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(54) **ROOM VENTILATING AND AIR CONDITIONING SYSTEM HAVING AT LEAST ONE FLOW DUCT FOR A MEDIUM FLOWING THEREIN AND HAVING AT LEAST TWO AIR-RELATED COMPONENTS**

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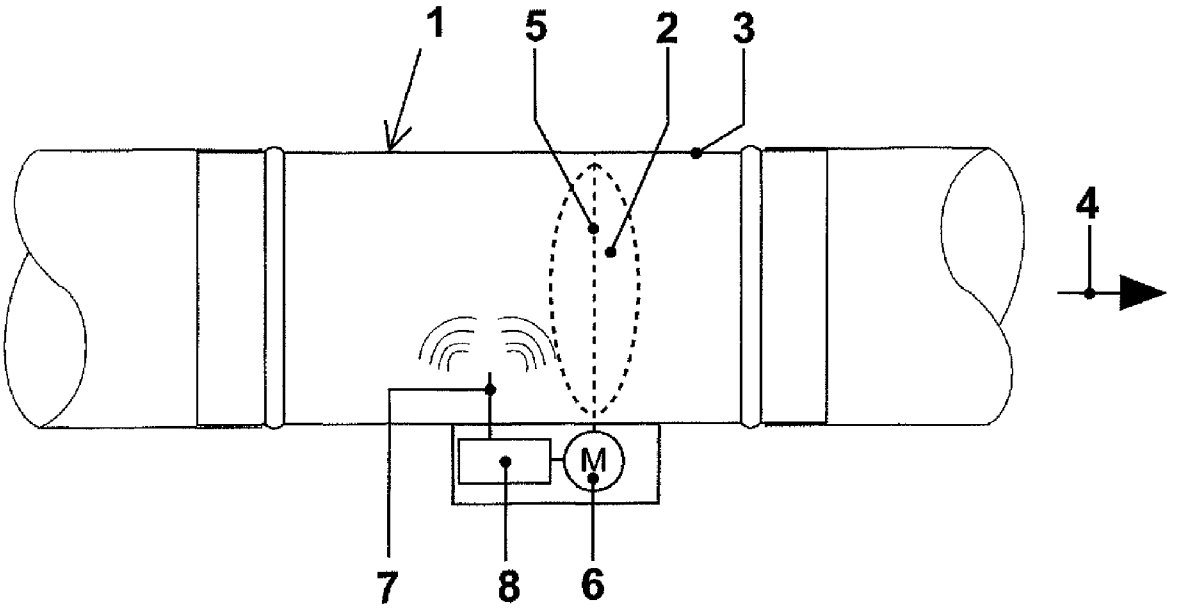
(57) **ABSTRACT**

A room ventilating and air conditioning system has at least one flow duct for a medium flowing therein and at least two air-related components. One component has a receiver and one component has a transmitter and the two components are connected via a wire-free connection, in particular a radio connection. At least one of the transmitters should project, at least with a subregion, to such an extent into the interior of the flow duct that the waves emitted by this transmitter are conducted substantially through the flow duct and/or at least one of the receivers should project, at least with a subregion, to such an extent into the interior of the flow duct that it is able to receive the waves conducted substantially through the flow duct.



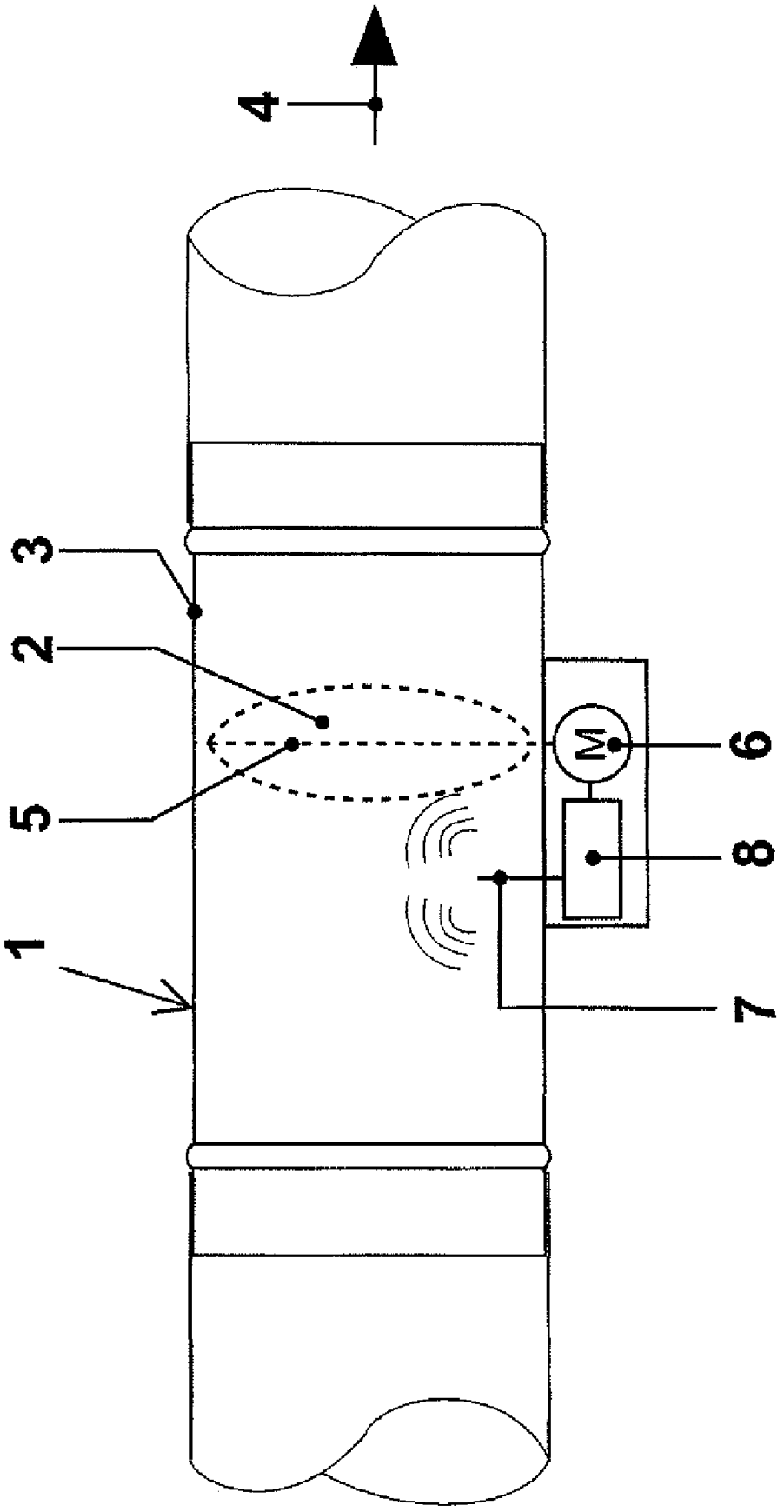


Fig. 1

Fig. 2

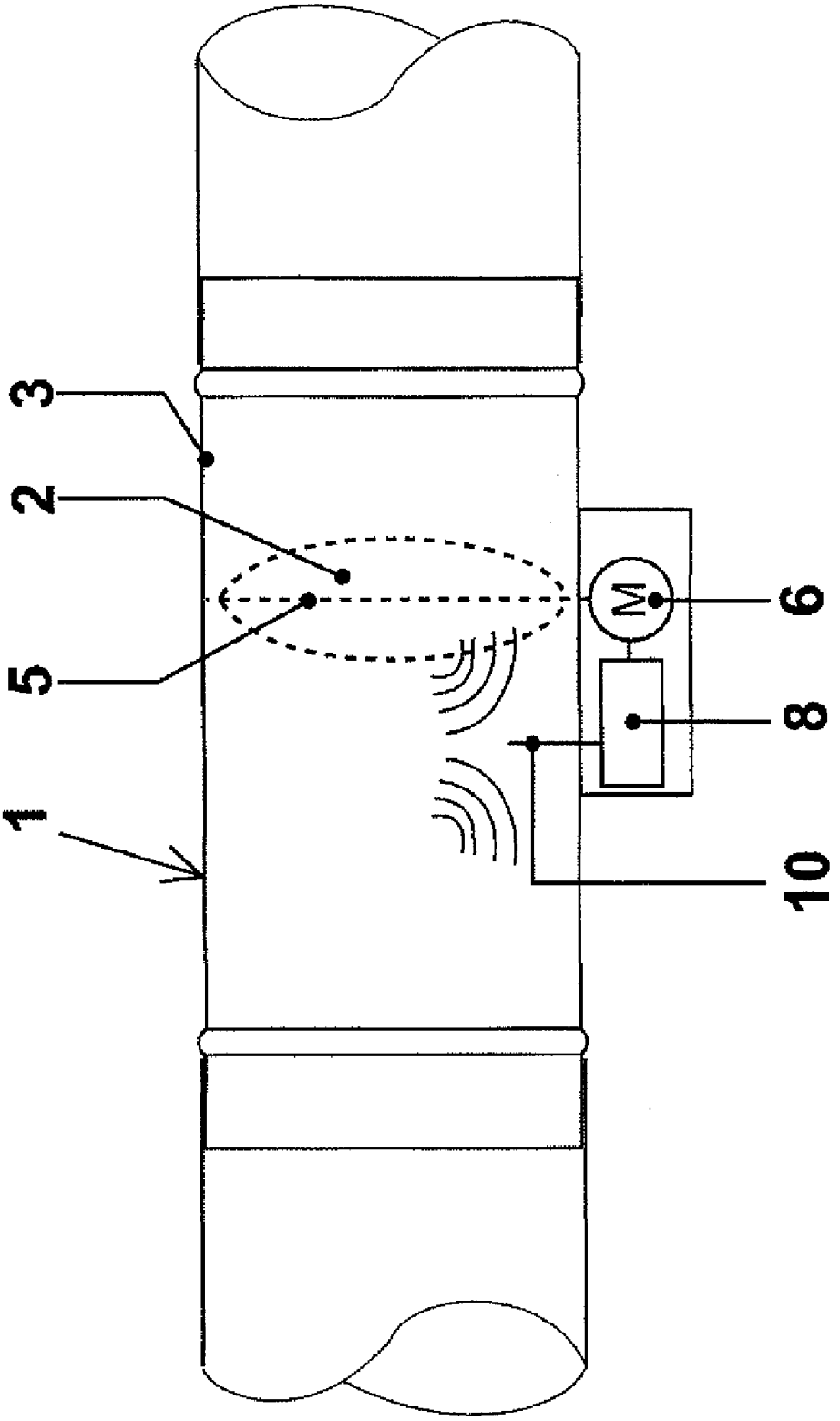
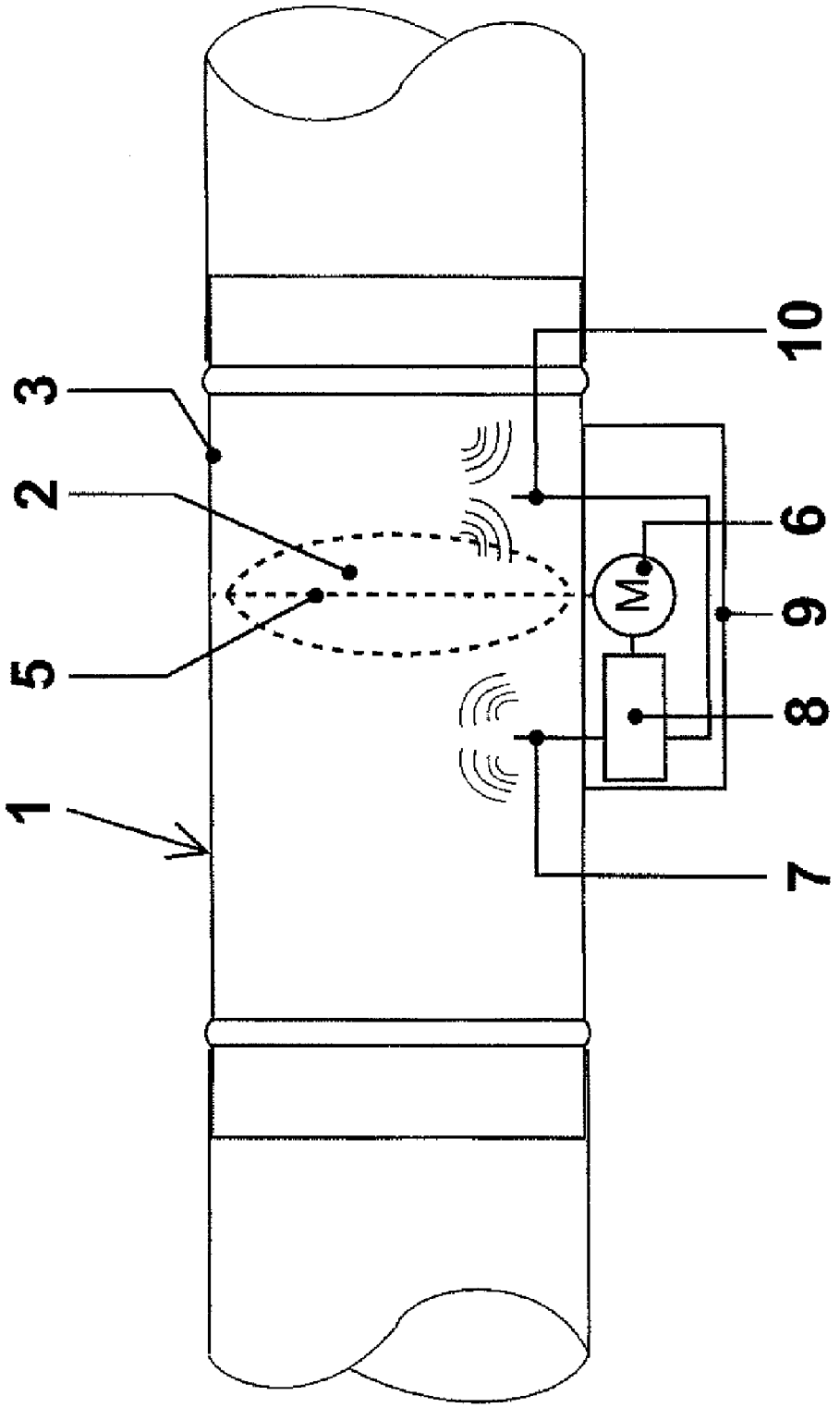


Fig. 3



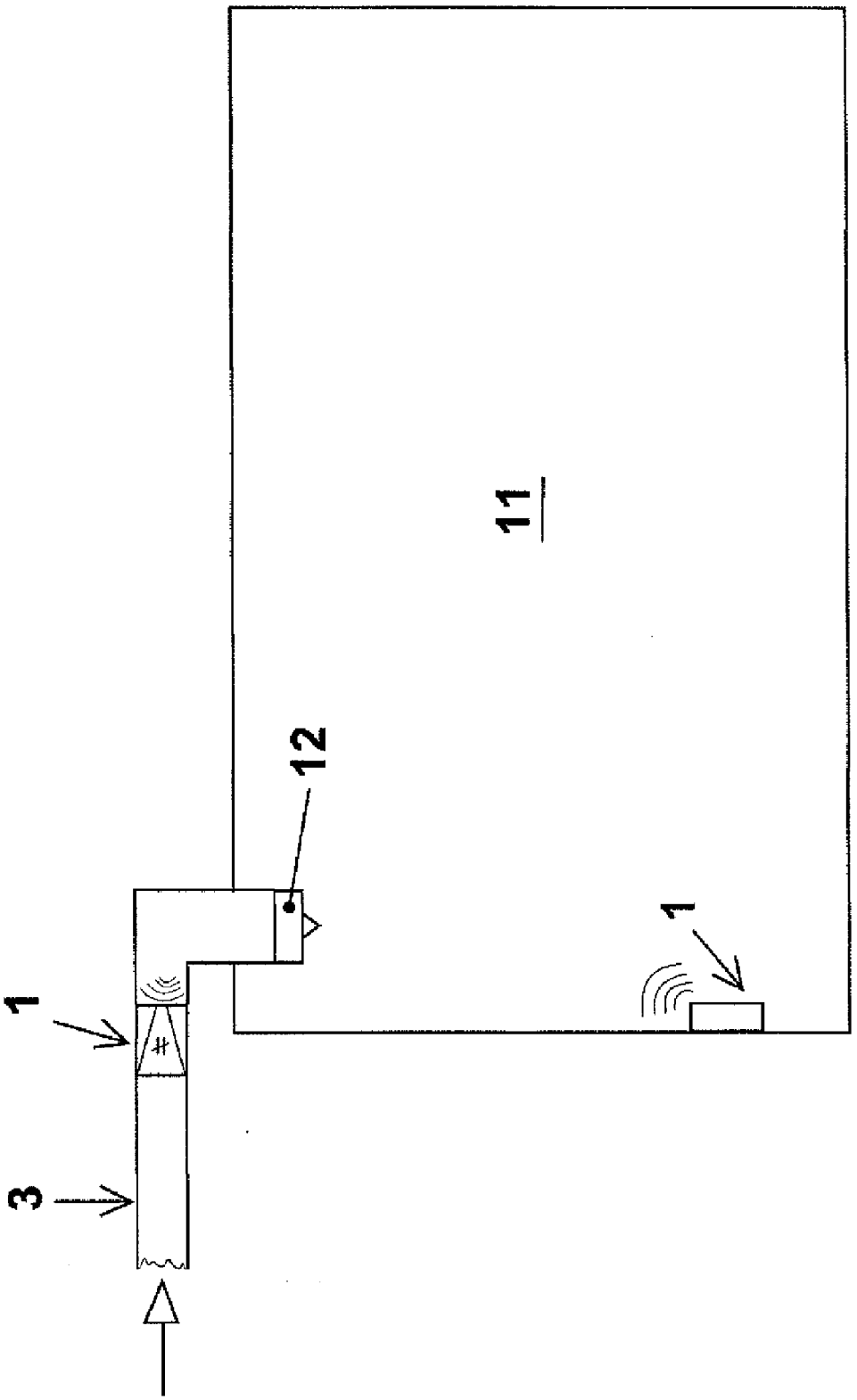


Fig. 4

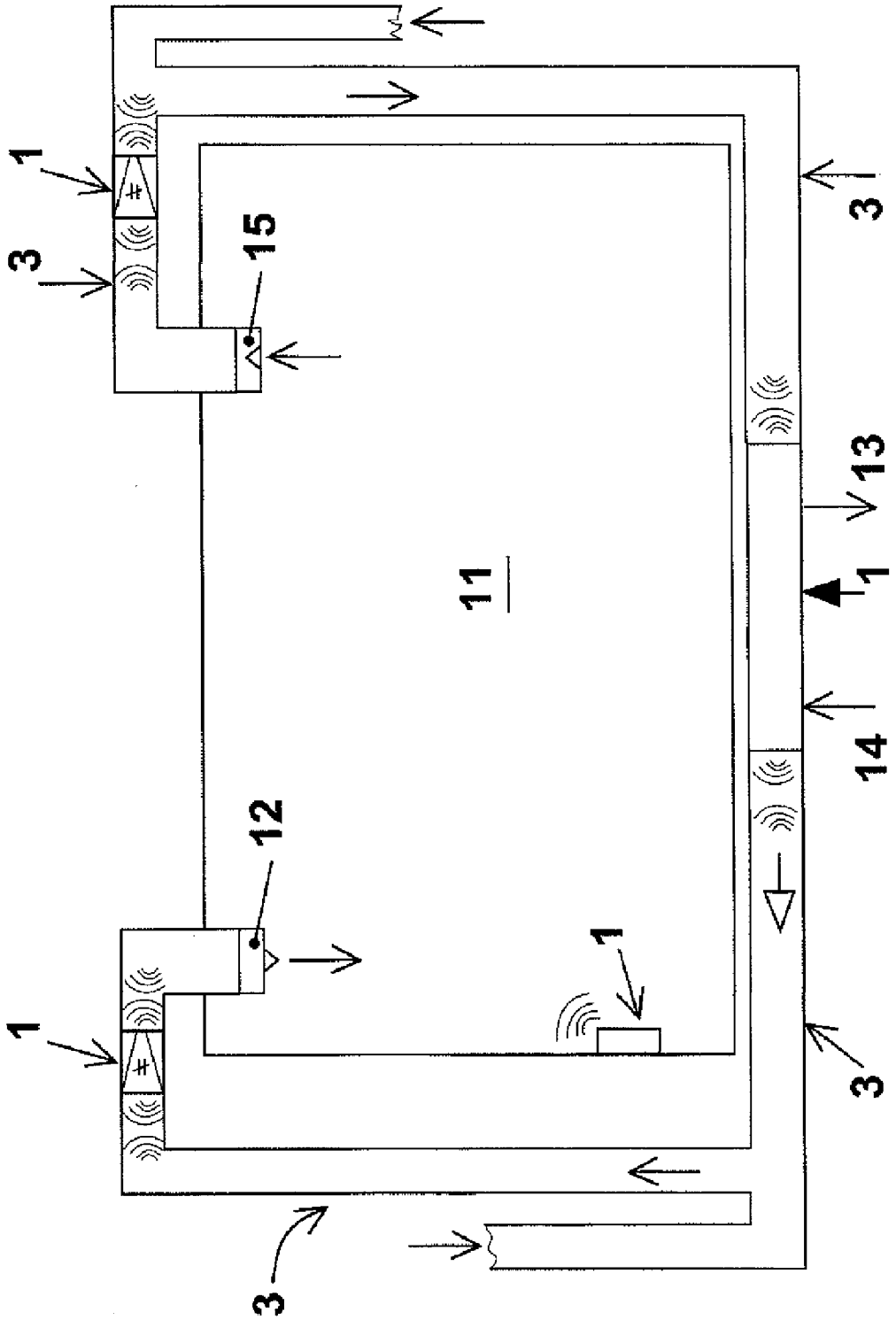


Fig. 5

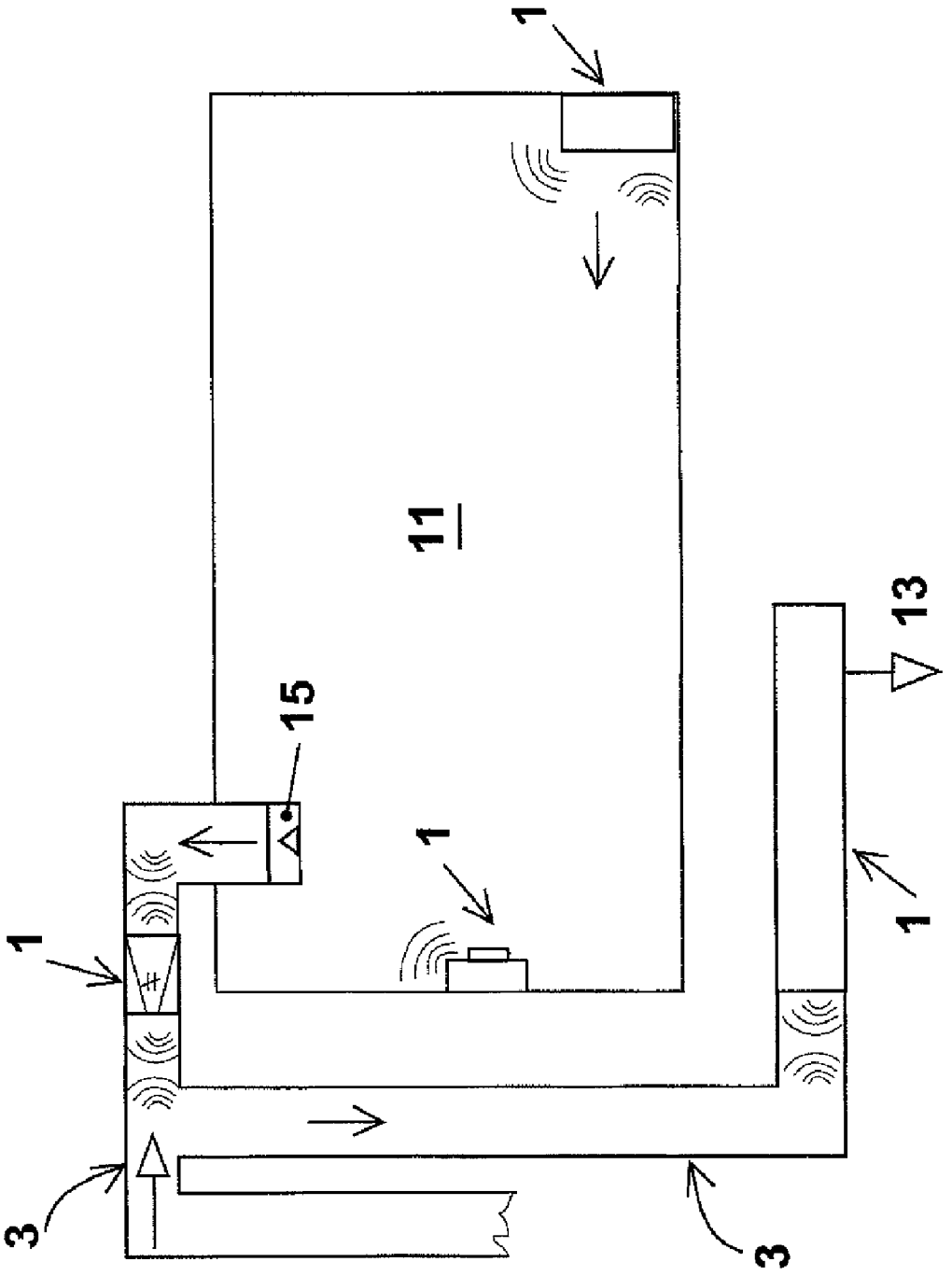


Fig. 6

ROOM VENTILATING AND AIR CONDITIONING SYSTEM HAVING AT LEAST ONE FLOW DUCT FOR A MEDIUM FLOWING THEREIN AND HAVING AT LEAST TWO AIR-RELATED COMPONENTS

CROSS-REFERENCE TO RELATED APPLICATIONS AND CLAIM TO PRIORITY

[0001] This application is related to application number 08010171.0, filed Jun. 4, 2008 with the European Patent Office, the disclosure of which is incorporated by reference and to which priority is claimed.

FIELD OF THE INVENTION

[0002] The invention relates to a room ventilating and air conditioning system having at least one flow duct for a medium flowing therein and having at least two air-related components, at least one component of the room ventilating and air conditioning system having a receiver and at least one component having a transmitter and the two components being connected to each other via a wire-free connection, in particular via a radio connection.

BACKGROUND OF THE INVENTION

[0003] Known systems firstly have a component constructed as an operating device which, for example, is installed on a room wall, and secondly a further component arranged in a flow duct and constructed as a volume flow regulator. The two components are connected to each other via a radio connection, which is formed in such a way that the signals are transmitted in free space. It proves to be disadvantageous that such radio connections have only a very limited range and therefore corresponding systems can be used only to a restricted extent, in particular in multi-storey buildings. For example, room walls or other objects lead to considerable impairment of the radio connection. An arrangement of two components connected to each other via a radio connection in different rooms or even on different floors is therefore virtually impossible.

SUMMARY OF THE INVENTION

[0004] The object of the invention is to avoid the aforementioned disadvantages and to specify a room ventilating and air conditioning system which can be used irrespective of the structural conditions of the relevant building in which the system is installed.

[0005] This object is achieved in that at least one of the transmitters projects, at least with a subregion, to such an extent into the interior of the flow duct that the waves emitted by this transmitter are conducted substantially through the flow duct and/or at least one of the receivers projects, at least with a subregion, to such an extent into the interior of the flow duct that it is able to receive the waves conducted substantially through the flow duct.

[0006] The arrangement according to the invention uses the flow duct itself for the wire-free transmission. Since the waves emitted by the transmitter are conducted substantially through the flow duct and/or the waves are received by the receiver projecting, at least with a subregion, into the interior of the flow duct, it is therefore even possible for great distances within the system to be overcome. Conventional problem regions on the building side, for example such as concrete ceilings or else concrete walls, which in the case of conventional systems lead to severe impairment as far as breakdown of the radio connection, therefore no longer constitute any obstacle.

[0007] By means of the solution according to the invention, each appropriately designed individual component of any air conditioning and room ventilating system is able to communicate directly with another component or a number of other components of a central room ventilation system. Even communication between a central room ventilation system and, for example, a decentralised ventilation appliance is possible, given an appropriate configuration. By means of a direct connection to decentralised ventilation appliances, it is therefore possible for co-ordination between temperature and volume flow requirements to be achieved centrally but also decentrally.

[0008] The connection can be, for example, a radio connection, an infrared connection, an ultrasonic connection or else a connection by means of light in the visible or invisible wavelength range.

[0009] The system can be employed without structural changes in stock systems, so that stock systems can therefore be re-equipped without difficulty. The system can have any desired number of components. In its simplest configuration, only two components are provided, which are connected to each other in a wire-free manner.

[0010] For instance, two components arranged one after another in a flow duct, as seen in the flow direction, are able to communicate with each other if they are appropriately equipped with a transmitter and/or a receiver. The communication between two components can be unidirectional or else bidirectional. It is therefore possible to dispense with a central building services control system, since each component itself is assigned a transmitter and/or a receiver, depending on the requirement.

[0011] If there is a building services control system, it is of course possible for a conventional central device belonging to the building services control system of a room ventilation system likewise to be equipped with at least one transmitter and/or at least one receiver. In this way, for example, the rotational speed of a component constructed as a fan can be adapted, with the result of a saving in energy, by means of de-restricting the distribution system or the feed air temperature by decoupling temperature regulation and volume flow.

[0012] At least one component of the room ventilating and air conditioning system can comprise a measuring and/or operating device and in particular have at least one transmitter. This can be, for example, an operating device which is assigned to a room. This operating device can, for example, have only one switch, so that in the event that the switch position is changed, an appropriate signal is transmitted to the associated component via the transmitter. The operating device can also have a measuring element. If a set point set in the operating device is overshot or undershot, in the presence of a control device an appropriate signal is transmitted to the associated component, in order to reproduce the desired set point.

[0013] At least one component can comprise a volume flow regulator, a fire-prevention valve, a fan, a heat exchanger or the like and in particular have at least one receiver. Components of this type normally include an actuator, which is usually constructed as a motor. In the case of a fire prevention valve, the actuator effects a change in the valve position and in the case of a fan is used as a drive.

[0014] If the actuator is, for example, a volume flow regulator, a signal is transmitted by the corresponding transmitter to the effect that the valve is either open or closed. Of course, by using the system according to the invention, other "queries" can also be transmitted in a wire-free manner. These are, for example, cyclically prescribed logs from test runs, from maintenance work or the like.

[0015] At least one of the transmitters can be combined with a receiver and, in particular, also or exclusively be designed as a repeater. Repeaters receive a signal, re-condition this and send it out again. Repeaters are electrical or else optical devices. Simply configured repeaters do not influence the transmitted information. Instead, the electrical or optical signal is only conditioned. More intelligent repeaters are able to re-synchronise an electrical signal.

[0016] If a component has a transmitter and receiver, both reception and transmission are possible. In this case, signals from other components can be received, if necessary processed and forwarded, or else individual data can be transmitted. On the basis of these components, a network of a wire-free connection is thus produced, which is able, partly or completely, to perform the functions of a conventional central building services control system.

[0017] Given such a configuration, the transmitter and the receiver of a component are connected functionally to each other, so that to this extent reception and transmission are possible. Such a configuration is recommended in particular when, for example, a number of components arranged one after another are arranged in a flow duct and communicate with one another. This permits a particularly energy-optimized operation of the system, since the air-conditioning action of the complete system can be adapted optimally at any point in the system.

[0018] If at least one of the transmitters is combined with a receiver and is also designed as a repeater, signals can be forwarded to a further component. However, in the case of such an embodiment, it is also entirely possible for only some of the signals received from another component to be used or converted, while the remainder of the signals are forwarded to another component.

[0019] It is not necessary for one component to find exactly the component with which communication is intended. Instead, it is merely necessary for a component to find any other component at all for communication, since this component is able to forward the relevant signals to the relevant component, directly or possibly via further components, in particular on account of its property as a repeater.

[0020] For instance, if one component is constructed as an operating device, to which three components are assigned, in each case a connection, for example a radio connection, can exist between the operating device and each individual component. However, it is also entirely possible for the operating device to communicate only with one component and for this component to forward the signals which are not intended for this component to the relevant other component or to the relevant other components. Therefore, by means of the components according to the invention, systems of any desired size and also complex systems can be produced.

[0021] Components with repeaters are recommended in particular in complex systems in which, for example, a plurality of secondary flow ducts extending parallel to one another and having components located therein in each case, such as volume flow regulators and fans, are supplied by a main flow duct. If, for example in the case of a variable volume flow at the outlet of a secondary flow duct, too low a quantity of air flowing out is measured by a measuring device, an appropriate signal to change the valve position is transmitted from the corresponding measuring device, via the transmitter, to the component assigned to this secondary flow duct and, for example, formed as a volume flow regulator, instead of an increase in the output of the fan arranged in the main flow duct. This permits energy-optimised operation.

[0022] At least one component of the room ventilating and air conditioning system can comprise a control device and in particular have at least one transmitter. Of course, it is also possible for a receiver to be provided in addition to the transmitter.

[0023] At least one component of the room ventilating and air conditioning system can comprise a regulating device and in particular have at least one transmitter and one receiver.

[0024] In the system according to the invention, the control and/or regulating device(s) are decentralised, since each component can preferably itself be assigned a corresponding device. Preferably, the corresponding control and/or regulating devices are protectively encoded, self-detecting, self-addressing and self-configuring. This simplifies the mounting and commissioning on site, since the components within the system identify themselves.

[0025] It is obvious that the invention can also relate to a complete room ventilation system. Of course, isolated systems, that is to say individual rooms and components assigned to these rooms, are also conceivable.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026] In the following text, exemplary embodiments of the invention illustrated in the drawing will be explained.

[0027] FIG. **1** shows a section through a component according to the invention having a transmitter which projects with at least one subregion into the interior,

[0028] FIG. **2** shows a section through a component according to the invention, in which the receiver projects with at least one subregion into the interior,

[0029] FIG. **3** shows a section through a component in which a transmitter and a receiver each project with at least one subregion into the interior,

[0030] FIG. **4** shows a sketch of a room ventilating and air conditioning system for room ventilation and air conditioning by means of a feed air system with volume flow regulation,

[0031] FIG. **5** shows a sketch of a room ventilating and air conditioning system having room ventilation and air conditioning by means of a central room ventilating system, and

[0032] FIG. **6** shows a sketch of a room ventilating and air conditioning system for room ventilation and air conditioning having a decentralised feed air device and a central room ventilating device for waste air.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT(S)

[0033] In all the figures, mutually agreeing reference symbols are used for the same or same types of components.

[0034] The invention is illustrated by using a component **1** constructed as a volume flow regulator. FIGS. **1** to **3** show a volume flow regulator which has a valve disc **2** which is mounted in the interior of a flow duct **3** such that it can pivot on a pivot axis **5** oriented transversely with respect to the flow

direction (arrow **4**). Provided as an actuator is a drive **6***r* which is arranged outside the flow duct **3** and acts on the pivot axis **5** at the end.

[0035] In the exemplary embodiment illustrated in FIG. **1**, the volume flow regulator has a transmitter which projects into the interior of the flow duct **3** with a subregion **7**, with an antenna in the exemplary embodiment illustrated. Therefore, the waves emitted by this transmitter are conducted substantially through the flow duct **3**.

[0036] In the embodiments illustrated in FIGS. **1** to **3**, the antenna is connected to the drive via a component **8** which is arranged outside the flow duct **3**. The drive **6** and the component **8** are arranged in a common housing **9**.

[0037] The component **8** can be, for example, a converter which, for example, converts a received radio signal into an analogue or digital signal or vice versa. It is also possible for the component **8** to have an amplifier function, so that an incoming signal can be amplified.

[0038] Of course, the component **8** can also be formed as a control device or as a regulating device, which is recommended in particular in complex systems.

[0039] FIG. **2** illustrates an exemplary embodiment in which the component **1** has a receiver. In order that the receiver can receive waves and signals emitted through the flow duct **3** by another transmitter, the receiver projects, at least with a subregion **10**—with its antenna in the exemplary embodiment illustrated—into the flow duct **3**.

[0040] FIG. **3** shows an embodiment in which the component **1** has both a receiver and a transmitter. Both the transmitter and receiver project with a subregion **7**, **10** into the flow duct **3**. Therefore, the component **1** can firstly receive signals emitted by a transmitter, not illustrated, and secondly can forward signals to another component **1** which has an appropriate receiver.

[0041] In FIGS. **4** to **6**, for improved clarity, the components **1** are in each case illustrated without a transmitter and/or receiver according to the invention or a transmitting and/or receiving device.

[0042] FIG. **4** shows a basic sketch of room ventilation and air conditioning by means of a feed air system having a volume flow regulator. A flow duct **3** for the feed air, having an outlet **12** at the end, opens into a room **11**. Provided in the flow duct **3** for the feed air is a component **1** constructed as a volume flow regulator. A room-side operating device is illustrated as a further component **1**.

[0043] As indicated in FIG. **4**, the operating device can for example have a transmitter, and the volume flow regulator itself can be provided with a receiver which projects, at least with a subregion **10**, into the flow duct **3**. If a signal or a wave is transmitted by the operating device to the volume flow regulator and is received by the receiver of the volume flow regulator, a corresponding change is made in the position of the valve disc **2**. If the volume flow regulator has a transmitter and the operating device has a receiver, communication in the other direction is also possible.

[0044] FIG. **5** shows a basic sketch of room ventilation and air conditioning by means of a central room ventilating system. As can be gathered from this figure, a flow duct **3** for the feed air and a flow duct **3** for the waste air are provided. On the room side, the flow duct **3** for the waste air has an inlet **15**. The flow ducts **3** for the feed air and for the waste air are led to the component **1** constructed as a central room ventilating device which, in the exemplary embodiment illustrated, has a transmitter and a receiver. The waste air outlet **13** and the feed air inlet **14** are merely indicated.

[0045] As indicated in FIG. **5**, the flow ducts **3** for the feed air, for example of different rooms or zones, and the flow ducts **3** for the waste air, for example of different rooms or zones, are in each case led together. Both in the flow duct **3** for the waste air and in the flow duct **3** for the feed air, in each case a component **1** constructed as a volume flow regulator is provided and, in the exemplary embodiment illustrated, is able both to transmit and to receive.

[0046] The individual components **1** can communicate with one another as desired within the system via the flow ducts **3**, since the waves are transmitted through the flow duct **3**. It is therefore also possible for the two volume flow regulators to communicate with each other, in order for example to coordinate the position of the valve disc **2** with one another in order to achieve an equalised air volume balance, the corresponding waves and signals being forwarded via the component **1** constructed as a central room ventilating device. In addition, for example, waves from the component **1** constructed as an operating device can be transmitted to the room ventilating device via a volume flow regulator.

[0047] FIG. **6** shows a basic depiction of room ventilation and air conditioning with a component **1** constructed as a decentralised feed air device and a component **1** for the waste air constructed as a central room ventilating device. In the flow duct **3** for the waste air, a component **1** constructed as a volume flow regulator and having a transmitter and a receiver is provided. The flow duct **3** for the waste air opens into the central room ventilating device which, in the exemplary embodiment illustrated, is likewise equipped with a transmitter and receiver. The waste air outlet **13** is merely indicated. As further indicated, a number of flow ducts **3** for the waste air are led together.

[0048] In the room **11**, the component **1** constructed as a decentralised feed air device is provided for ventilation. In the simplest case, this can have only one receiver, for example. If, for example, a signal is transmitted from the component **1** constructed as an operating device to the volume flow regulator to open the valve disc **2** more into the open position in order to increase the waste air flow, a corresponding signal is also sent from the operating device to the decentralised feed air device in order to increase the feed air flow. Of course, the decentralised feed air device, as indicated, can also have a transmitter, in order for its part to transmit signals or waves to a further component **1** of the room ventilating and air conditioning system.

I claim:

1. Room ventilating and air conditioning system having at least one flow duct (**3**) for a medium flowing therein and having at least two air-related components (**1**), at least one component (**1**) of the room ventilating and air conditioning system having a receiver and at least one component (**1**) having a transmitter and the two components (**1**) being connected to each other via a wire-free connection, in particular via a radio connection, characterized in that at least one of the transmitters projects, at least with a subregion (**7**), to such an extent into the interior of the flow duct (**3**) that the waves emitted by this transmitter are conducted substantially through the flow duct (**3**) and/or at least one of the receivers projects, at least with a subregion (**10**), to such an extent into the interior of the flow duct (**3**) that it is able to receive the waves conducted substantially through the flow duct (**3**).

2. Room ventilating and air conditioning system according to claim **1**, characterized in that at least one component (**1**) of the room ventilating and air conditioning system comprises a measuring and/or operating device and in particular has at least one transmitter.

3. Room ventilating and air conditioning system according to claim **1**, characterized in that at least one component (**1**) comprises a volume flow regulator, fire prevention valve, fan, heat exchanger or the like and in particular has at least one receiver.

4. Room ventilating and air conditioning system according to claim **1**, characterized in that at least one of the transmitters is combined with a receiver and in particular is also or exclusively designed as a repeater.

5. Room ventilating and air conditioning system according to claim **1**, characterized in that at least one component (**1**) of the room ventilating and air conditioning system comprises a control device and in particular has at least one transmitter.

6. Room ventilating and air conditioning system according to claim **1**, characterized in that at least one component (**1**) of the room ventilating and air conditioning system comprises a regulating device and in particular has at least one transmitter and one receiver.

7. Room ventilating and air conditioning system according to claim **2**, characterized in that at least one component (**1**) comprises a volume flow regulator, fire prevention valve, fan, heat exchanger or the like and in particular has at least one receiver.

8. Room ventilating and air conditioning system according to claim **2**, characterized in that at least one of the transmitters is combined with a receiver and in particular is also or exclusively designed as a repeater.

9. Room ventilating and air conditioning system according to claim **3**, characterized in that at least one of the transmitters is combined with a receiver and in particular is also or exclusively designed as a repeater.

10. Room ventilating and air conditioning system according to claim **2**, characterized in that at least one component (**1**) of the room ventilating and air conditioning system comprises a control device and in particular has at least one transmitter.

11. Room ventilating and air conditioning system according to claim **3**, characterized in that at least one component (**1**) of the room ventilating and air conditioning system comprises a control device and in particular has at least one transmitter.

12. Room ventilating and air conditioning system according to claim **4**, characterized in that at least one component (**1**) of the room ventilating and air conditioning system comprises a control device and in particular has at least one transmitter.

13. Room ventilating and air conditioning system according to claim **2**, characterized in that at least one component (**1**) of the room ventilating and air conditioning system comprises a regulating device and in particular has at least one transmitter and one receiver.

14. Room ventilating and air conditioning system according to claim **3**, characterized in that at least one component (**1**) of the room ventilating and air conditioning system comprises a regulating device and in particular has at least one transmitter and one receiver.

15. Room ventilating and air conditioning system according to claim **4**, characterized in that at least one component (**1**) of the room ventilating and air conditioning system comprises a regulating device and in particular has at least one transmitter and one receiver.

16. Room ventilating and air conditioning system according to claim **5**, characterized in that at least one component (**1**) of the room ventilating and air conditioning system comprises a regulating device and in particular has at least one transmitter and one receiver.

17. Room ventilating and air conditioning system according to claim **1**, characterized in that the connection is a radio connection or a connection by means of light in the visible or non-visible wave length region.

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