



(12)

EUROPEAN PATENT APPLICATION

(21) Application number : **94306714.0**

(51) Int. Cl.⁶ : **F04D 25/06, F04D 17/16**

(22) Date of filing : **13.09.94**

(30) Priority : **16.09.93 GB 9319172**

(43) Date of publication of application :
22.03.95 Bulletin 95/12

(84) Designated Contracting States :
AT DE ES FR GB IE IT PT SE

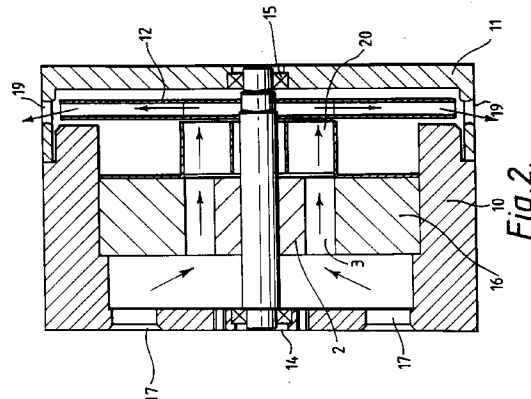
(71) Applicant : **ELECTROLUX LIMITED**
Oakley Road
Luton, LU4 9QQ (GB)

(72) Inventor : **Clapp, Kathryn**
173 High Street
Arlesey, Bedfordshire SG15 6SZ (GB)

(74) Representative : **Arthur, Bryan Edward et al**
Withers & Rogers
4 Dyers Buildings
Holborn
London, EC1N 2JT (GB)

(54) **Air impeller and devices incorporating air impellers.**

(57) An air impeller comprising a fan (12) situated within the air duct and driven by a switched-reluctance motor, air impelled by the fan passing through the rotor (2) of the motor. Air guides (20) may be interposed between the motor armature and the fan. The fan may be a centrifugal fan. The impeller is applicable to vacuum cleaners, air-cushion-supported lawn mowers, leaf blowers, air conditions, hand driers, hair driers, hot-air heaters and the like.



This invention relates to air impellers, in particular electrically driven air impellers, and to devices incorporating such air impellers, for example vacuum cleaners, air-cushion-supported lawnmowers, leaf blowers, air conditioners, hand driers, hair driers, hot-air heaters and the like.

Such impellers comprise an electric motor driving a fan to provide the air flow. The motor is normally of the induction type and requires cooling. This is generally provided by a separate flow of cooling air generated by an additional fan mounted on the armature shaft, or it may be provided by part or all of the air flow generated by the main fan being caused to pass over the outside of the motor.

The present invention, which is defined in the appended claims, depends on the use of a motor of the switched-reluctance type. The armature of such a motor has salient poles without any windings and so presents a large "window" through which air can flow. Such motors can run at high speeds, which makes them particularly suitable for driving centrifugal fans.

Preferably the motor is positioned upstream of the fan, so that it is not subjected to the heat generated by the fan and is, therefore, more efficiently cooled.

The motor armature itself produces a pumping action and this may be further increased by appropriate shaping of the pole pieces. Air guides may be positioned downstream of the rotor to redirect the flow of air as it leaves the armature.

The invention will be further described by way of example with reference to the accompanying drawings, in which

Figure 1 is a diagrammatic end view of a motor to be used in the present invention.

Figure 2 is an axial section through an air impeller according to the invention.

Figure 3 is a longitudinal section through a wheeled domestic vacuum cleaner incorporating the invention.

Referring first to Figure 1 which is a much simplified end view of the motor, the motor comprises a stator 1, the windings and pole structure of which are not shown in the figure, and a rotor or armature 2. The motor is of the switched-reluctance type, designed to run at 40 000 rpm and areas 3 between the rotor poles, shown shaded, are not occupied by windings, and so present a large area allowing for the free passage of air through the motor. The pole pieces are of a slightly oblique section, so as to exert a pumping action as they rotate.

Figure 2 is an axial section through an air impeller designed to form part of a domestic vacuum cleaner. The impeller comprises an outer housing in two sections 10, 11, containing the motor and fan, and which define a duct for the air passing through the impeller. The fan 12 is mounted on the rotor shaft 13, which rotates in ball bearings, 14, 15, respectively, in the

housing sections 10, 11.

Section 10 houses the motor stator 1 and is provided with apertures 17 for the inflow of air, while the section 11 houses the fan 12, and is provided with apertures 10 at its periphery for the outflow of the air. The rotor 2 has large window areas between its poles through which the air can pass, and between the motor and the fan 12 is positioned an air guide 20 which redirects air emerging from the rotor into an axial direction of movement.

In use of the vacuum cleaner, air entering the nozzle and passing through the hose is drawn through the dust bag into the impeller unit by way of the apertures 17, subjected to a first pumping action due to the rotor 2, re-directed axially by the air guides 20, and then pumped out through the peripheral apertures 19 by the fan 12.

Figure 3 shows a longitudinal section of a wheeled vacuum cleaner machine 21 with hose attachment which includes the motor of the present invention.

The motor of the machine 21 draws air from the hose into the machine body 22 via a machine inlet 23. The air then passes into a duct collection bag 24 which filters dust and debris from the air. The air then passes into the motor unit through apertures 17 in the outer housing 10 of the motor. The air experiences a pumping action from the interaction of the stator 1 and the oblique rotor or armature 2 as the rotor 2 rotates with respect to the stator 1. This causes the air to be drawn through the areas 3 between the poles of the rotor 2. The rotor 2 is mounted on a rotor shaft 13 which in turn is mounted for rotation in bearings 14, 15.

The air then passes past the air guide 20 into the section 11 which houses the fan 12. The fan 12 is mounted on the rotor shaft 13 and, when the motor is operating, draws air through the motor and impels the air out of the housing section 11 through apertures 10. The air is then vented to atmospheric air through a machine outlet 25 in the machine body 22.

Claims

1. An air impeller comprising a fan situated within an air duct and driven by an electric motor, characterised in that the motor is a switched-reluctance motor and at least the armature of the motor lies within the duct so that air impelled by the fan passes through the armature.
2. An air impeller according to claim 1 in which the motor armature is positioned upstream of the fan so that air impelled by the fan passes first through the motor armature.
3. An air impeller according to claim 2 in which one

or more air guides are interposed between the motor armature and the fan.

4. An air impeller according to any preceding claim in which the poles of the armature are shaped so as to exert a pumping action on the air passing through them. 5
5. An air impeller according to any preceding claim in which the fan is a centrifugal fan. 10
6. An air impeller according to any preceding claim in which the motor is designed to operate at a speed exceeding 10 000 revolutions per minute. 15
7. A vacuum cleaner incorporating an air impeller according to any preceding claim.

20

25

30

35

40

45

50

55

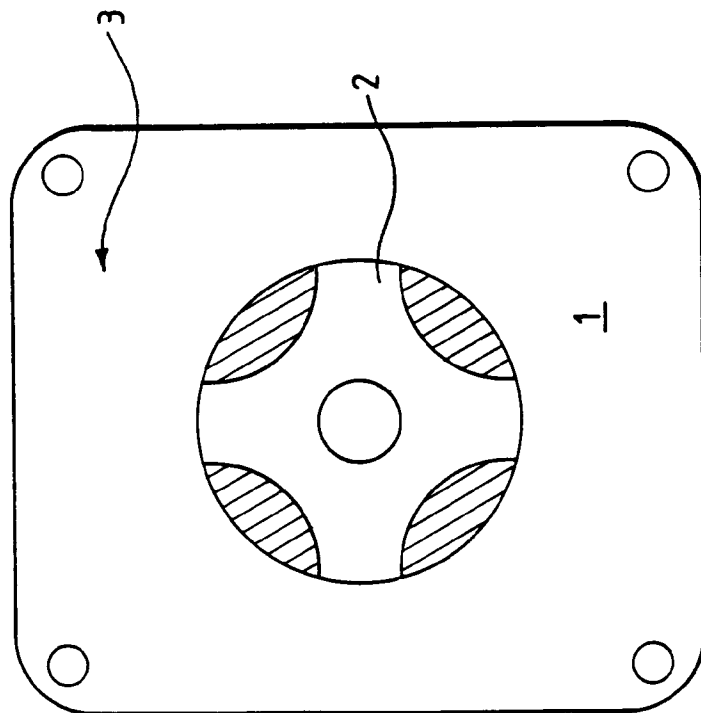


Fig.1.

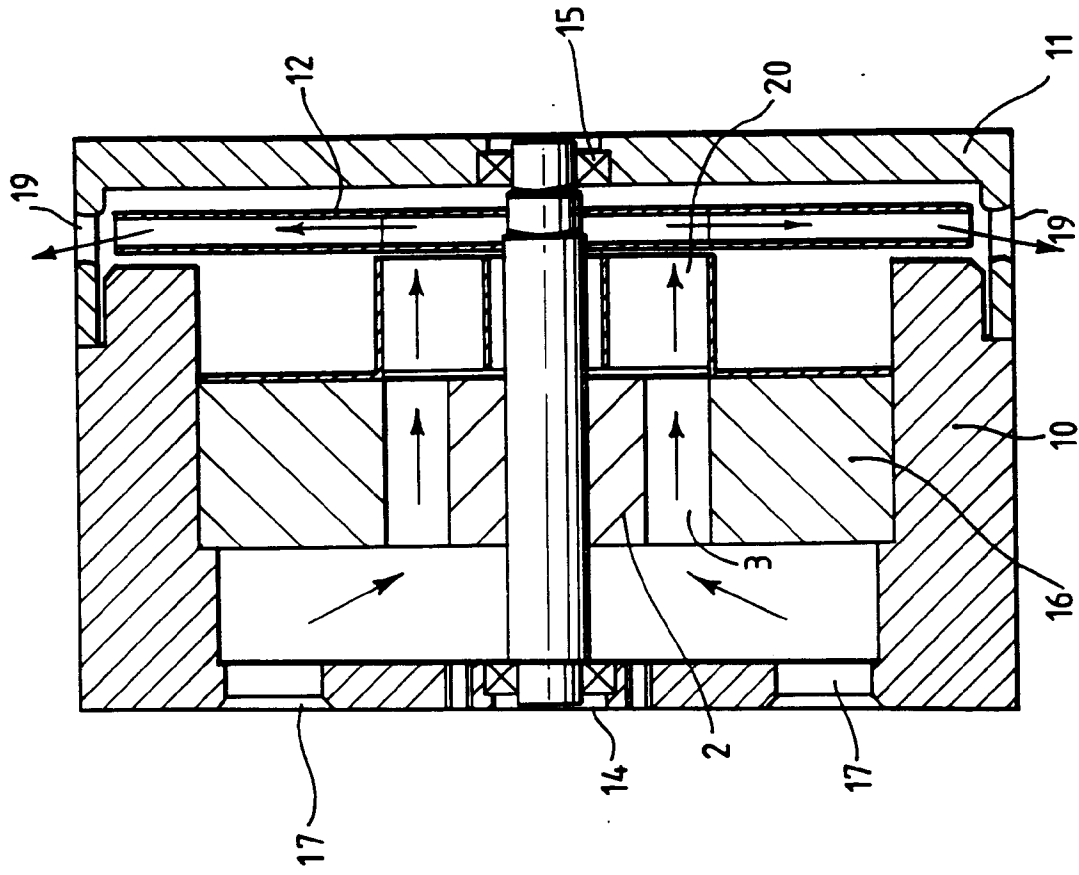
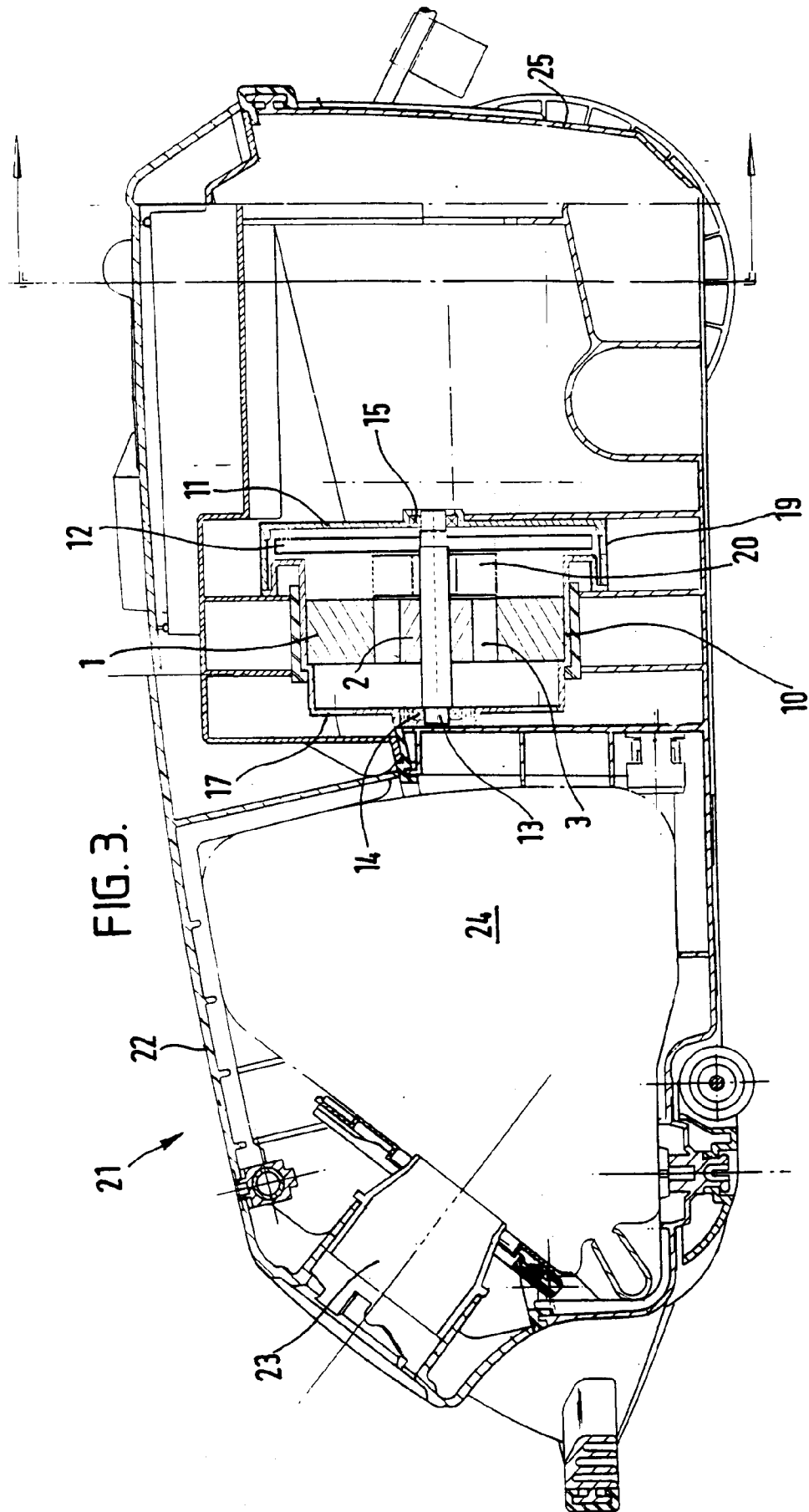


Fig.2.





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 30 6714

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	EP-A-0 531 792 (LICENTIA PATENT-VERWALTUNGS-GMBH.) * page 2, column 2, line 44 - page 4, column 5, line 3; figures 1-3 *	1,2	F04D25/06 F04D17/16
Y	---	3-7	
Y	US-A-3 730 642 (BARNSTEAD) * column 2, line 20 - column 3, line 51; figures 1,2 *	3,5,7	
Y	---		
Y	EP-A-0 427 145 (ARTHUR PHEIFFER VAKUUMTECHNIK WETZLAR) * the whole document *	4	
Y	---		
Y	DE-A-41 14 989 (VDO ADOLF SCHINDLING) * the whole document *	4	
Y	---		
Y	PATENT ABSTRACTS OF JAPAN vol. 17, no. 85 (E-1322) 19 February 1993 & JP-A-04 281 390 (SECOH GIKEN) 6 October 1992 * abstract *	6	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	---		
A	GB-A-150 286 (CRAMER) * figure 1 *	1,2	F04D H02K
A	---		
A	DE-A-16 28 318 (LICENTIA PATENT-VERWALTUNGS-GMBH.) * the whole document *	1,2	

The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 22 December 1994	Examiner Teerling, J
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 (3.82 (P04C01))