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(54) **PORTABLE HAIR DRYER WITH SEPARATE HEAT AND BLOWER SPEED CONTROL MEANS**

TRAGBARER HAARTROCKNER MIT SEPARATER HITZE- UND GEBLÄSEGESCHWINDIGKEITSSTEUERUNG

SÈCHE-CHEVEUX PORTATIF AVEC MOYENS DE COMMANDE DE LA VITESSE DE CHAUFFAGE ET DE SOUFFLANTE SÉPARÉS

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(73) Proprietor: **Arçelik Anonim Sirketi**
34445 Istanbul (TR)

(72) Inventors:
- **GULSEN, Deha**
  34950 Istanbul (TR)
- **OZDEMIR, Mehmet Cahit**
  34950 Istanbul (TR)
- **ELMAS, Serdal**
  34950 Istanbul (TR)
- **DUMLU, Bekir**
  34950 Istanbul (TR)
- **KARTAL, Resul**
  34950 Istanbul (TR)

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Description

[0001] The present invention relates to a portable hair dryer and particularly to simultaneous control of heating and blower speed settings embodiments.

[0002] Several wired products can be typically plugged into one or more electrical outlets, such devices for instance being hair dryers, electric clippers, and/or curling irons. During use, the cords thereof can get mixed up, and usually one may need to unplug each and every cord and re-plug those in use to the electrical outlets. Another problem is that the length of a cord can prevent for instance a hairdresser from freely moving in an effort to serving to the customer.

[0003] It is well-known that a hair dryer typically includes a means for moving the hot air in a volumetric high flow towards the indicated area. For this reason, most of the designs proposed for hair dryers include an electric motor driven fan powered by a cable coupled to the power outlet.

[0004] However, as mentioned above, there might be cases where increased mobility of a hair dryer remains a need. Thus, there are various designs that are called portable hair dryers for use in travel. However, while such hair dryers are considered "portable", they still need an external source of power supply to operate the motor driven fan. Hence, in such cases, "portable" only means "small". Real portability requires the hair dryer to have an independent power supply, typically an internal battery.

[0005] A still further problem with portable hair dryers which are powered by batteries is that they should incorporate compact size batteries to attain the goal of being portable. The above mentioned requirement necessitates the user to drive the device with relatively low voltage values. Increasing battery power will make hair dryer to tend to lose its portability. Therefore, the present invention proposes an improved electrical circuit to enable using a portable hair dryer with sufficient power without compromising compactness and portability.

[0006] A still further drawback with known hair dryers lies in that generally resistance value of the resistors is determined so as to decrease the voltage value taken from the source when the fan group is operated in the DC motor section. In this way, the fan group is operated in different power levels. This approach typically causes a change in the power values of the resistors by the operation of the fan group and causes the heater efficiency to change during use.

[0007] In the case of cordless hair dryers, the motor fan group cannot reach out at high speeds due to the limitation of the voltage value that can be generated by the battery in addition to the above problem. This makes it difficult for the hair dryer to reach more satisfactory flow rates. Restricting the speed of the fan group adversely affects the flow rate of the product and therefore the drying speed. It is possible to increase the flow rate of the motor fan group by way of increasing the serial number of battery cells in the hair dryer. In this case, however, extra batteries cause the weight of the product to increase and user dissatisfaction may emerge due to poor ergonomics and usability, which in turn has a negative impact on mobility, i.e. the most important feature of a portable hair dryer.

[0008] Among others, a prior art publication in the technical field of the presented invention may be referred to as US8146264, which discloses a cordless hair dryer device comprising a handle, air cone, rechargeable lithium-type battery pack that releasably attaches to a battery mount on the back of the hair dryer, temperature controls, blower speed controls, DC motor, heater and battery pack charger. The heater comprises a tourmaline impregnated ceramic heater. Intake air flows over the tourmaline/ceramic heater producing negative ions so the hair does not become statically charged during the drying process. The air intake at the back of the hair dryer includes a removable filter to catch errant fibers and hair before they flow into the blower/heater area. The motor and tourmaline impregnated ceramic heater are mounted close to the battery pack in a manner that provides easier control.

[0009] US4003388 discloses an electric hair dryer having a variable control which provides smooth continuous fan speed and heat adjustment.

[0010] The present invention, on the other hand, addresses the situation where a portable hair dryer has separate control settings for heating and blower speed functions.

[0011] To this end, the present invention provides an effective approach by increasing the flow rate of the blower without increasing the number and/or capacity of the batteries in the charger of the hair dryer and also ensures operation of the motor fan group without reducing the effective power of the fan through resistors.

[0012] The present invention provides a high-flow performance achievement without increasing the number of batteries in the portable hair dryer and at the same time the heating efficiency is increased by providing motor control and operation through voltage boosting.

[0013] The present invention provides a portable hair dryer as provided by the characterizing features defined in Claim 1.

[0014] Primary object of the present invention is to provide a system for the operation of a portable hair dryer by which an improved electrical circuit provides separate setting options for heating and blowing functions, further increasing fan group's speed.

[0015] Accompanying drawings are given solely for the purpose of exemplifying a portable hair dryer, whose advantages over prior art were outlined above and will be explained in brief hereinafter.

[0016] The drawings are not meant to delimit the scope of protection as identified in the Claims, nor should they be referred to alone in an effort to interpret the scope identified in said Claims without recourse to the technical disclosure in the description of the present invention.

[0017] The drawings are only exemplary in the sense that they do not necessarily reflect the actual dimensions and relative proportions of the respective components of the system if not otherwise explicitly stated.

[0018] Fig. 1 demonstrates a simplified general representation of a portable hair dryer according to the present invention.

[0019] Fig. 2 demonstrates a cross sectional view of a portable hair dryer according to the present invention.

[0020] Fig. 3 demonstrates a circuit equivalent of a boost converter of a portable hair dryer according to the present invention.

[0021] Fig. 4 demonstrates a general circuit design of a portable hair dryer according to the present invention.

[0022] The following numerals are assigned to different part numbers used in the detailed description:

[0023]

1) Hair dryer
2) Blower
3) Motor
4) Heater
5) Suction section
6) Exit section
7) Handle section
8) Battery
9) Boost converter
10) Third switch
11) Second switch
12) First switch

[0024] The present invention proposes a hair dryer (1) having a motor (3) that drives a blower (2) located between the motor (3) and a suction section (5). The air drawn from the suction section (5) by the blower (2) having blades, provides that the outside air passes through a heater (4) to be heated. The drying process is carried out through the heated air being circulated towards an exit section (6). When the DC motor (3), the blower (2) and the heater (4) are supplied power through batteries (8), as in the case of hair dryers which are cordless, the DC motor (3) is not powered by way of reducing the nominal value of the supply voltage through resistor elements.

[0025] Fig. 2 illustrates a boost converter (9) used in accordance with the invention and eliminating the need for reducing the nominal value of the supply voltage through resistances for adjusting the speed range of the motor fan group. Advantageously, the batteries (8) are adapted to be disposed at a protruding section relative to the handle section (7) to provide better ergonomic handle design to accommodate operator grasp and reduce hand fatigue.

[0026] The control mechanism as shown in Fig. 3 conventionally operates in accordance with the conducting and non-conducting modes of the semiconductor power switch. As is known, when the power switch is closed, the current typically increases along the coil and energy begins to be stored in the coil. When the switch is opened, the charging current through the coil begins to flow through the diodes and loads. As the coil discharges the stored electric energy, the polarity of the voltage in the coil becomes the same as the polarity of the voltage source and is connected to the load via the diode. Thus, the output voltage level is increased and the speed of the blower (2) is increased independently from the heating level.

[0027] The boost converter (9) is used to energize the DC motor (3) and change the operational performance thereof through duty cycle adjustments. According to the present invention, heating level and motor speed control can be done independently without affecting each other. Making use of separate resistor elements to gradually change the heating level independently from the motor (3) control process provides user flexibility.

[0028] The actual amount of energies to be extracted from the battery pack and the potential difference generated by the battery pack depends on the battery cell chemistry and battery configuration. The voltage applied to the fan blower (2) can differentiate from the voltage applied to the heater's (4) heating resistors configured in parallel. Thus, the voltage applied to the fan can be increased or decreased independently from the heating power.

[0029] As it can be seen from the circuit in Fig. 4, the voltage relationship between the motor speed setting associated with the boost converter (9) voltage and the heater's dissipated active power is interrupted. In this manner, the level of heating and speed performance are adjusted independently from each other to avoid power fluctuations experienced when driving the fan.

[0030] In accordance with the invention, thanks to the boost converter (9), the voltage value needed for ensuring higher speed performance for motor fan assembly is provided. When the boost converter (9) is used according to the invention, performance measurements are found to reveal that the hair dryer's flow rate performance increases by up to 50% in comparison with a case where said boost converter (9) is not used.

[0031] Further, switches illustrated in Fig. 4, provide a configuration to change the resistance value of the heater (4) provided with a plurality of resistor elements configured in parallel connection. Opening/Closing a third switch (10) connected with a minimum number of resistor elements provides a power dissipation setting to be used as the heating power. Configuring a second switch (11) which involves voltage supply to at least two resistor elements in parallel with each other causes a varied resistance value and associated voltage. The precision of the heating level adjustment can be further increased by adding a first switch (12), upon opening/closing of which all resistor elements powered in parallel result in a smaller resistance value.

[0032] In a nutshell, the present invention proposes a portable hair dryer (1) comprising a DC motor (3) to drive a blower (2) of said hair dryer (1), said blower (2) being disposed between said DC motor (3) and a suction sec-

tion (5) to draw the outside air by the blower (2) to pass the same through a heater (4) to heat it and circulate towards an exit section (6), said heater (4) comprising a plurality of resistor elements and said portable hair dryer (1) comprising at least one battery (8) to supply power to said DC motor (3), blower (2) and heater (4).

[0033] In one embodiment of the present invention, said portable hair dryer (1) comprises a boost converter (9) energizing said DC motor (3) to drive said blower (2) in the manner that the output voltage level of the boost converter (9) is adjustable by varying the duty cycle of a power switch of said boost converter (9).

[0034] In a further embodiment of the present invention, said heater (4) comprises at least two resistor elements selectively supplied power by a plurality of switches.

[0035] In a further embodiment of the present invention, the voltage level applied to the fan blower (2) is different from the voltage level applied to the heater's (4) heating resistors in the manner that the output voltage level of the boost converter (9) is increased and the speed of the blower (2) is increased independently from the heating level of the heater (4).

[0036] In a further embodiment of the present invention, said at least two resistor elements are configured in parallel.

[0037] In a further embodiment of the present invention, at least one of said at least two resistor elements are connected in series with a switch.

[0038] In a further embodiment of the present invention, said at least one battery (8) is adapted to be disposed at a protruding section relative to the handle section (7) whereby operator grasp is ergonomically accommodated.

[0039] In a further embodiment of the present invention, said protruding section relative to the handle section (7) extends in perpendicular to the longitudinal axis of said handle section (7).

[0040] Basic notation for the electrical circuit in the figures can be indicated as L (Inductance), V_L (Inductance voltage), I_L (Inductance current), S (Power switch), C (Capacitance), D (Diode), R (Resistor) and V_0 (Load voltage).

[0041] The present invention relates to a circuit adjustment to increase the blower (2) flow rate and ensure separately adjustable setting configurations for heating level of the heater (4) and speed level of the blower (2) in a portable hair dryer (1). A boost converter (9) placed in a handle section (7) selectively increases the applicable voltage value to the motor (3). A plurality of resistor elements changing the voltage value for the heater (4) can also be selectively put into use separately from the boost converter (9) which drives the motor in control of the speed of the blower (2).

Claims

1. A portable hair dryer (1) comprising a DC motor (3) to drive a blower (2) of said hair dryer (1), said blower (2) being disposed between said DC motor (3) and a suction section (5) to draw the outside air by the blower (2) to pass the same through a heater (4) to heat it and circulate towards an exit section (6), said heater (4) comprising a plurality of resistor elements and said portable hair dryer (1) comprising at least one battery (8) to supply power to said DC motor (3), blower (2) and heater (4) **characterized in that**;
said portable hair dryer (1) comprises a boost converter (9) energizing said DC motor (3) to drive said blower (2) in the manner that the output voltage level of the boost converter (9) is adjustable by varying the duty cycle of a power switch of said boost converter (9),
said heater (4) comprises at least two resistor elements selectively supplied power by a plurality of switches and,
wherein the voltage level applied to the fan blower (2) is different from the voltage level applied to the heater's (4) heating resistors in the manner that the output voltage level of the boost converter (9) is increased and the speed of the blower (2) is increased independently from the heating level of the heater (4).

2. A portable hair dryer (1) as in Claim 1 **characterized in that** said at least two resistor elements are configured in parallel.

3. A portable hair dryer (1) as in Claim 2 **characterized in that** at least one of said at least two resistor elements are connected in series with a switch.

4. A portable hair dryer (1) as in Claim 1 **characterized in that** said at least one battery (8) is adapted to be disposed at a protruding section relative to a handle section (7) whereby operator grasp is ergonomically accommodated.

5. A portable hair dryer (1) as in Claim 4 **characterized in that** said protruding section relative to the handle section (7) extends in perpendicular to the longitudinal axis of said handle section (7).

Patentansprüche

1. Ein tragbarer Haartrockner (1) umfasst einen Gleichstrommotor (3) für den Antrieb eines Gebläses (2) des Haartrockners (1), wobei das Gebläse (2) zwischen dem Gleichstrommotor (3) und einem Saugabschnitt (5) angeordnet ist, um die Außenluft durch das Gebläse (2) abzusaugen, diese durch eine Heizung (4) zu leiten, sie zu erwärmen und in Rich-

tung eines Ausgangs des Abschnitt (6) zu zirkulieren, wobei die Heizung (4) mehrere Widerstandselemente umfasst; wobei der tragbare Haartrockner (1) mindestens eine Batterie (8) umfasst, um den Gleichstrommotor (3), das Gebläse (2) und die Heizung (4) mit Strom zu versorgen; **gekennzeichnet ist er dadurch,**

dass der tragbare Haartrockner (1) einen Aufwärtswandler (9) umfasst, der den Gleichstrommotor (3) mit Strom versorgt, um das Gebläse (2) so anzutreiben, dass der Ausgangsspannungspegel des Aufwärtswandlers (9) durch Variieren des Arbeitszyklus eines Leistungsschalters des Aufwärtswandlers (9) einstellbar ist,

dass die Heizung (4) mindestens zwei Widerstandselemente umfasst, die selektiv von mehreren Schaltern mit Strom versorgt werden,

wobei der an das Gebläse (2) angelegte Spannungspegel sich von dem an die Heizwiderstände des Heizgeräts (4) angelegten Spannungspegel dadurch unterscheidet, dass der Ausgangsspannungspegel des Aufwärtswandlers (9) und die Drehzahl des Gebläses (2) erhöht unabhängig vom Heizniveau des Heizgeräts (4) erhöht wird.

2. Ein tragbarer Haartrockner (1), wie in Anspruch 1 aufgeführt, **ist dadurch gekennzeichnet, dass** mindestens zwei Widerstandselemente parallel konfiguriert sind.

3. Ein tragbarer Haartrockner (1), wie in Anspruch 2 aufgeführt, **ist dadurch gekennzeichnet, dass** mindestens eines der mindestens zwei Widerstandselemente mit einem Schalter in Reihe geschaltet ist.

4. Ein tragbarer Haartrockner (1), wie in Anspruch 1 aufgeführt, **ist dadurch gekennzeichnet, dass** mindestens eine Batterie (8) an einem hervorstehenden Abschnitt relativ zu einem Griffabschnitt (7) angeordnet ist, wodurch der Griff des Bedieners ergonomisch untergebracht ist.

5. Ein tragbarer Haartrockner (1), wie in Anspruch 4 aufgeführt, **ist dadurch gekennzeichnet, dass** sich der hervorstehende Abschnitt relativ zum Griffabschnitt (7) senkrecht zur Längsachse des Griffabschnitts (7) erstreckt.

Revendications

1. Un sèche-cheveux portable (1) comprenant un moteur à courant continu (3) pour entraîner une soufflerie (2) dudit sèche-cheveux (1), ladite soufflerie (2) étant disposée entre ledit moteur à courant continu (3) et une section d'aspiration (5) pour aspirer l'air extérieur par la soufflerie (2) afin de faire passer celui-ci à travers un réchauffeur (4) pour le chauffer et le faire circuler vers une section de sortie (6), ledit dispositif de chauffage (4) comprenant une pluralité d'éléments de résistance et ledit sèche-cheveux portable (1) comprenant au moins une batterie (8) pour alimenter en énergie ledit moteur à courant continu (3), le ventilateur (2) et le dispositif de chauffage (4), **est caractérisé en ce que**

ledit sèche-cheveux portable (1) comprend un convertisseur (9) alimentant ledit moteur à courant continu (3) pour entraîner ledit ventilateur (2) de telle manière que le niveau de tension de sortie du convertisseur (9) est réglable en faisant varier le rapport cyclique d'un interrupteur de puissance dudit convertisseur (9),

ledit chauffage (4) comprend au moins deux éléments de résistance alimentés de manière sélective par une pluralité d'interrupteurs et,

dans lequel le niveau de tension appliqué à la soufflerie du ventilateur (2) est différent du niveau de tension appliqué aux résistances chauffantes de l'appareil de chauffage (4) de telle sorte que le niveau de tension de sortie du convertisseur (9) est augmenté et que la vitesse de la soufflerie (2) est augmentée indépendamment du niveau de chauffage de l'appareil de chauffage (4).

2. Un sèche-cheveux portable (1) comme dans la déclaration 1, est **caractérisé en ce que** lesdits au moins deux éléments de résistance sont configurés en parallèle.

3. Un sèche-cheveux portable (1) selon la déclaration 2, est **caractérisé en ce qu'**au moins un desdits au moins deux éléments de résistance est connecté en série avec un interrupteur.

4. Un sèche-cheveux portable (1) comme dans la déclaration 1, est **caractérisé en ce que** ladite au moins une batterie (8) est adaptée pour être disposée à une section en saillie par rapport à une section de poignée (7), de sorte que la prise de l'opérateur est logée de manière ergonomique.

5. Un sèche-cheveux portable (1) selon la déclaration 4, est **caractérisé en ce que** ladite section en saillie par rapport à la section de poignée (7) s'étend perpendiculairement à l'axe longitudinal de ladite section de poignée (7).

Fig. 1

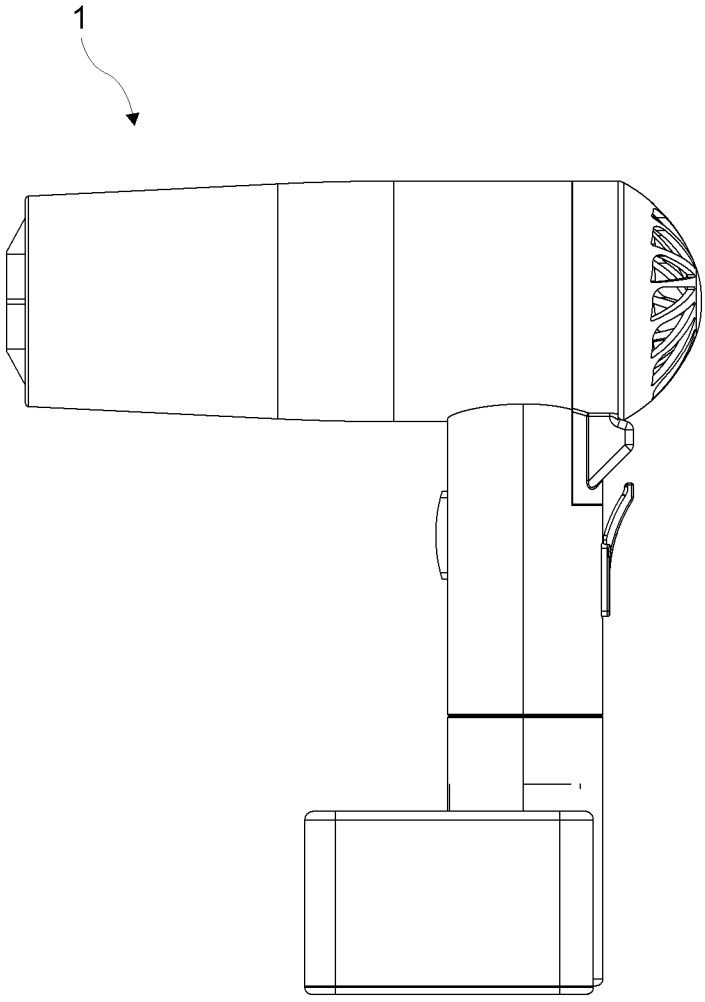


Fig. 2

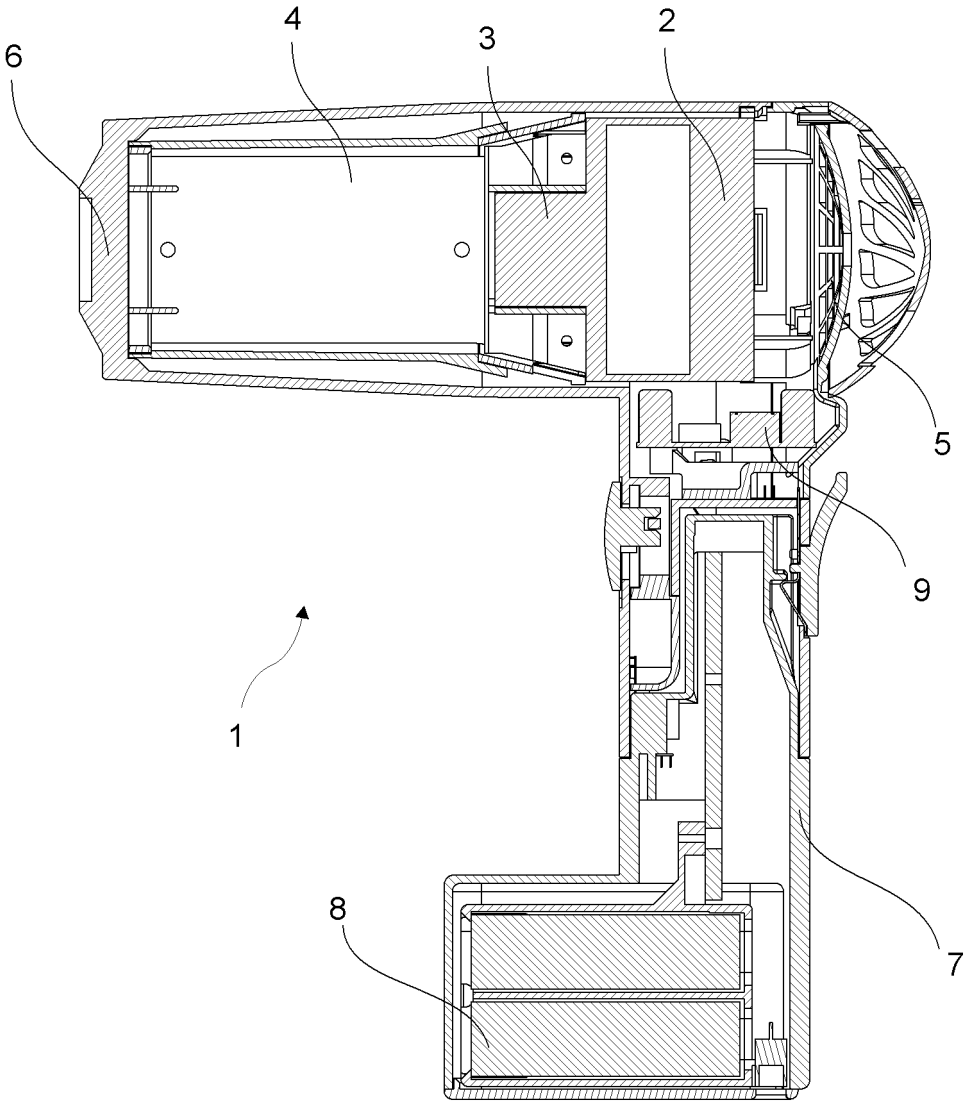


Fig. 3

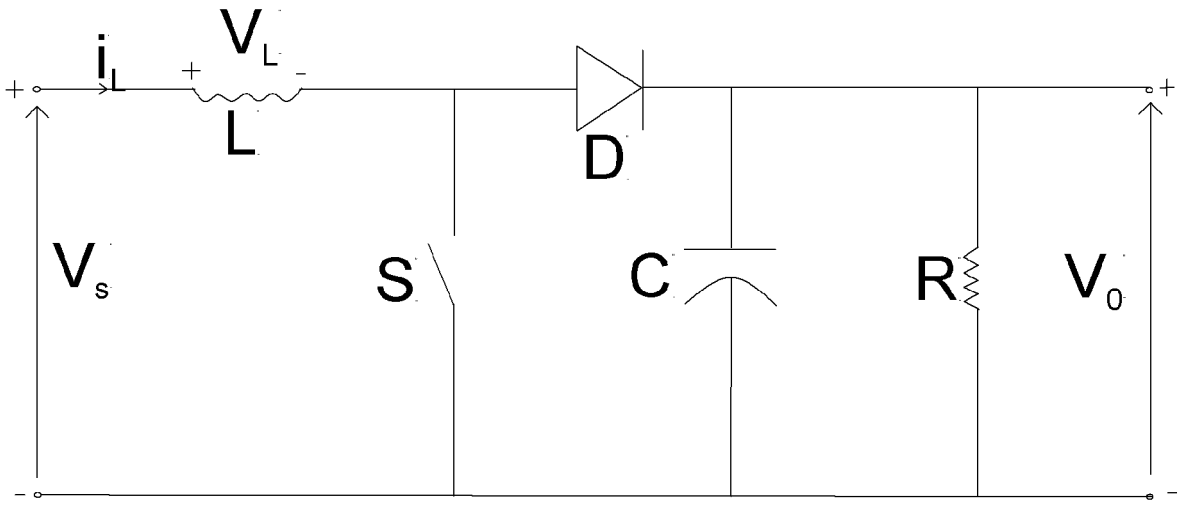
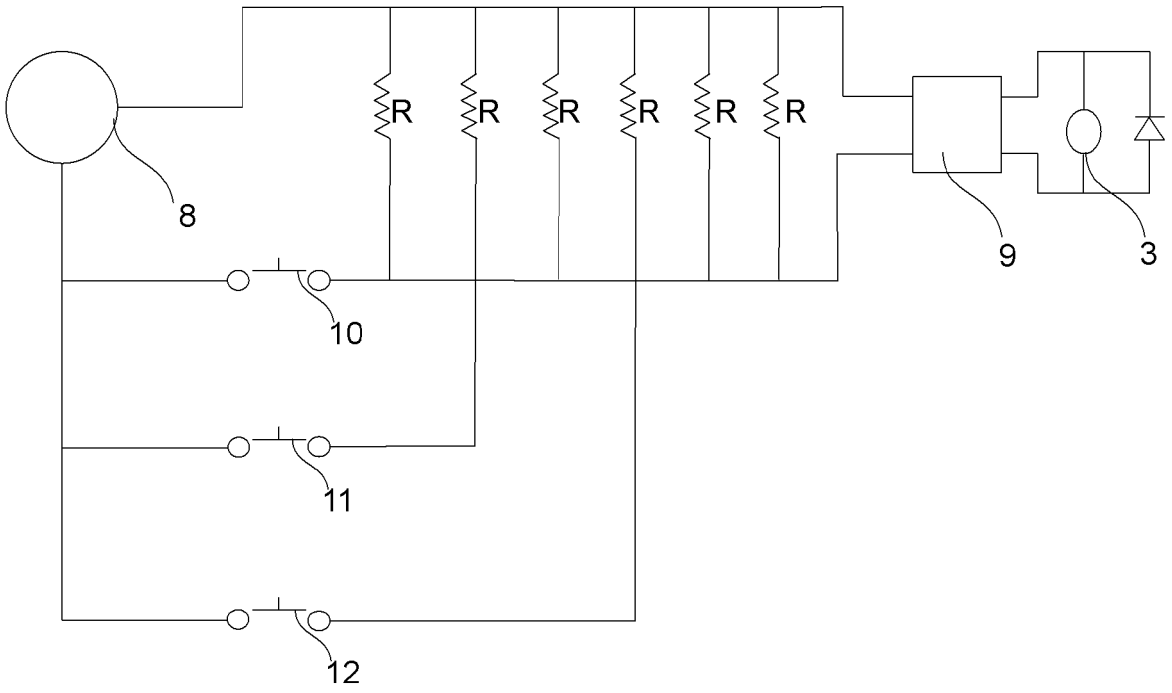


Fig. 4



REFERENCES CITED IN THE DESCRIPTION

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