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(54) FAN WITH A COOLED MOTOR

(71) We, SOCIETE ANONYME FRANCAISE DU FERODO, a French Societe Anonyme of 64 Avenue de la Grand-Armee, 75-Paris, France, do hereby declare the invention, for which we pray that a Patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

The invention relates to motor-fan units comprising a helicoid fan driven by an electric motor, and applies to those which are used to cool the motors of automobile vehicles. More precisely, it concerns the cooling of the electric motor.

This cooling poses problems, arising from the fact that often it cannot be ensured by the air stream created by the fan. As a matter of fact, it is known that a helicoid fan has an output distinctly lower near its hub than near its periphery, so that it produces a mask effect and so that the air stream circulating against or in the electric driving motor may be insufficient to cool it properly. It is particularly the case with motor-fan units used for producing or speeding up the air stream passing through the radiator for cooling the circulation water of an automobile vehicle motor, in which the electric motor driving the fan often works with a mediocre output, especially if it is a two speed motor, and consequently dissipates a significant quantity of energy as heat.

Two speed motor-fan units, in which the slow speed is obtained by connecting a resistor in series in the supply circuit of the electric motor, poses, moreover, the problem of cooling this resistor. In addition, the fan of an apparatus for cooling by water is placed either in front of the radiator in order to blow the air through the latter or behind in order to draw the air through it. In the first instance, the

electric motor is often at the suction side of the fan; in the second instance, this motor is often at the output side. The cooling apparatus of the electric motor must therefore be installed with due regard paid to the direction of the flow, in relation to this motor, of the air stream created by the helicoid fan.

The essential aim of the invention is to allow realisation of a motor-fan unit whose motor is efficiently cooled. Another aim is to ensure cooling of the resistor of a two speed motor-fan unit. Yet another aim is to allow realisation of a motor-fan unit whose motor is efficiently cooled whether placed at the output side or at the suction side of the helicoid fan.

The proposal has already been made, either with an aim of increasing the output and the output pressure in a helicoid fan, or with the aim of lessening the resistance given to the out-flow of an airstream by a helicoid fan when arrested or wind-driven, while avoiding driving air back upstream, or contriving, in the hub or in the neighbourhood of the axis of the helicoid fan, passages forming a centrifugal or helicocentrifugal fan driving back in the same direction as the helicoid fan.

According to the present invention there is provided a motor-fan unit for use in an automobile engine cooling system, comprising an electric motor driving a rotary helicoid fan in a central area of which there is fitted centrifugal blading, the air sucked by the centrifugal blading being caused to flow over and cool the electric motor, and a fixed volute extending all around the rotary centrifugal blading and arranged to collect the air discharged thereby, and having an air outlet located at the side of the helicoid fan which is adjacent to the electric motor, for discharging air from the volute at that side of the helicoid fan.

The air discharged by the volute is at a static pressure far greater than that of the air driven by the helicoid fan. Therefore, even if the direction of rotation is such that the opening of the volute is at the output side of the helicoid fan, there is no risk of the flow of air driven by the latter blocking the outlet of the flow of the cooling air of the electric motor. The direction of rotation can be reversed, the air driven by the centrifugal fan being then drawn through the helicoid fan, with no risk of this air being recirculated through the motor by the centrifugal fan.

In the case of a two speed motor, the "slow speed" resistance is advantageously placed in the volute or outside the outlet of the latter, which allows cooling of the resistor to be ensured, while keeping it enclosed and protected.

The description which follows, with regard to the attached drawings given by way of non-limiting example, will make the way in which the invention can be realised completely comprehensible, the details which appear, as much as the drawings of the text, forming, of course, part of the said invention.

Figure 1 represents diagrammatically a motor-fan unit according to the invention, seen in section through the axis, and shows the flow of the air when the fan draws in the air through a radiator.

Figure 2 is a diagrammatic view in plan along the arrow II of figure 1.

Figure 3 is a similar view to figure 1, showing a fan blowing the air through a radiator.

Figure 4 is a view in section of an embodiment of a motor-fan according to the invention.

Figure 5 is a partial view along arrow V of figure 4, the rotor being seen partially in section.

The motor-fan unit of figures 1 and 2 is intended to draw the air through a radiator 1 where the cooling water of the motor of an automobile vehicle, not represented, circulates. The motor-fan unit comprises an electric motor 2 on the shaft 3 of which are mounted the vanes 4 of a helicoid fan and an internal centrifugal blading 5. The helicoid fan is surrounded by a collar 6 which is fixed behind the radiator 1 by means not represented and which is connected by arms 7 to a housing 8 in which is fixed the motor 2. Around the centrifugal blading 5 is disposed a volute 9 whose outlet orifice 10 is located behind the back edge (or outlet edge) of the vanes 4. The volute 9 is fixed to the front of the housing 8 and the latter is provided at the back with openings 11 through which enters, when the motor-fan unit is driven in rotation, a flow of cooling air represented diagrammatically by the arrows 12. This air flow 12 circulates from back to front in the motor 2 to cool it, by being drawn in by the centrifugal blading 5 which drives it into the volute 9, where it is slowed down and dis-

charged at 10 at a static pressure far greater than that of the principal flow of air, represented diagrammatically by the arrows 13, which is discharged towards the back by the vanes 4 after having been drawn in through the radiator 70 1. The pressure of the air flow 13 consequently cannot prevent the air flow 12 from issuing at 10.

Figure 3, in which the same elements are designated by the same reference numbers bearing the index *a*, shows diagrammatically a motor-fan unit disposed in such a way as to blow the air flow 13*a* through the radiator 1*a*. The flow 12*a*, issuing at 10*a* from the volute 9*a*, is taken up again by the vanes 4*a* of the helicoid 80 fan, which drive it with the flow 13*a* through the radiator 1*a*. Consequently there is no risk of the flow 12*a* being recycled through the openings 10*a* and the motor 2*a*. Therefore it is seen that an identical motor-fan unit could be 85 mounted either as in figure 1 or as in figure 3; it would be sufficient, at least theoretically, to reverse the direction of rotation of the motor, in order to change from the installation in figure 1 to that of figure 3. An identical profile 90 of vanes, however, does not allow the obtaining of a good output in the two directions or rotation. In practice, preference will consequently be given to providing two types of rotor whose vanes are suitable respectively 95 for the installation of figure 1 and for that of figure 1, and a single type of motor unit 2-8-9 equally able to receive a rotor of one type or the other.

Figures 4 and 5, in which the elements playing the same part as in figure 1 are designated by the same reference numbers bearing the index *b*, show an embodiment in which an electrical resistor 14 is connected in series in the supply circuit 15 of the motor 2*b* when the motor-fan unit has to turn over at a slow speed. 105 The rotor of the fan comprises a hub 16 fixed to the shaft 3*b* of the motor and solid with a "head" 17 which supports the vanes 4*b* of the helicoid fan and the centrifugal blading 5*b*. The "head" 17 is formed by a disc whose peripheral part is curved towards the motor at 17*a*, the vanes 4*b* being fixed to the exterior of the curved peripheral part 17*a* and the blades 5*b* being fixed to the interior wall of the "head". 115

The motor 2*b* is fixed in the cylindrical housing 8*b* by clamps 18, and the volute 9 is delimited, inside the peripheral part 17*a* of the "head" by a piece 19 which comprises a cylindrical skirt 19*a* solid with the housing 8*b* and carrying at its end a perpendicular plane wall 19*b* whose circular exterior edge 19*c* is connected by a wall 19*d*, parallel with the skirt 19*a* and of progressively increasing length, in such a way that its end 19*e* forms a helix, to a helicoidal transverse wall 19*f* which extends radially up to an exterior edge 19*g*, also forming a helix in immediate proximity to the curved peripheral part 17*a* of the "head", while leaving, however, inside the latter enough play 130

to allow its rotation. The casing 9*b* is thus formed by the space comprised between the "head", the wall 19*d* and the wall 19*f*, a space whose section gradually increases from its beginning to the outlet 10*b*.

AT the outlet 10*b* (figure 5), the wall 19*f* curves sharply at 19*h* and fits together with the skirt 19*a* to form a support 20 to which the resistor 14 is fixed. This resistor is thus immersed in the flow of air 12*b*, which is channelled in the volute 9*b*, and is efficiently cooled by this flow of air. This flow of air has a relatively low output and the presence of the resistor consequently runs no risk of producing a disagreeable noise, which would be produced if it were immersed in the flow of air extracted by the vanes 4*b*. In addition, the walls 17*a*, 19*b* and 20 protect the resistor against shocks.

It is evident that the mode of realisation described is only an example and that it could be modified, particularly by substitution of equivalent techniques, without thereby going beyond the scope of the invention. In particular, the resistor could be placed in the volute and not at the outlet of the latter.

WHAT WE CLAIM IS:—

1. A motor-fan unit for use in an automobile engine cooling system, comprising an electric motor driving a rotary helicoid fan in a central area of which there is fitted centrifugal blading, the air sucked by the centrifugal blading being caused to flow over and cool the electric motor, and a fixed volute extending all around the rotary centrifugal blading and arranged to collect the air discharged thereby, and having an air outlet located at the side of the helicoid fan which is adjacent to the electric motor, for discharging air from the volute at

that side of the helicoid fan.

2. A motor-fan unit as claimed in claim 1, further comprising an electrical resistor in the energizing circuit of the electric motor and supported adjacent the air outlet of the volute.

3. A motor-fan unit as claimed in claim 1 or 2, comprising a rotary, cupped first wall forming a hollow rotor carrying the helicoid fan externally and the centrifugal blading internally, and a stationary housing around the electric motor and having an annular flange extending radially to a circular outer edge located approximately opposite the trailing edge of the centrifugal blading, a stationary second wall extending axially away from the centrifugal blading from the circular edge to a helical edge, and a stationary helical third wall extending radially from the helical edge to the immediate vicinity of the cupped first wall, whereby the first, second and third walls together bound the volute.

4. A motor-fan unit as claimed in claim 3, insofar as dependent on claim 2, further comprising a support integral with the helical wall, the electrical resistor being carried by the support adjacent the air outlet of the volute.

5. A motor-fan unit constructed and arranged substantially as herein described with reference to Figures 1—2, Figure 3 or Figures 4—5 of the accompanying drawings.

6. An automobile engine cooling system comprising a motor-fan unit according to any of the preceding claims.

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FIG.:2

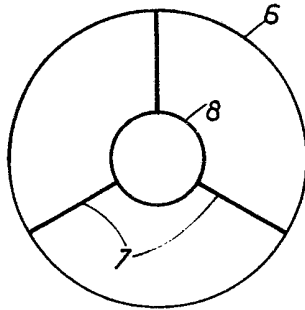


FIG.:1

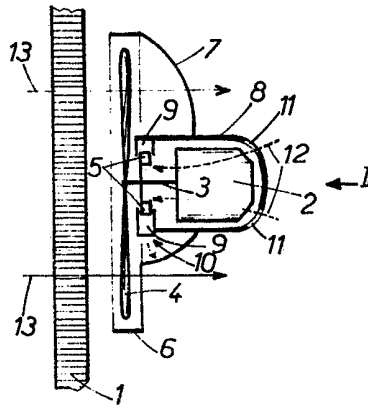


FIG.:3

