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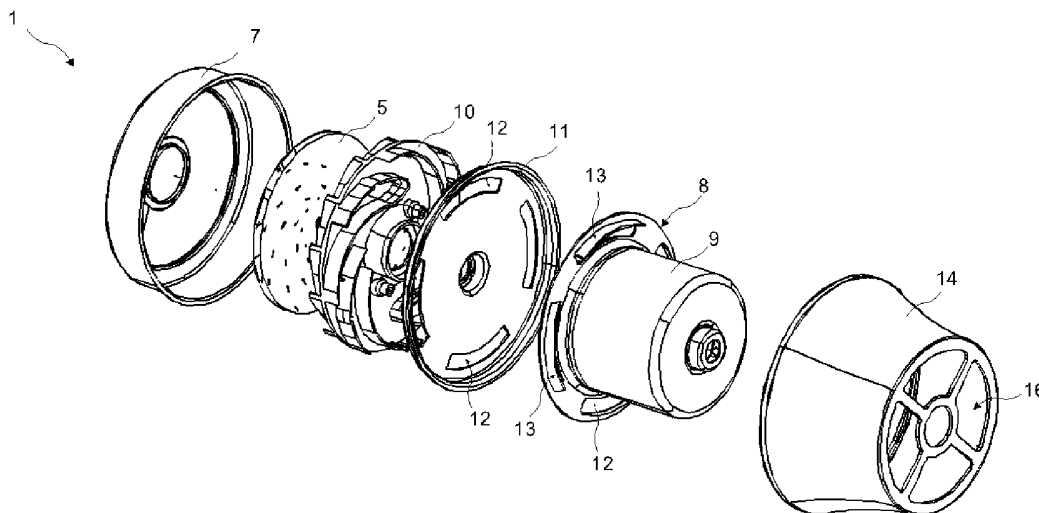
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(54) Title: AN ELECTRIC MOTOR



(57) Abstract: The present invention relates to the cooling of the brushless dc electric motors utilized in vacuum cleaners, having windings in the stator (2) and a magnet in the rotor, (3) wherein the stator (2) and the rotor (3) operate in an inner casing (9).

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Description

AN ELECTRIC MOTOR

- [001] The present invention relates to the cooling of a brushless dc type electric motor utilized in vacuum cleaners.
- [002] In vacuum cleaners air suction is generally provided by a fan which rotates in high speed creating centrifugal force, wherein the rotation of the fan is provided by electric motors with brush-collector mechanism in series type or brushless direct current motors. The air sucked in by the fan is passed over the motor and used for cooling the heated motor components. The rotor and stator windings get hot during operation in brush and collector type electric motors, especially the rotor windings can get overheated and burn. In order to yield the maximum performance from motors, the air gap between the stator and the rotor should be kept as narrow as possible. When the air sucked in by the fan is sent over the rotor and the stator for cooling purposes, it is forced to pass through the narrow air gap and the motor efficiency is reduced. Since the brushless dc motors utilized in vacuum cleaners do not have rotor windings, the problem of heating of the rotor and its windings is less compared to motors with brush and collector, but the stator and its windings should effectively be cooled anyway.
- [003] In the German Patent Application no. DE10200951, a fan is utilized for air flow from both sides in a vacuum cleaner. The fan vanes in the vacuum side provide air suction and the fan vanes on the motor side provide the cooling of the motor windings. In another embodiment, an exhaust fan is utilized for cooling the motor windings separately from the vacuum creating fan.
- [004] The United States of America Patent no. US 4065233 relates to a blower shape which provides suction in electric motors in vacuum cleaners. The air guide is designed such that the air current is expelled under the influence of the centrifugal force by the blower; the form of its front section helps to convert the dynamic pressure into static pressure during the air flow. The air flow under the static pressure is subsequently guided at a relatively low pneumatic velocity into the body of the motor and the motor is thus cooled.
- [005] In the United States of America Patent no. US 2658665 there are winding slots in the stator casing as well as the passages for flow of the cooling air to cool the fan motor of the vacuum cleaner.
- [006] In the United States of America Patent no. US5454690 a description is given for a fan housing comprising vanes which direct the air sucked in by the fan radially inward, cooling the motor and decreasing the noise of the airflow.
- [007] The aim of the present invention is the realization of a brushless dc type electric motor utilized in vacuum cleaners, with enhanced air directing structure for cooling it

effectively by the sucked in ambient air.

[008] The electric motor realized in order to attain above mentioned aim of the present invention is shown in the attached figures where:

[009] Figure 1 – is the exploded view of an electric motor.

[010] Figure 2 – is the cross-sectional view of an electric motor.

[011] Figure 3 – is the schematic view of an electric motor.

[012] Elements shown in the figures are numbered as follows:

1. Electric motor
2. Stator
3. Rotor
4. Shaft
5. Fan
6. Suction inlet
7. Fan cover
8. Flange
9. Inner casing
10. Diffuser
11. Supporting plate
12. Air hole
13. Vane
14. Outer casing
15. Cooling volume
16. Exhaust outlet

[013] The electric motor (1) utilized in vacuum cleaners comprises a stator (2) which converts the input voltage into a magnetic field, a rotor (3) which is activated in the field generated by the stator (2), a shaft (4) which transmits the rotating movement of the rotor (3), one or more fans (5) assembled on the shaft (4) and which enables the sucking of air from the outside with the rotating movement, a fan cover (7) that forms an air sucking volume by closing over the fan (5) and having a suction inlet (6), an inner casing (9) into which the stator (2) and the rotor (3) are situated, preferably having a cylindrical shape and having a flange (8) at its side that helps for its assembling, a diffuser (10) that is for directing the air sucked in by the fan (5), and a supporting plate (11) between the diffuser (10) and the inner casing (9).

[014] In the embodiment of the present invention, the electric motor (1) comprises one or more air holes (12) situated on the supporting plate (11) and/or the flange (8), outside of the area covered by the inner casing (9) on the supporting plate (11) enabling the air drawn in the suction inlet (6) passing through the diffuser (10) to be blown towards the inner casing (9) to cool the components heated during operation and to be blown

outside the inner casing (9) shell, one or more vanes (13) which direct the air towards the outer wall of the inner casing (9), preferably extending from the side of the air holes (12) and formed with a shape inclined towards the inner casing (9) so that it can direct the air towards the inner casing (9) shell, an air directing outer casing (14) which help the air blown through the air holes (12) and directed by the air diffusing vanes (13) to pass entirely sweeping the outer wall of the inner casing (9) shell to consequently cool the stator (2) and is positioned on the shell of the inner casing (9) by snap-fitting and a cooling volume (15) between the outer casing (14) and the inner casing (15).

[015] The outer casing (14) comprises one or more exhaust outlets (16) helping to expel out the air passed through the cooling volume (15).

[016] The outer casing (14) encircling the inner casing (9) with the cooling volume (15) in between for air flow, is assembled on the supporting plate (11). The air sucked in from the outside is blown through the air holes (12), directed to the shell of the inner casing (9) by the vanes (13) and flows along the cooling volume (15) to be expelled out from the exhaust outlet (16) after sweeping the outer wall of the inner casing (9) shell.

[017] Rotor (3) overheating problem is not confronted in the brushless dc electric motor (1) since the rotor (3) does not comprise windings of copper wire. In the brushless dc electric motor (1) of the present invention, since there is no need for passing air through the air gap between the stator (2) and the rotor (3) for cooling the rotor (3), air with high flow rate can be blown from the outer wall of the inner casing (9) where the stator (2) is embedded.

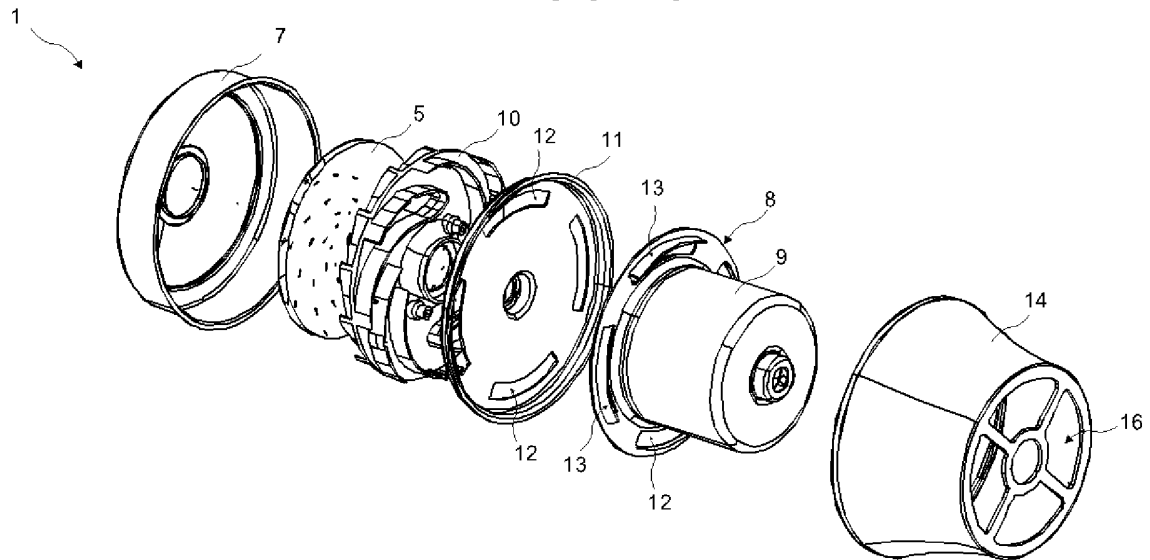
[018] When the electric motor (1) operates, the fan (5) rotates in high speed creating a vacuum effect and the ambient air is drawn in from the suction inlet (6). The air that flows in through the suction inlet (6) is dispersed in radial direction over the fan (5) blades due to the centrifugal effect and passes through the diffuser (10) within the volume limited by the fan cover (7) and is directed towards the air holes (12). The air blown outside the inner casing (9) shell through the air holes (12) situated on the supporting plate (11) and/or the flange (8), is directed towards the outer wall of the inner casing (9) shell with the help of the vanes (13). The blown air is made to sweep the entire outer wall of the inner casing (9) shell with the help of the outer casing (14).

[019] In vacuum cleaners, effective cooling of the stator (2), rotor (3), and the inner casing (9) which embeds the stator (2) and the rotor (2) in brushless dc type electric motors (1) is achieved by the air directed via the vanes (13) and the outer casing (14), and the heating of the components in contact with the electric motor (1) within the vacuum cleaner is prevented as well.

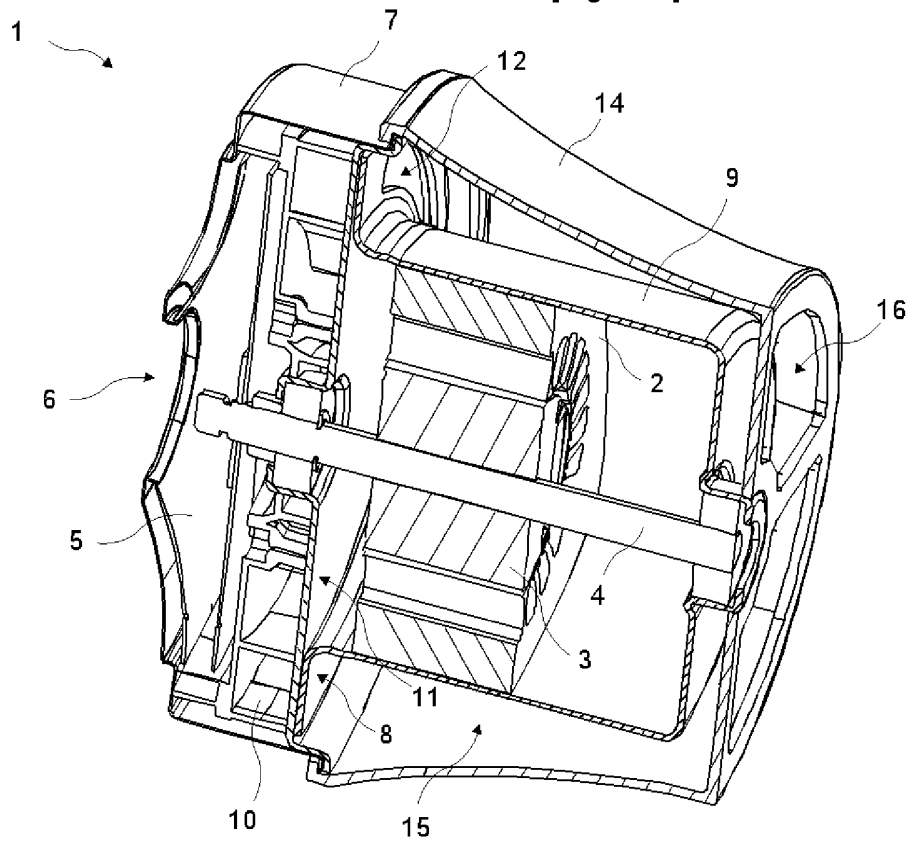
Claims

- [001] An electric motor (1) utilized in vacuum cleaners (1) comprising a stator (2) which converts the input voltage into a magnetic field, a rotor (3) which is activated in the field generated by the stator (2), a shaft (4) which transmits the rotating movement of the rotor (3), one or more fans (5) assembled on the shaft (4) enabling the sucking of air from the outside with the rotating movement, an inner casing (9) in which the stator (2) and the rotor (3) are situated, having a flange (8) that helps for its assembling, a diffuser (10) helping direct the air sucked in by the fan (5) and a supporting plate (11) between the diffuser (10) and the inner casing (9), and characterized by more than one air holes (12) that help the air to be blown to the outside of the inner casing (9) shell, an air directing outer casing (14) making the air blown from the air holes (12) to sweep the entire outer wall of the inner casing (9) shell thus cooling the stator (2) situated within the shell of the inner casing (9) and a cooling volume (15) between the outer casing (14) and the inner casing (9).
- [002] An electric motor (1) as in Claim 1, characterized by an outer casing (14) comprising one or more exhaust outlets (16) that help expel out the air flowing through the cooling volume (15).
- [003] An electric motor (1) as in Claim 1, characterized by one or more vanes (13) situated on the flange (8) and/or the supporting plate (11) directing the air towards the outer wall of the inner casing (9) shell.
- [004] An electric motor (1) as in Claim 3, characterized by vanes (13) extending from the side of the air holes (12) to the inner casing (9), formed with a shape inclined towards the inner casing (9) shell so that it can direct the air towards the inner casing (9) shell.

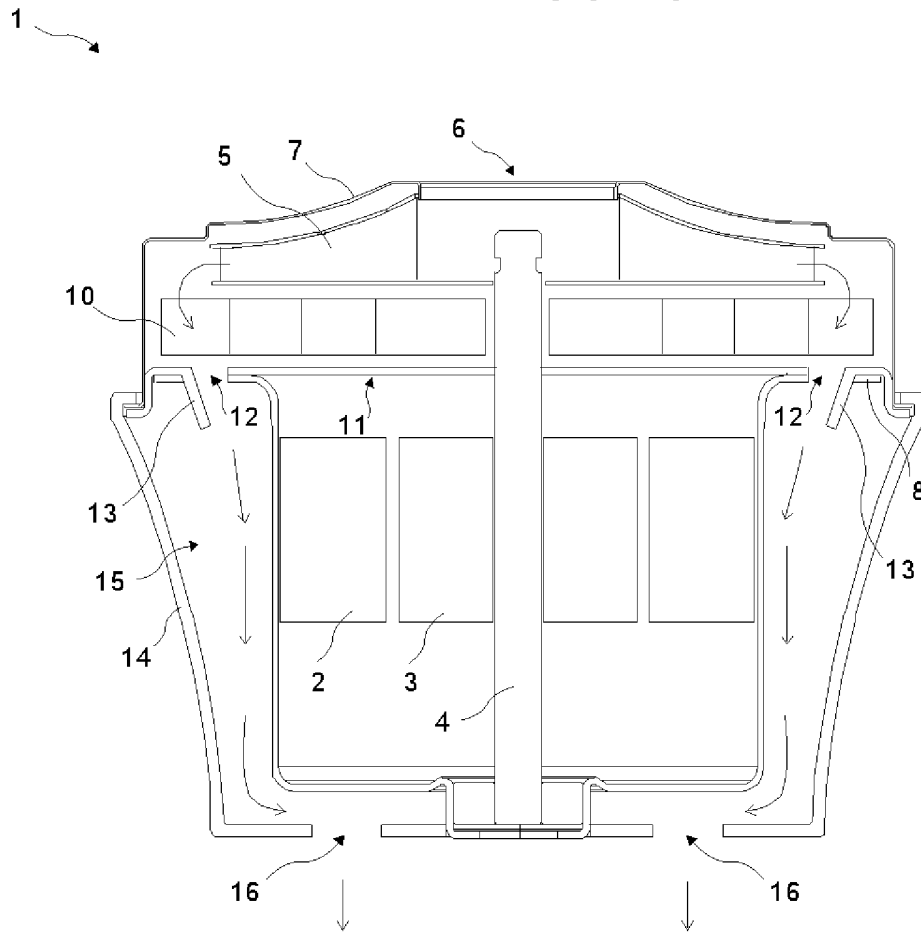
[Fig. 001]



[Fig. 002]



[Fig. 003]



INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER H02K9/14				
According to International Patent Classification (IPC) or to both national classification and IPC				
B. FIELDS SEARCHED				
Minimum documentation searched (classification system followed by classification symbols) H02K				
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched				
Electronic data base consulted during the international search (name of data base and, where practical, search terms used) EPO-Internal, WPI Data, PAJ				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
X	GB 1 531 664 A (FISKER & NIELSEN AS) 8 November 1978 (1978-11-08)	1,2		
Y	page 3, left-hand column, line 1 - page 4, left-hand column, line 44; figures 1,2	3,4		
Y	----- PATENT ABSTRACTS OF JAPAN vol. 2002, no. 05, 3 May 2002 (2002-05-03) -& JP 2002 010575 A (MITSUBISHI ELECTRIC CORP), 11 January 2002 (2002-01-11) abstract; figures 1-6	3,4		
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<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. </td> <td style="width: 50%; border: none;"> <input checked="" type="checkbox"/> See patent family annex. </td> </tr> </table>			<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C.	<input checked="" type="checkbox"/> See patent family annex.
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Date of the actual completion of the international search <p style="text-align: center;">20 March 2006</p>	Date of mailing of the international search report <p style="text-align: center;">30/03/2006</p>			
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer <p style="text-align: center;">Tangocci, A</p>			

INTERNATIONAL SEARCH REPORT

International application No

PCT/IB2005/054326

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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Information on patent family members

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