switched off and as it is switched on again, the light amounts on said photodetectors being read-out again and being actuated said red LED depending on this read-out.

15. A hairdryer, according to claim **1**, characterized in that said card is powered up simultaneously with said fan motor, the amount of light both on said phototransistor and on said photoresistor being controlled and the card operating as indicated up to its power down; the photodetectors being read out after about a second from the card power up, to allow the signals to be stabilized, and the following read-outs being performed repeatedly at even intervals up to the power down of the card.

16. A hairdryer, according to claim **1**, characterized in that a dirty filter signal is considered as valid only after some consecutive seconds providing the same results; the same thing occurring for the clean filter signal, thereby preventing false read-outs due to noises from occurring.

17. A hairdryer, according to claim **1**, characterized in that, as a dirty filter condition is detected, said red LED is switched on and being switched off if a new clean filter condition is detected, by the mode of operation as disclosed or as said card is switched off.

18. A hairdryer, according to claim **1**, characterized in that all the components of the electronic circuit arranged downstream of the power supply operate on a low voltage obtained by a starting middle voltage V.110÷250 ac a low voltage.

19. A hairdryer, according to claim **1**, characterized in that said electronic circuit comprises a resistor Ri operating for providing a potential difference at the ends thereof to provide a low voltage due to a resistive drop, the high value of this component and its dissipated power operating to block the surge type of noises which can arrive at the power supply and cause the electronic card to fail.

20. A hairdryer, according to claim **1**, characterized in that said electronic circuit comprises a diode bridge designed for modifying the voltage wave shape from an alternating one

with a position half wave and a negative half wave inside a fiftieth of seconds to two positive half waves inside a fiftieth second.

21. A hairdryer, according to claim **1**, characterized in that said electronic circuit comprises a zener diode for stabilizing the voltage to a value of 5.1V.

22. A hairdryer, according to claim **1**, characterized in that said electronic circuit comprises an electrolytic capacitor operating to filter said voltage and transform it from a pulse voltage to a continuous or DC voltage.

23. A hairdryer, according to claim **1**, characterized in that said electronic circuit comprises a resistor for quickly discharging the energy stored by said capacitor, as the power supply voltage fails; this operation being required by the microprocessor reset circuit to operate in a proper time and manner, while allowing a proper resetting and performing of the program instructions, as the power supply voltage is reset.

24. A hairdryer, according to claim **1**, characterized in that said electronic circuit comprises a filter ceramics capacitor arranged near the power supply pins of the microprocessor, and operating to increase the burst type of noise immunity.

25. A hairdryer, according to claim **1**, characterized in that said electronic circuit comprises an electronic circuit branch operating to read-out, through a microprocessor analogic digital input, the signal sent by said phototransistor; said signal changing its level depending on the light amount impinging on said phototransistor, thereby increasing or decreasing the conductivity of said phototransistor toward the ground; the fixed reference to +5 being obtained through the resistor R**4**; the variable reference being just provided by said phototransistor.

26. A hairdryer, according to claim **1**, characterized in that said electronic circuit comprises an electronic circuit branch operating to read-out, through a microprocessor analogic digital input, the signal sent by said photoresistor; said signal changing its level depending on the light amount impinging on said photoresistor thereby increasing or decreasing the resistive value thereof toward the ground; the fixed reference at +5 being achieved through the resistor R**6**; the variable reference being just achieved by the photoresistor.

27. A hairdryer, according to claim **1**, characterized in that said microprocessor, through an output pin thereof, enables the switching on or switching off of said red color LED diode DL**1**; the current being limited by the series resistor R**3**.

28. A hairdryer, according to claim **1**, characterized in that said electronic circuit comprises a flash type of microprocessor, the core of the system, with an on-board software for operating said electronic card; in addition to the power supply being used only other three pins, two as inlet pins and one as outlet pin; said microprocessor operating at 4 Mhz and including an inner oscillator and brown-out.

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