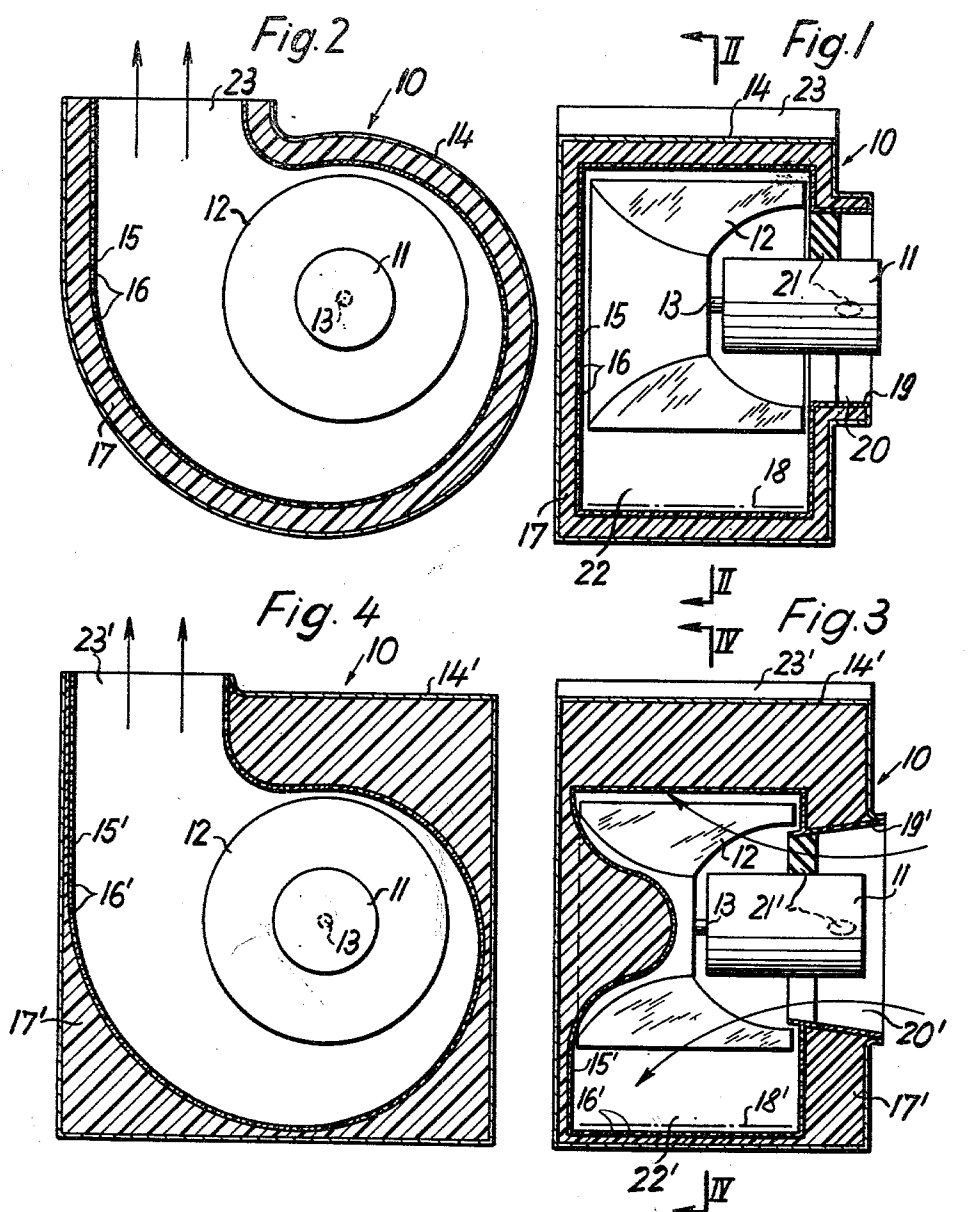


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HEATING OR COOLING FAN

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HEATING OR COOLING FAN

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The present invention relates to a heating or cooling fan, especially for heating and ventilating systems of motor vehicles, and it is the principal object of the invention to reduce the sound of operation of such a fan by very simple means at the very source of the sound.

There are numerous kinds of such fans known in which the attempt is made to reduce especially the sound of the fan which is caused by the separation of the vortices on the rotor edges of the fan by the provision of sound-absorbent materials, such as pulverized cork, fibrous substances, or the like, which are embedded in a finely divided condition in an adhesive which is applied upon the inner wall surface of the fan housing. However, since the outer housing walls of these fans consist of metal or a solid plastic, the noise of operation is transmitted to the outside through the sound-transmitting properties of these materials. Moreover, this noise is even amplified by the natural vibration of the solid, nonresilient parts of the housing.

Based on the finding that sound vibrations pass through solid parts and are amplified thereby, it is an object of the present invention to provide suitable means for reducing the sound vibrations coming from a source of sound to such an extent that the noise can no longer be noticed outside of the fan housing.

For attaining this object, the invention provides the housing of the heating or cooling fan to be made in the form of a sound-absorbing filter, the absorbent layer of which is defined toward the outside by a gastight wall and toward the inside by a perforated wall. The outer wall may then consist of a flexible material and the inner wall of a solid material. The vibration-damping properties of the flexible material of the outer wall prevent any natural vibration thereof.

Another feature of the invention consists in providing the inner wall of the fan housing of a skeletonlike structure which may consist, for example, of a stamped-out or expanded piece of sheet metal, of a wire screen, or of perforated parts of plastic.

The sound-suppressing properties of the fan housing may be further improved by making the absorbent layer which is provided between the outer and inner walls of unwoven organic or inorganic fibers or of a foam plastic with open pores. Such a foam plastic may be foamed into the space between the two walls after the housing as such has been built and in a manner so that the inner wall may be partly or fully embedded in the foam plastic.

The invention further permits the sound-absorbent layer between the two walls of the housing to be made of a substantially uniform thickness or of a varying thickness in accordance with the outer shape of the housing inasmuch as the outer walls of the latter may, for example, be assembled to form a rectangular box. It may also be advisable to make the sound-absorbent layer of a greater thickness in the vicinity of the air inlet and outlet openings than at other parts of the housing.

For suppressing the noise which is caused by the fan motor, the invention further provides the housing of the motor to be mounted on the inner perforated wall of the air-intake port by supporting means consisting of an elastic material, for example, rubber, which have a cross-

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sectional size and shape to produce very little air resistance and are offset relative to each other.

The objects, features, and advantages of the present invention will become more clearly apparent from the following detailed description thereof which is to be read with reference to the accompanying drawings, in which—

FIGURE 1 shows a cross section of a fan according to the invention which is provided with a sound-absorbent layer of a substantially uniform thickness at all points of the housing;

FIGURE 2 shows a cross section taken along line II—II of FIGURE 1;

FIGURE 3 shows a cross section of another fan according to the invention which is provided with a sound-absorbent layer of a varying thickness; while

FIGURE 4 shows a cross section taken along line IV—IV of FIGURE 3.

In all of the drawings, the housing of the cooling fan which is primarily intended for the use in a motor vehicle is generally indicated at 10, the motor for driving this fan at 11, the fan rotor at 12, and the motor shaft for driving the latter at 13.

The housing 10 of the fan according to FIGURES 1 and 2, as well as according to FIGURES 3 and 4 is formed by an outer gastight wall 14 or 14', respectively, which consists of a flexible material and by an inner perforated wall 15 or 15' which may be of a solid material. The inner wall 15 or 15' may be made, for example, of a stamped sheet of metal which is provided with apertures 16 or 16' and has a sufficient solidity to serve as a skeleton for supporting the entire fan and for giving the housing 10 an adequate stability. The production of the housing may be carried out in any suitable manner, for example, by first molding the two walls into the desired shapes, by then bending the flexible outer wall 14 or 14' around the inner wall 15 or 15', spacing them at the required distance from each other in a suitable mold, and then injecting into the space between the walls a foam plastic which then forms a sound-absorbing layer 17 or 17' therein which has open pores facing toward the inside of the housing. The foam plastic may then penetrate through the apertures 16 or 16' in the inner wall 15 or 15' so that the latter will be partly or entirely embedded therein, as indicated by the dot-and-dash lines 18 and 18' in FIGURES 1 and 3, respectively.

The outer and inner walls 14, 14' and 15, 15' of the housing 10 are connected to each other by an inner wall 19 or 19' which is likewise perforated and forms the air intake port 20 or 20'. The motor 11 which drives the fan rotor 12 is mounted on this inner perforated wall 19 or 19' by rubber supports 21 or 21' which are offset relative to each other. The fan rotor then sucks the air from the outside which then flows through the intake port 20 or 20' to the inside 22 or 22' of the housing 10 and thereby also cools the motor 11. The air, the sound of which within the housing 10 is first reduced by the perforated walls 19 or 19' and 15 or 15' and then completely eliminated by the sound-absorbent layer 17 or 17', is ejected from the housing through the outlet port 23 or 23' and then flows through the pipes of the ventilation system which are connected thereto.

While the outer and inner walls 14 and 15 of the fan housing 10 according to FIGURES 1 and 2 have a similar spiral shape so that the sound-absorbent layer 17 of foam plastic, fibers, or the like has a substantially uniform thickness, the outer wall 14' of the housing 10 according to FIGURES 3 and 4 has a substantially rectangular boxlike shape. Consequently, the sound-absorbent layer 17' also varies in thickness, whereby the sound of the fan is suppressed to a still greater extent since

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the sound-absorbent material may then be partly applied still more closely to the source of the sound. The rectangular outer wall 14' which encloses the spirally-shaped inner space 22' which is defined by the inner wall 16' is preferably made as small as possible in order to save in space in the motor vehicle. The outer wall of the housing may, of course, also be of any other desired shape than that illustrated in the drawings.

Although our invention has been illustrated and described with reference to the preferred embodiments thereof, we wish to have it understood that it is in no way limited to the details of such embodiments, but is capable of numerous modifications within the scope of the appended claims.

Having thus fully disclosed our invention, what we claim is:

1. A heating or cooling fan, preferably for a motor vehicle, having a housing with an air intake port and an air outlet port, a motor adapted to be supported at least partly within said intake port, said intake port comprising wall means guiding the inflow of air in directions toward the interior of said housing, said air outlet port comprising wall means guiding the outflow of air to directions transverse to said first-named directions, a fan rotor connected to the shaft of said motor and rotatable within said housing, said housing forming a filter adapted to absorb sound vibrations and comprising an outer gas-tight wall of a flexible material spaced from and surrounding said rotor and said motor, an inner perforated wall forming a skeleton for supporting the entire fan, said inner perforated wall being inwardly spaced from said outer wall in directions toward said rotor and said motor, and a layer of sound-absorbing material filling the space between said walls, said wall means of said air intake port comprising inner perforated wall means connecting said outer gas-tight wall and said inner perforated wall, and elastic supporting means securing said motor to said inner perforated wall means of said intake port.

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2. A fan as defined in claim 1, wherein said sound absorbing material comprises a layer of unwoven fibers packed in the space between said spaced outer and inner walls.

3. A fan as defined in claim 1, wherein said sound-absorbing material comprises a layer of foam plastic having open pores filling the space between said spaced outer and inner walls and foamed into said space during the production of the housing, said inner wall being at least partly embedded in said foam plastic.

4. A fan as defined in claim 1, wherein said outer gas-tight wall has a substantially rectangular box-like shape, said inner perforated wall has a substantially spiral shape and is spaced at different distances from said outer wall, said box-like shape facilitating the provision of a varying thickness of said layer of sound-absorbing material.

5. A heating or cooling fan, according to claim 1, further comprising a plurality of elastic supporting means securing said motor on said inner perforated wall means of said intake port, said supporting means being offset relative to each other in directions axial of said motor and have a cross-sectional size and shape so as to produce little air resistance.

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