

5 Description

Air-conditioned room

- 10 The invention relates to an air-conditioned room, comprising at least walls limiting the room, at least preferably two heat exchangers, and electronic devices to be cooled and arranged in rows in the room.

15 Air-conditioned rooms are known in which a cooling device in the form of a heat exchanger is arranged in a limiting wall. The room can be supplied here via the heat exchanger with cold air which flows through electronic devices, such as computers or servers arranged in rows, to cool them. These rows limit a so-called hot aisle from which the hot air is extracted.

- 20 If a corresponding heat exchanger is replaced, cooling must in principle be interrupted, as otherwise a short-circuit in the air flow would occur during the time in which the heat exchanger is being replaced.

25 The object underlying the invention is to develop an air-conditioned room of the type mentioned at the outset such that it is ensured even during replacement of a heat exchanger that the room is supplied with cooling air to the required extent and hence the electronic devices are sufficiently cooled.

To achieve that object, the invention proposes an air-conditioned room comprising at least walls limiting the room, at least one heat exchanger, and electronic devices to be cooled and arranged in rows in the room, where an aisle passes between two rows and is preferably separated from the room and in terms of air flow, i.e. in terms of the air to be conveyed, is connected to the at least one heat exchanger, which is at least one section of one of the walls limiting the room or is connected to an opening provided in one of the walls, the exchanger and/or the opening being assigned on the room side a covering element, which in a first position prevents a flow of air through the heat exchanger and in a second position permits a flow of air.

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In particular however, the aisle is separated from the room, so that mixing of hot and cold air in the room is not possible.

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In accordance with the invention, each heat exchanger is assigned a covering element which then covers the area of the heat exchanger to be replaced or the opening in the limiting wall assigned to the heat exchanger when a replacement is to take place, so that the air to be cooled can flow exclusively through at least one second heat exchanger or further heat exchangers provided, so that an air short-circuit is avoided, i.e. hot air cannot flow directly out of the further room into the room to be cooled, i.e. bypassing a heat exchanger.

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The covering element can for example be a roller blind, a Venetian blind, a louvre damper or a corresponding closed element which does not close the flow path through the heat exchanger when the heat exchanger is to ensure cooling.

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Regarding the Venetian blind or louvre damper, it can be one having adjustable slats, in order to permit or prevent the passage of air through the heat exchanger depending on their setting. The Venetian blind can also be designed collapsible.

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If a movable flat element is used, it can if necessary be moved along heat exchangers arranged in particular in rows, to enable covering to the required extent. If the flat element is not in use, it is positioned outside the heat exchanger, i.e. in particular in an area of the room limiting wall having the heat exchanger in which a heat exchanger is not located or no opening is provided to which a heat exchanger is assigned.

In particular, it is provided that the aisle limited by the electronic devices arranged in rows is a hot aisle, which is connected to a cavity on the ceiling side or floor side and which in turn is connected to a further room limited by the wall having the preferably at least two
5 heat exchangers or the at least one opening. The further room can be a maintenance aisle, in which for example control devices are arranged for operation of the heat exchangers or of the fans required for conveying the air.

For conveying the air, at least one fan and preferably several fans are provided, which
10 is/are in particular installed above the heat exchanger(s) in the limiting wall. This is however not an essential feature. The at least one fan can also be arranged in the second room or in the cavity.

In an embodiment of the invention, the further room can be limited by two walls, which in
15 turn each limit a room with electronic devices to be cooled and arranged in rows therein and which each contain at least two heat exchangers and/or at least one opening with heat exchangers assigned thereto.

The invention relates to an air-conditioning arrangement of a first room with electronic
20 devices to be cooled and arranged in rows therein, each two rows limiting an aisle which is connected to an area separated from the room in terms of air flow and which in turn is connected to a second room which is separated from the first room by a wall in which at least two heat exchangers are arranged or two heat exchangers are assigned to at least one opening in the wall through which air flows into the first room or out of it, and is
25 characterized in that each heat exchanger is assigned a covering element which in a first position prevents a flow of air and in a second position permits a flow of air.

It is here in particular provided that the covering element is a roller blind, a Venetian blind
or finned damper, preferably with adjustable slats, or a movable flat element.
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The area which is separated in terms of air flow from the room containing the electronic devices to be cooled and arranged in rows can be a ceiling cavity, such as a cavity limited by a drop ceiling, or a hollow floor.

In particular, it is provided that at least one fan sucking in air from the aisle is arranged between the ceiling cavity and the second room.

5 In particular, the invention is also characterized by a method for replacement of a heat exchanger arranged in a wall limiting a room or assigned to at least one opening in the wall out of several heat exchangers arranged in said wall or a further wall and/or assigned to at least one opening in at least one of the walls, each of the heat exchangers being assigned a covering element, and for replacement of one of the heat exchangers while air continues to flow through the further heat exchangers, the heat exchanger or the opening assigned
10 thereto being covered by a covering element.

The heat exchanger should be a flat heat exchanger or finned heat exchanger.

15 Further details, advantages and features of the invention can be gathered not only from the claims and in the features to be found therein – singly and/or in combination – but also from the description of preferred embodiments to be found in the description of the drawing.

The drawing shows in:
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Fig. 1 an illustration of the principle of a room to be air-conditioned,

Fig. 2 a plan view of rooms to be air-conditioned and

25 Fig. 3 a sectional view of a heat exchanger with cover and fan.

The figures show in an illustration of the principle rooms in which heat-emitting electronic devices, such as servers, are to be cooled. They are therefore in particular computer rooms.

30 The electronic devices are here arranged in so-called racks, which are in turn aligned with one another in rows.

A corresponding computer room is identified in Fig. 1 with the reference number 10. The racks arranged in rows have the reference numbers 12 and 14.

Cold air flows through the racks 12, 14 from their outsides (arrows 16, 18). The racks 12, 14 thus limit a hot aisle 20 which is separated from the room 10. To do so, the room 10 has for example a drop ceiling to form a cavity 22 via which the hot air (arrows 24) is extracted by a fan 26 into a further room 28, which is also referred to as a maintenance aisle. The room 10, which is a first room, is separated from the second room 28 by a wall which is designed in some sections as a cooling wall. To do so, heat exchangers 30 are arranged in the wall, one of which is shown purely in principle and in section in Fig. 1.

10 The heat exchangers 30 should be flat or finned heat exchangers.

The heat exchanger 30 has a filter 32 on the side facing away from the room 10. Facing the room 10, the heat exchanger 30 is assigned a cover 34 by which the passage surface through the heat exchanger 30 can be completely covered whenever the heat exchanger 30 is for example to be replaced or for example taken out of service for maintenance purposes.

Since, as mentioned, at least one and preferably several further corresponding heat exchangers 30 of flat design are arranged in the wall or in another wall limiting the room 10, a short-circuit in the air flow would occur at least during removal of the heat exchanger.

Arrangement in the wall means that the heat exchanger is for example integrated in the wall without a housing. The same effect is however achieved by positioning the heat exchanger in a housing which is installed in the wall or closes an opening in the wall. The heat exchanger can be arranged in or on the wall.

To avoid this, the cover 34 assigned to the heat exchanger 30 is closed, so that air can no longer flow through the opening resulting from removal of the heat exchanger 30.

30 The cover 34 can be for example a roller blind which can be wound up.

A louvre damper or Venetian blind with slats which are tiltable is preferably used. A collapsible Venetian blind is however also possible.

A further cover could for example be a closed panel element which is movable along the heat exchanger 30, i.e. along that surface of the heat exchanger facing the room 10. A corresponding covering element can here be optionally assigned to one of several heat exchangers. A corresponding covering element can for example be guided in rails, not
 5 shown.

The invention equally encompasses a solution in which the heat exchanger 30 is not arranged directly in the wall, but is at a distance thereto and hence an opening in the limiting wall is assigned to the heat exchanger for passage of the cooled air.
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In this case, the opening on the side facing the room 10 is preferably closable or openable by means of a covering element.

If the hot aisle 20 is connected to the ceiling cavity 22, the solution in accordance with the
 15 invention also encompasses a room to be air-conditioned in which hot air is extracted via a hollow floor.

There is no departure from the teachings in accordance with the invention even if cold air is supplied to the aisle between the racks 12, 14 in order to then suck in hot air from the
 20 side of the room 10 via the heat exchanger. In this case too, corresponding teachings in accordance with the invention would be applicable.

Fig. 2 shows an arrangement in which two rooms 110, 210 extend from a maintenance aisle 128, to be referred to as a second room, in which rooms electronic devices to be
 25 cooled and placed in rows are arranged, preferably also in racks, as explained in connection with Fig. 1.

Corresponding rows are identified with the reference numbers 112, 114; 152, 154; 212, 214; and 252, 254. In the design example of Fig. 2, the rows also limit hot aisles 120, 160,
 30 220, 260 which are not directly connected to the room 110, 210, but instead are connected to the second room 128 via hollow ceilings, not shown.

In the rooms 110, 210, there is no direct mixing between hot and cold air, so that the hot air extracted from the hot aisles 120, 160, 220, 260 is separated in terms of air flow from the cold air present in the rooms 110, 210.

- 5 Each hot aisle 120, 160, 220, 260 is assigned a group of heat exchangers 130, 131, 230, 240, which in the design example each consist of three flat or finned heat exchangers arranged in a row, of which those of the group 130 are identified with the reference numbers 132, 134, 136. On the room side, each heat exchanger 132, 134, 136 is assigned a cover identified with the reference numbers 138, 140, 142. Instead of each heat exchanger
10 132, 134, 136 being assigned a separate cover 138, 140, 142, a movable element can be used – as explained in connection with Fig. 1 – which is optionally positionable in front of one of the heat exchangers 132, 134, 136 whenever the corresponding heat exchanger is to be replaced, for example.
- 15 In accordance with the drawing representation in Fig. 2, the group 130, 131, 230, 240 can be arranged central relative to the assigned aisle 120, 160, 220, 260.

Fig. 2 also makes clear that in the walls 100 and 200 limiting the rooms 110 and 210 respectively from the second room, i.e. the maintenance room 128, the heat exchangers
20 132, 134, 136 are arranged and form cooler wall areas of the limiting walls 100 and 200.

Fig. 3 shows purely in principle a section through a heat exchanger 300 as flat or finned heat exchangers whose one outer surface is covered by a filter 320 on the maintenance aisle side. On that side of the heat exchanger 300 facing the rooms 110 and 210 is the
25 cover 334, which in accordance with the invention is designed such that the outlet surface of the heat exchanger 300 is closable to the required extent, i.e. cannot be passed by air, or is openable.

Above the heat exchanger 300, fans 326 can be arranged, which also pass through the
30 limiting walls 100, 200.

Claims

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1. Air-conditioned room (10, 110, 210) comprising walls (100, 200) limiting at least the room, at least one heat exchanger (30, 132, 134, 136, 300) and electronic devices to be cooled and arranged in rows (12, 14, 112, 114, 150, 152, 212, 214, 252, 254) in the room, an aisle (20, 120, 160, 220, 260) passing between two rows which is preferably separated from the room and is connected in terms of air flow to the at least one heat exchanger, which is at least one section of one of the walls limiting the room or is connected to an opening provided in one of the walls, the heat exchanger and/or the opening being assigned on the room side a covering element (34, 138, 140, 142, 334) which in a first position prevents a flow of air through the heat exchanger and in a second position permits a flow of air through it.
2. Air-conditioned room according to claim 1,
w h e r e i n
the covering element (34, 138, 140, 142, 334) is a roller blind, a louvre damper, preferably with adjustable slats, or a movable flat element.
3. Air-conditioned room according to claim 1 or 2,
w h e r e i n
the aisle (20, 120, 160, 220, 260) is a hot aisle which is connected to a cavity (22) on the ceiling side or floor side which in turn is connected to a room (28, 128) limited by the wall (100, 200) in or on which the at least one heat exchanger (30, 132, 134, 136, 300) is arranged.
4. Air-conditioned room according to claim 3,
w h e r e i n
at least one fan (26, 326) is provided between the further room (28, 110, 210) and the cavity (22) for sucking in air from the hot aisle (20, 120, 160, 220, 260).

5. Air-conditioned room according to at least one of the preceding claims,
 w h e r e i n
 the further room (28, 128) is limited by two walls (100, 200), each of which limits a
 room (110, 210) with electronic devices to be cooled and arranged in rows (12, 14,
 112, 114, 150, 152, 212, 214, 252, 254) therein, at least one heat exchanger (30,
 132, 134, 136, 300) being arranged in or on each wall.

6. Air-conditioned room according to at least one of the preceding claims,
 w h e r e i n
 several heat exchangers (30, 132, 134, 136, 300) are arranged in the wall (100, 200)
 and/or in a further wall limiting the room (10, 110, 210) and/or openings in the one
 wall or in the several walls are assigned several heat exchangers, in particular
 several groups (130, 131, 230, 240) are provided of flat heat exchangers arranged in
 rows.

7. Air-conditioned room according to at least one of the preceding claims,
 w h e r e i n
 the heat exchanger (30, 132, 134, 136, 300) is a flat heat exchanger or finned heat
 exchanger.

8. Air-conditioning arrangement of a first room (10, 110, 210) with electronic devices
 to be cooled and arranged in rows (12, 14, 112, 114, 150, 152, 212, 214, 252, 254)
 therein, each two rows limiting an aisle (20, 120, 160, 220, 260) which is connected
 to an area (22) separated from the room and which is in turn connected to a second
 room (28, 128) which is separated from the first room by a wall (100, 200) in which
 at least two heat exchangers (30, 132, 134, 136, 300) are arranged or two heat
 exchangers are assigned to at least one opening in the wall through which air flows
 into the first room or out of it,
 w h e r e i n
 each heat exchanger (30, 132, 134, 136, 300) is assigned a covering element (34,
 138, 140, 142, 334) which in a first position prevents a flow of air and in a second
 position permits a flow of air.

9. Air-conditioning arrangement according to claim 8,

w h e r e i n

the covering element (34, 138, 140, 142, 334) is a roller blind, a louvre damper, preferably with adjustable slats, or a movable flat element.

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10. Air-conditioning arrangement according to claim 8 or 9,

w h e r e i n

the area is a ceiling cavity (22), such as a cavity limited by a drop ceiling, or a hollow floor.

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11. Air-conditioning arrangement according to at least one of claims 8 to 10,

w h e r e i n

at least one fan (26, 326) sucking in air from the aisle (20, 120, 160, 220, 260) is arranged between the ceiling cavity (22) and the second room (28, 128).

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12. Air-conditioning arrangement according to at least one of claims 8 to 11,

w h e r e i n

the air-conditioning arrangement has groups (130, 131, 230, 240) of heat exchangers (30, 132, 134, 136, 300) arranged in rows.

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13. Air-conditioned room according to at least one of the preceding claims,

w h e r e i n

the heat exchanger (30, 132, 134, 136, 300) is a flat heat exchanger or finned heat exchanger.

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14. Method for replacement of a flat heat exchanger (30, 132, 134, 136, 300) arranged in a wall (100, 200) limiting a room (10, 110, 210) or assigned to at least one opening in the wall out of several heat exchangers, such as flat or finned heat exchangers, arranged in said wall or a further wall and/or assigned to at least one opening of at least one of the walls,

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w h e r e i n

each of the heat exchangers (30, 132, 134, 136, 300) is assigned a covering element (34, 138, 140, 142, 334) and for replacement of one of the heat exchangers while

air continues to flow through the further heat exchangers the heat exchanger or the opening assigned thereto is covered by a covering element.