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(54) **Air curtain with an auxiliary stream**

(57) Air curtain with an auxiliary stream, which is used to protect rooms against the impact of external factors (weather conditions, volatile substances, particulate solids, insects etc.), as well as to protect rooms against the outflow of internal air outside, **characterised in that**

the air exhausts (6, 7) form at least two separate air streams, the main stream (A) is directed towards the construction hole at the limit of the room, while the auxiliary stream (C) - into the room at an acute angle in relation to the plane of the construction hole, and the main stream (A) and the auxiliary stream (C) do not cross each other.

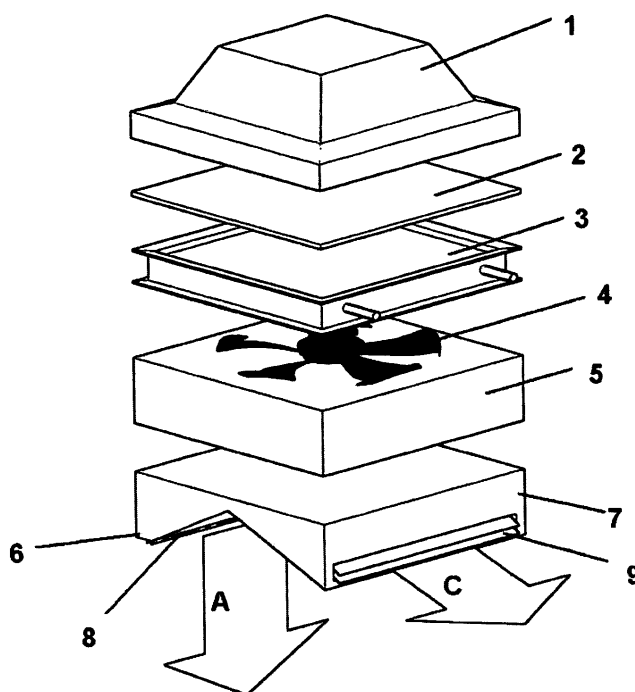


Fig. 1

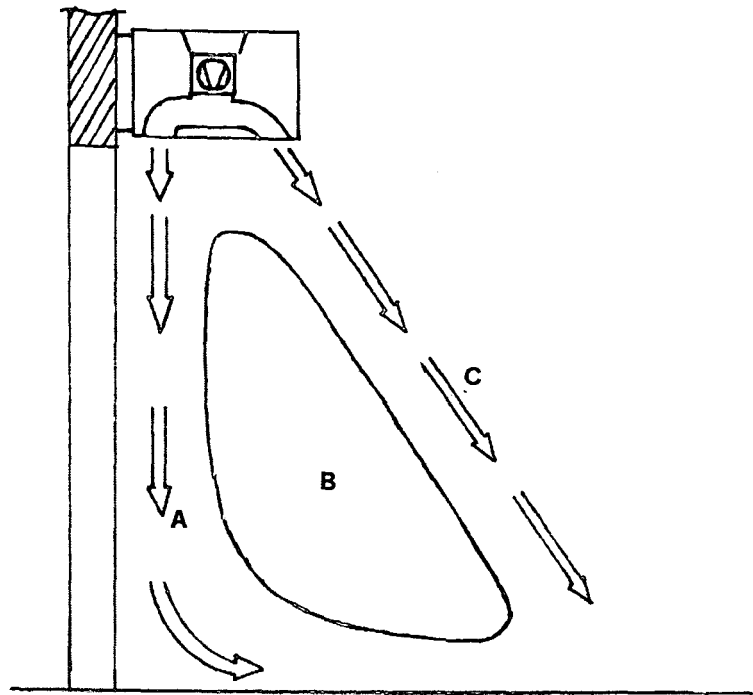


Fig. 3

Description

[0001] The subject of the invention is an air curtain with an auxiliary stream, which is used to protect rooms against the impact of external factors (weather conditions, volatile substances, particulate solids, insects etc.), as well as to protect rooms against the outflow of internal air outside, using an air stream that separates both zones. The solution proposed in the present invention protects against a particularly unfavourable external factor which is the inflow of the external air with physical parameters (density, pressure, velocity, temperature etc.) different than the desired levels. In the case that the temperature of the external air is lower than the temperature in the room, the heated jet of air is directed outside or there is an increased inflow of external air, which results in high losses of temperature, as the demand for thermal energy is increased. However, if the temperature of external air is higher than the temperature of the air in the room, it results in loss of energy which is related to the increase of energy consumption required for the cooling of the air in the room.

[0002] The European patent application No. EP 1462730 A1 refers to a device that generates an air curtain within the area of a construction hole such as, particularly, gates, doors or similar structures. The device is comprised of at least one apparatus generating the air stream, at least one heat exchanger (heater or radiator) and directional components. The device is used to generate an air curtain comprised of at least two adjacent partial streams - one of the partial streams is generated at a higher flow velocity than the other. Each partial stream may be generated by its own individual air fence. The air fences are set in such a way as to provide various velocities of the air flow. A variation of the mentioned solution is based on the concept that each air fence generating a partial stream is equipped with at least one dedicated apparatus which generates the air stream.

[0003] Another known device mentioned in the European patent No. EP 0645588 B1 refers to an air curtain that generates two parallel primary air streams using at least two blowing elements, situated in parallel, adjacent to each other. Both streams have the same direction and velocity, and between the two mentioned blowing elements there is at least one blowing element that generates an intermediate stream which is directed parallel to the primary streams and has the same velocity as the primary streams.

[0004] The known solutions for air curtains generating one or more air streams, directed parallel to the plane of the construction hole, are based on the concept that the part of the air stream in the bottom zone deviates from the vertical plane of the hole. The deviation of the stream to the outside the room results in the outflow of the air from the curtain, thus generating a significant loss of the thermal energy of the stream. When the air stream is deviated towards the interior of the room, as a consequence of the velocity of the flowing, underpressure (vac-

uum) is created on the external edge of the stream, which results in the sucking of the external air into the room.

[0005] In the curtain as per the invention air exhausts form at least two separate air streams. The main stream is directed towards the construction hole (an opening for doors, gates, windows etc.) at the limit of the room, while the auxiliary stream (which objective is to turn up the main stream into the room in a controlled way) is directed into the room at an acute angle in relation to the plane of the construction hole. Both the main and auxiliary streams do not cross. The curtain can be placed at the top or on the side of the construction hole. Each stream, the main and the auxiliary, advantageously is generated by at least one fan separate for each stream. The curtain advantageously has at least one heat exchanger which sets the required thermal parameters for at least one air stream. The curtain advantageously is also equipped with at least one filter for the sucked-in air. The additional directional element which directs the air stream advantageously is added to at least one of the air exhausts. The additional directional element advantageously is mobile.

[0006] The main stream is directed towards the construction hole at the limit of the room. Its objective is to separate two zones of different temperatures or different physical parameters, present near the area of the construction hole. According to the laws of physics, adequate velocity of the flowing auxiliary stream (directed into the room an acute angle in relation to the plane of the construction hole) results in the phenomenon of 'induction' (suction) of the air. The velocity of the auxiliary stream creates underpressure (vacuum) along its edge, which produces a turbulent mixing zone. The mixing zone lifts up the still layers of the air located below the auxiliary stream. The layers of the air confined in the space between the streams, lifted up by the kinetic energy produced by the auxiliary stream, create the phenomenon of sucking the main stream around the floor area, towards the interior of the room, in a controlled way. Such phenomenon may be additionally strengthened by the difference in temperatures of the air streams. If the room's internal temperature exceeds the external temperature, it would be particularly advantageous to use the auxiliary stream and/or the main stream whose temperature is equal to or higher than the internal temperature. Heating up the auxiliary stream to a higher temperature enables the strengthening of the mentioned phenomenon of directing the curtain's stream towards the interior of the room thanks to the effect of convection (lifting up of warmer air mass). Such solution to the problem enables the reducing of the auxiliary stream's velocity, without hampering the performance of the solution as per the invention.

[0007] Using the solution proposed in the present invention provides a uniform distribution of the main stream within the entire area of the plane of the construction hole, down to its bottom edge. Thanks to the eliminating of the negative phenomenon related to the flowing out of

significant amount of the main stream outside the room and, simultaneously, of unwanted inflow of external air into the room, the use of air curtain in question increases the effectiveness of performance and protection of the room, the thermal protection in particular.

[0008] The subject of the invention is shown in the example drawings, where:

- fig. 1 - shows general view of the curtain;
- fig. 2 - shows a view of the curtain from the bottom.

Fig. 3 presents the operational principle of the air curtain in a schematic way.

[0009] The air curtain has an air intake 1 which sucks in the external air, and the air filter 2 which cleans the sucked-in air. The curtain has a plate-fin heat exchanger 3 which, depending on the medium applied, is used to set appropriate thermal parameters for the air that flows round the exchanger 3, i.e. heat it up or cool it down to the desired temperature. The air is sucked through an axial-flow fan 4. The fan 4 generates pressure on the pumping side which contains the expansion chamber 5. The air expanded in the expansion chamber 5 is directed to the air exhausts 6, 7 formed by a common element. Then, the air exhausts 6, 7 form the following: the main A and the auxiliary C streams. There are the additional directional elements 8, 9 for the air streams A, C, installed at the ends of the air exhaust 6, 7.

Marking list

[0010]

1. Air intake
 2. Filter for the sucked-in air
 3. Heat exchanger
 4. Fan
 5. Expansion chamber
 6. Air exhaust for the main stream
 7. Air exhaust for the auxiliary stream
 8. Additional directional element for the main stream
 9. Additional directional element for the auxiliary stream
-
- A. Main stream
 - B. Space between streams
 - C. Auxiliary stream

Claims

1. Air curtain with an auxiliary stream, air intake and at least one fan, as well as at least two air exhausts, **characterised in that** the air exhausts (6, 7) form at least two separate air streams, the main stream (A) is directed towards the construction hole at the limit of the room, while the auxiliary stream (C) - into the room at an acute angle in relation to the plane

of the construction hole, and the main stream (A) and the auxiliary stream (C) do not cross each other.

2. The curtain, according to the claim 1, **characterised in that** at least one fan (4) generates the main stream (A) and the auxiliary stream (C), each one separately.
3. The curtain, according to the claim 1 or 2, **characterised in that** at least one heat exchanger (3) sets the required thermal parameters for at least one air stream (A, C).
4. The curtain, according to the claim 1 or 2 or 3, **characterised in that** it has at least one filter for the sucked-in air (2).
5. The curtain, according to any of the above-mentioned claims, **characterised in that** the additional directional element (8, 9) which directs the air stream (A, C) is added to at least one of the air exhausts (6, 7).
6. The curtain, according to the claim 5, **characterised in that** the additional directional element (8, 9) which directs the air stream (A, C) is mobile.

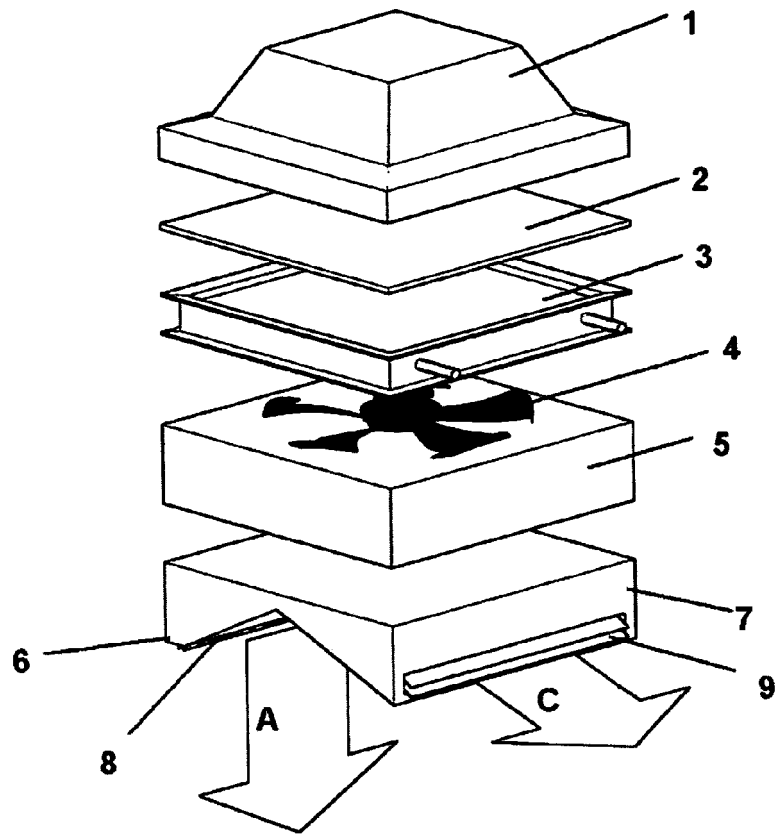


Fig. 1

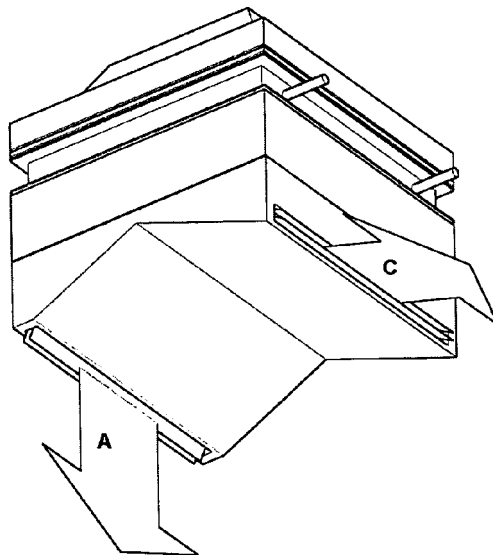


Fig. 2

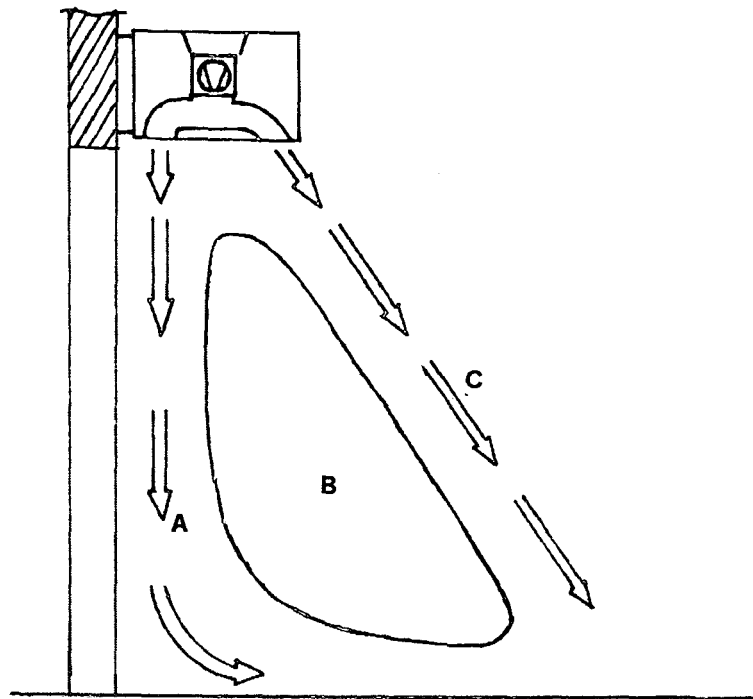


Fig. 3

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1462730 A1 [0002]
- EP 0645588 B1 [0003]