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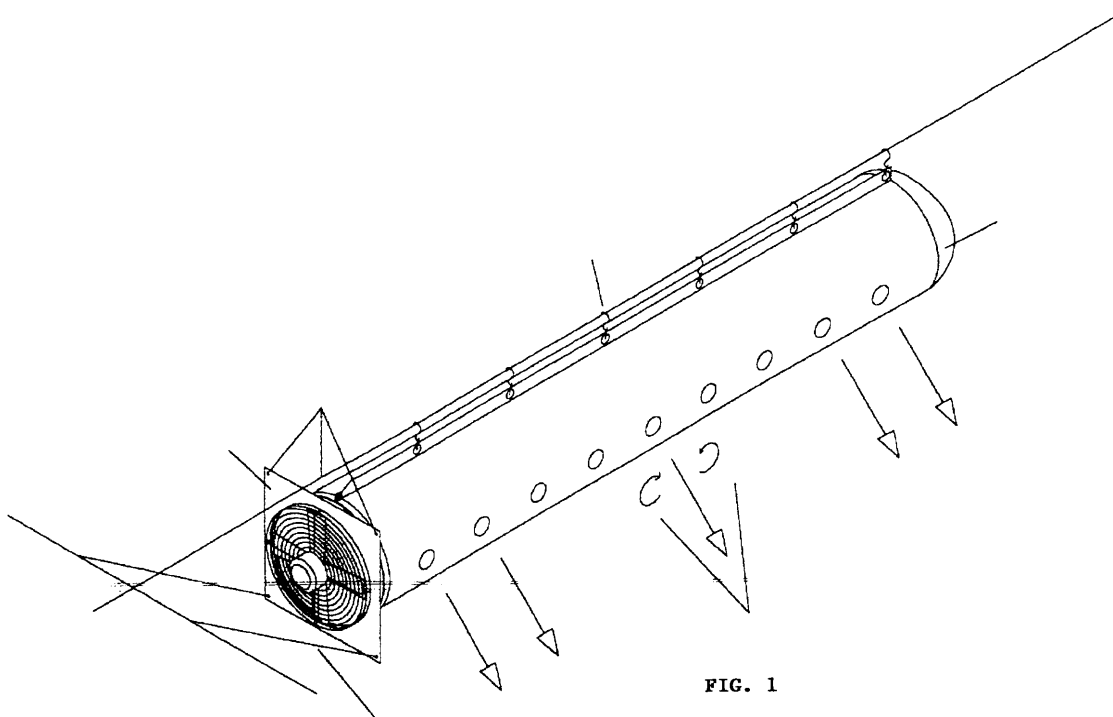
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(54) **Air diffuser**

(57) According to the invention, a diffuser (10) with an airtight tubular body (11) having a flexible wall is positioned in the upper part of an environment, in which a static layering of warm air tends to occur. The said body (11) has at least one air intake (11.1) through which warm air is conveyed by forced conveying means (13) into the said tubular body (11) and fed in the form of a

continuous flow to at least one aperture (nozzle 12) of the body for the outlet of pressurized air, oriented towards the lower layers of air in the environment. A continuous flow of primary air (C) passes through the said at least one aperture (12) into the said lower layers of air in the environment concerned, while it generates an ambient air recirculation field in the vicinity of the aperture (12) by an inductive phenomenon.



**FIG. 1**

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**Description**

**[0001]** The present invention relates to an ambient air recirculation system, particularly for public and industrial environments of medium and large cubic capacity. The invention also relates to a diffuser for the application of the said system.

**[0002]** As is known, heating, air-conditioning and ventilation systems, particularly in public and industrial environments of medium and large cubic capacity, give rise to an undesirable static layering of warm air in the upper part of the environment concerned. This phenomenon causes environmental discomfort for persons and a considerable waste of energy.

**[0003]** In particular, according to the prior art, the aforesaid problem can be partially overcome only by complicated and costly structural modifications of existing heating, air-conditioning and ventilation systems.

**[0004]** Starting from the concept of the problems raised above, the present invention is intended to remedy them in a simple and economical way.

**[0005]** The principal object of the present invention is therefore to provide an ambient air recirculation system, particularly for public and industrial environments of medium and large cubic capacity, which makes it possible to maintain a constant and optimal circulation of ambient air between the upper and lower layers in the environment concerned, without the need for significant modifications to the existing heating, air-conditioning and/or ventilation systems, and with a low technical and financial input.

**[0006]** Another object is to provide an ambient air diffuser which is structurally simple and reliable in operation, as well as being easily installed, for the application of the system specified above.

**[0007]** In view of these objects, the present invention provides an ambient air recirculation system, particularly for public and industrial environments of medium and large cubic capacity, whose essential characteristic is specified in Claim 1.

**[0008]** The ambient air diffuser for the application of the system according to the invention is specified in Claim 3.

**[0009]** Further advantageous characteristics are described in the dependent claims.

**[0010]** The aforesaid claims shall be considered to form an integral part of this document.

**[0011]** In the ambient air recirculation system according to the present invention, at least one airtight tubular diffuser with a flexible wall is positioned in the upper part of the environment concerned, in which a static layering of warm air tends to occur. The said diffuser has a static air intake which is located at the height of the layered warm air, and through which warm air is conveyed by forced conveying means into the said diffuser and fed in a continuous flow to at least one static aperture (nozzle) of the diffuser for the outlet of pressurized air, oriented towards the lower layers of air in the environment concerned. A continuous flow of primary air in the shape of a cone passes through the said aperture into the said lower layers of the ambient air, while it generates an ambient air recirculation field in the vicinity of the aperture by an inductive phenomenon, since a low-pressure area is formed in the vicinity of the aperture by the "Venturi" effect, which causes the return of a continuous flow of layered air into the high part of the environment concerned and its mixing with the primary air flow passing out of the aperture.

**[0012]** Advantageously, the said recirculation system comprises an arrangement of diffusers in one or more lines with at least one diffuser in each.

**[0013]** The invention is described in detail below, with reference to the attached drawing, provided solely by way of example, in which:

- Fig. 1 shows, in a schematic perspective view, a warm air diffuser for the application of the ambient air recirculation system, particularly for public and industrial environments of medium and large cubic capacity, according to the invention;
- Fig. 2 shows, in a schematic view and in cross section, the effects of a flow of warm air passing out of an aperture of the diffuser in Fig. 1.

**[0014]** With reference to the drawings, the number 10 (Fig. 1) indicates as a whole a warm air diffuser for the application of the system according to the invention.

**[0015]** The said diffuser 10 comprises an airtight tubular body 11 with a flexible wall, which is for example essentially cylindrical, and open at one of its axial ends 11.1, which forms a static intake for ambient air. At the opposite end, the said diffuser 10 is closed by an airtight cap 11.2.

**[0016]** Advantageously, the said diffuser 10 is made from fabric double-coated with polyvinyl chloride (PVC), with a high-frequency welded fireproof polyester insert (operating temperature from -10 to 80°C).

**[0017]** The said diffuser 10 is suspended in the upper area of a heated, air-conditioned and/or ventilated environment. It is connected, for example, to a galvanized steel suspension cable F by a plurality of suspension hooks G, engaged in corresponding reinforced eyelets provided along a longitudinal rib 11.3 of the diffuser. The diffuser is suspended parallel to the said cable F.

**[0018]** A linear arrangement of static apertures (nozzles) for air diffusion 12 is provided along the tubular body 11 of the said diffuser 10. The said diffusion apertures 12 are oriented towards the lower layers of air in the environment concerned.

**[0019]** An axial electric fan 13 is placed facing the said static ambient air intake 11.1 of the diffuser 10 and is suspended by elastic positioning cable means. When its motor is switched on, the said fan 13 causes a forced suction of warm air drawn from the upper area of the environment concerned, and conveys it through the said air intake 11.1 and through the said diffuser 10 in the form of a corresponding continuous flow of warm air. The diffuser 10 is thus kept continuously inflated with air in the form of a windsock. Thus, an effect is created by which the diffuser 10 is filled with air, ensuring a constant and equal distribution along the whole of its extension of the air flows passing out through the diffusion apertures 12, which are suitably designed.

**[0020]** Consequently, as illustrated by way of example in Fig. 2, a continuous flow C in the form of a cone of primary air passes out through each diffusion aperture 12 and enters the lower layers of the air in the environment concerned. This flow C also generates an ambient air recirculation field by an inductive phenomenon at the aperture 12, since it forms a low-pressure area D in the vicinity of the aperture by the "Venturi" effect. This causes the return of a continuous flow S of layered air into the high part of the room concerned and its mixing with the primary air flow C (as shown by way of example by the arrows R in Fig. 1).

**[0021]** The principal technical and functional characteristics of the system illustrated here by way of example are shown in the following table:

Fan: model AFQ - 450 - 30/4m - B	type: forced draught propeller fan with protective grille single phase, 4 pole, 230 V 50 Hz delivery, m <sup>3</sup> /hr: 4,000 static: 100 pascals (max.) power input: 450 watts weight: 12 kg noise level at 3 m: 58 dB
Diffuser:	made from high-toughness Trevira double-coated with PVC class 2 - CSE RF1 - 75 A CSE RF 3 /// weight in grams 500 g/m <sup>2</sup> min. tensile strength kg/ 5 cm 200 kg length: 24 m, of which 22 m perforated for a height of 8 m.
Operation:	the system according to the invention produces a thorough delayering as a result of high induction for environments up to a height of 18 m. It provides a uniform distribution of the ambient air in the area concerned, by the "plenum" effect, with a maximum residual velocity of 0.25 m/s.

**[0022]** Advantageously, a plurality of diffusers 10 are arranged in line and, in a single environment, a plurality of lines, each having one or more diffusers 10, can be formed.

**[0023]** The relative lightness of the diffuser 10 enables it to be suspended easily and safely and to be made in shapes with a large linear extension.

## Claims

1. Ambient air recirculation system, particularly for public and industrial environments of medium and large cubic capacity, characterized in that at least one diffuser (10) with an airtight tubular body (11) having a flexible wall is positioned in the upper part of the environment concerned, in which a static layering of warm air tends to occur; in that the said body (11) has at least one air intake (11.1) which is located in the layered warm air in the said environment and through which warm air is conveyed by forced conveying means (13) into the said tubular body (11) and fed in the form of a continuous flow to at least one aperture (nozzle 12) of the body for the outlet of pressurized air, oriented towards the lower layers of air in the environment concerned; and in that a continuous flow of primary air (C) passes through the said at least one aperture (12) into the said lower layers of air of the environment concerned, while it generates an ambient air recirculation field in the vicinity of the aperture (12) by an inductive phenomenon, since a low-pressure area (D) is formed in its vicinity by the "Venturi" effect, which causes the return of a continuous flow of layered air (S) into the high part of the environment concerned and its mixing (R) with the flow of primary air (C) passing out of the aperture.

2. System according to Claim 1, characterized in that it comprises an arrangement of diffusers in one or more lines with at least one diffuser in each.
3. Diffuser for the application of the ambient air recirculation system according to Claim 1, characterized in that it comprises an airtight body (11) with a flexible wall, suspended in the upper area of a heated, air-conditioned and/or ventilated environment and provided with an ambient air intake (11.1) located in the said upper area of the environment, the said body (11) having at least one air diffusion aperture (nozzle 12) oriented towards the lower layers of air in the environment concerned, and also comprises means (13) for the forced conveying of air into the said tubular body (11) through the said air intake (11.1) in the form of a continuous flow passing through the body, which is thus kept continuously inflated with air along the whole of its extension, so that a continuous flow of primary air (C) passes through the said at least one diffusion aperture (12) and passes into the said lower layers of air of the environment concerned, while it generates an ambient air recirculation field in the vicinity of the aperture by an inductive phenomenon, since a low-pressure area (D) is formed by the "Venturi" effect, which causes the return of a continuous flow of layered air (S) into the high part of the environment concerned and its mixing (R) with the flow of primary air (C) passing out of the aperture (12).
4. Diffuser according to Claim 3, characterized in that it has a plurality of diffusion apertures (12), for example in a linear arrangement, designed in such a way that the said continuous flow of air passing through the said body (11) produces a constant and equal distribution of the air flows passing out through the diffusion apertures.
5. Diffuser according to Claim 3 or 4, characterized in that the said tubular body (11) is essentially cylindrical, is open at one end, forming the said air intake (11.1), is closed at the opposite end by a cap (11.2), and has a plurality of diffusion apertures (12) in a linear arrangement along its lateral wall.
6. Diffuser according to Claim 3, 4 or 5, characterized in that it is suspended by cable means (F).
7. Diffuser according to Claim 3, characterized in that the said means of forced conveying of air comprise a fan (13).

