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(54) **AIR HUMIDIFIER**

(57) The invention relates to electrical engineering, more specifically to air humidifiers for creating an artificial microclimate and can be used to increase humidity in any rooms or offices. The humidifier solves a technical problem of increasing an evaporation surface of an evaporative filter. The forced uniform distribution of air flow

on the surface of the evaporative filter and a free passage of air through said filter leads to an increase in air exchange inside a box and increases a rate of separation of water molecules from the surface of the evaporative filter, which leads to increased air humidifying efficiency in the room and to increased humidifier performance.

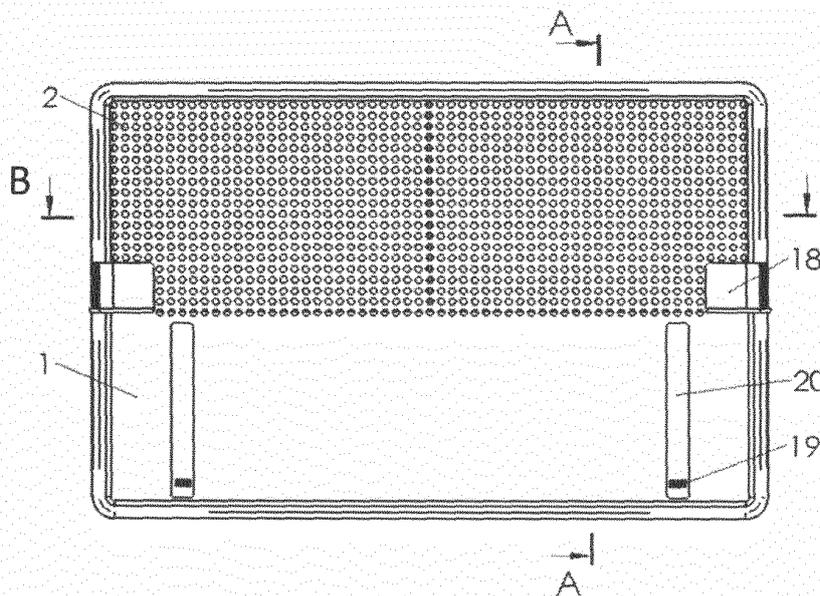


Fig. 1

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Description

[0001] The invention relates to electrical engineering, more specifically to air humidifiers for creating an artificial microclimate and can be used to increase humidity in any rooms or offices. The air humidifier can be installed either on a horizontal surface, on a floor of a room, as well as on a heating radiator, convector or heater.

[0002] There is a known air humidifier comprising a body, a water tank in which an evaporative filter is immersed, electric fan modules located in an upper part of the body, and filters for air purification (patent RU 2283459 C2).

[0003] Disadvantages of this humidifier are its large dimensions due to the large-diameter fan modules, a complexity of manufacturing, a noise from the fan modules and a high energy consumption required to pump air through the filters for air purification.

[0004] There is a known radiator air humidifier comprising a body in a form of a vertical rectangular box with a lid and an open rear side, with slots at a top of a front side, a water tank in which an evaporative filter is immersed, a top of the evaporative filter being fixed on a rod in the top of the body. The humidifier body is manufactured from a plastic. The evaporative filter is manufactured from a thin, dense cellulose material with high hygroscopicity (a sheet of thick cardboard, similar in structure to felt) (patent DE 8326722 U1).

[0005] Disadvantages of the known humidifier are the plastic body, which is subject to destruction by a prolonged heat exposure from the radiator, mechanical effects, as well as from an exposure to ultraviolet rays, as well as a dense structure of the evaporative filter, which does not allow air currents, including those created by the radiator, to pass through it, which slows down a natural convection in a room and reduces an efficiency of the humidifier and cannot ensure high humidifier performance.

[0006] Closest to the invention is a radiator air humidifier, comprising a body in a form of a box with slots at a top of a front side and an open rear side, a water tank located at a bottom of the box, an evaporative filter, a top of which is located in the box and a bottom of which is located at a bottom of the water tank.

[0007] The top of the evaporative filter is fixed to the rod at the top of the box. The evaporative filter is manufactured as a thin sheet made of dense hygroscopic material (patent RU 160861 U1).

[0008] Disadvantages of this humidifier are that the evaporative filter as a sheet made of hygroscopic material has a small evaporation surface. The evaporative filter in this design and location in the box is an obstacle to the free passage of air through the filter and the slots of the box, which leads to a decrease in air exchange inside the box and reduces a rate of separation of water molecules from a surface of the sheet, thereby reducing air humidification efficiency in a room and humidifier performance.

[0009] The dense structure of the evaporative filter does not allow air currents, including those generated by the radiator, to pass through the filter, which leads to a slowdown in natural convection in the room and a decrease in air humidification efficiency. A small evaporation area of the filter and its dense structure, which does not allow air to pass through, cannot ensure high humidifier performance.

[0010] The technical result of the claimed invention is to improve the efficiency of air humidification in the room and to ensure high humidifier performance.

[0011] The specified technical result is achieved by the fact that the air humidifier comprising a body in a form of a box with slots at a top of a front side and an open rear side, a water tank located at a bottom of the box, an evaporative filter a top of which is located and fixed in the box and a bottom of which is located in the water tank, according to the invention, has a diffuser and a fan rotatable in a vertical plane, installed and fixed in a narrow diffuser inlet, wherein the diffuser is located behind the evaporative filter in the upper rear open side of the box, fixed in the box and pressed with a wide outlet part to the evaporative filter, which has cells for a passage of air through it, wherein a lower part of the evaporative filter is fixed in the water tank.

[0012] The air humidifier has, at least one additional evaporative filter and at least one additional fan diffuser located in parallel with the evaporative filter and the fan diffuser.

[0013] In the air humidifier, the narrow inlet of the diffuser is manufactured on perimeter as round, the wide outlet of the diffuser is manufactured on perimeter as rectangular or square, and the diffuser is manufactured as a hollow truncated cone.

[0014] The diffuser has at least one strap to fasten the fan, said strap being mounted on diameter of the round narrow inlet of the diffuser.

[0015] In the humidifier, the cells for passing air through the evaporative filter can be manufactured as honeycombs.

[0016] The cells for passing air through the evaporative filter can be manufactured as holes.

[0017] The vertical rectangular box has holes in the front side to supply water into the water tank.

[0018] The air humidifier has float water level gauges installed in the tank.

[0019] The water tank is manufactured from a transparent plastic.

[0020] The box has windows in the front side for visual inspection of the float water level gauges.

[0021] The air humidifier has a fastener to a heating radiator or to a heater. The fastener has hooks and the box has hook holes on the sides.

[0022] The additional filter increases a total evaporation area of the filters, and the additional fan diffuser increases an overall rate at which air passes through the evaporative filters; as a result, the use of the additional evaporative filter and the additional fan allows to increase

an efficiency of air humidification in a room with a small size of the humidifier.

[0023] The evaporative filter, having a constant area, located across the entire width and height of the box, has a large evaporation surface due to the cells. A forced uniform distribution of the air flow created by the fan, directed through the diffuser space directly to the area of the evaporative filter, allows air to freely pass through the entire surface of the wet evaporative filter, and provides a quick air exchange inside the humidifier, which allows to increase a rate of separation of water molecules from the surface of the evaporative filter, and to carry out an intensive and stable saturation of indoor air with moisture and to increase the efficiency of humidification of indoor air.

[0024] Unobstructed, forced and diffuser-directed air-flow allows air to pass through the cells of the evaporative filter without loss, thereby increasing humidifier performance.

[0025] Also the humidifier has a low power consumption fan and a low noise level.

[0026] To increase an intensity of moisture evaporation, it is possible to place the air humidifier on a central heating radiator or any other household air heater (hereinafter referred to as a radiator). The honeycomb structure of the evaporative filter allows warm air to pass freely through the evaporative filter, which helps to increase the rate of removal of moist air from the body of the humidifier and thereby increase the efficiency of air humidification.

[0027] Fig. 1 is a front view of the air humidifier; Fig. 2 is a section along A-A on Fig. 1; Fig.3 is a section along B-B on Fig.1; Fig. 4 is a rear view of the air humidifier; Fig. 5 is a side view C of the air humidifier on Fig. 4; Fig. 6 is a view D, one of the variants of the cells of the evaporative filter on an enlarged scale.

[0028] The air humidifier comprises a body in the form of a box 1 with slots 2 at a top on a front side (Fig. 1) and with an open rear side 3 (Fig. 2). A water tank 4 is placed at a bottom of the box 1. There is an evaporative filter 5 a top part of which is located and fixed in the box 1, and a lower part of which is fixed in the water tank 4; a diffuser 6 (Fig. 3, 4) and a fan 7, rotatable in a vertical plane by means of an electric motor, installed and fixed in a narrow inlet part 8 of the diffuser 6. The diffuser 6 is located behind the evaporative filter 5 in the upper rear open side 3 of the box 1, fixed in the vertical rectangular box 1 and pressed with a wide outlet part 9 to the evaporative filter 5, which has cells 10 for a passage of air through it.

[0029] The box 1 at the top and the water tank 4 have, respectively, supports 11 and a cradle 12 for fixing and installing the evaporative filter.

[0030] The air humidifier has at least one additional evaporative filter 13 and at least one additional diffuser 14 with a fan 15, which are placed in parallel to the evaporative filter 5 and the diffuser 6 with the fan 7.

[0031] The additional evaporative filter 13 has the same design as the evaporative filter 5, and the additional

diffuser 14 with the fan 15 are designed, respectively, as the diffuser 6 and the fan 7.

[0032] In the described air humidifier, an horizontal axis of the fan is aligned with an horizontal axis of the diffuser. The narrow inlet part 8 of the diffuser 6 is manufactured on perimeter as round, the wide outlet part 9 of the diffuser 6 is manufactured on perimeter as rectangular or square, and the diffuser 6 is manufactured as a hollow truncated cone.

[0033] The wide outlet part 9 of the diffuser can be on perimeter not only rectangular, or square, but also round, triangular, or oval.

[0034] The diffuser 6 has at least one strap 16 to fasten the fan 7, said strap being mounted on diameter of the round narrow inlet of the diffuser. In the described humidifier, a second strap 17 is mounted, similar to strap 16. Any other number of straps can be used to mount the fan 7 with an electric motor.

[0035] The cells 10 for the passage of air through the evaporative filter 5 can be manufactured as honeycombs or as holes.

[0036] The box 1 has holes 18 in the front side to supply water into the water tank 4.

[0037] The water tank 4 is manufactured from a transparent plastic. Float water level gauges 19 are installed in the tank 4.

[0038] The box 1 has windows 20 in the front side for visual inspection of the float water level gauges 19.

[0039] The air humidifier has a fastener to a heating radiator or to a heater. The fastener has hooks 21, and the box 1 has holes 22 for the hooks 21 on lateral sides.

[0040] The evaporative filter 5 has hygroscopic properties.

[0041] The diffuser and the fans are manufactured of moisture resistant material such as plastic.

[0042] The slots 2 realized at the top on the front side of box 1, can be of any shape: for example, round, rectangular.

[0043] The air humidifier works as follows.

[0044] The air humidifier is installed on the floor of the room, water is poured through the holes 18 to supply water to the water tank 4, the evaporative filter 5 absorbs water because the lower part of the evaporative filter 5, fixed in the cradles 12, is submerged into water to the bottom of the water tank 4, and its top part, located above the water tank 4, soaked in water due to the hygroscopicity of the evaporative filter 5, becomes wet.

[0045] The evaporative filter 5, having a constant area, due to the cells 10, has a large evaporation surface.

[0046] When the fan 7 rotates, a dry air flow is forcibly drawn into the box 1 through the rear open side 3, enters the narrow part 8 of the diffuser 6, passes through blades of the fan 7 and enters 5 into the wide part 9 of the diffuser 6, which is adjacent to the evaporative filter. This creates air pressure on the evaporative filters 5. The air flow is evenly distributed over the entire surface of the cells 10 of the wet evaporative filter 5, located above the water tank 4, since the wide part 9 of the diffuser 6 is adjacent

to the evaporative filter 5. Air passes freely through the cells 10 of the wet evaporative filter 5 and is saturated with water molecules, after which humidified air, under the influence of air pressure, leaves the box 1 through the slots 2 on the front side of the box 1.

[0047] The forced uniform distribution of air flow on the surface of the evaporative filter and the free passage of air through the cells leads to an increase in air exchange inside the box and increases the rate of separation of water molecules from the surface of the evaporative filter, which leads to increased air humidifying efficiency in the room and increased humidifier performance.

[0048] As the air flow created by the fan 7 intensively blows away water molecules from the surface of the evaporative filter 5 through the diffuser 6, the evaporative filter 5 absorbs water from the water tank 4, as a result of which the water level in said water tank gradually decreases. Since the water tank 4 is made of transparent plastic, the float water level gauges 15 are visible through the windows 16. The water level is controlled. To ensure a continuous process of humidifying the room, it is necessary to regularly add water to the tank.

[0049] In order to increase the intensity of moisture evaporation, the air humidifier can be placed on a central heating radiator or any other household air heater.

[0050] The air humidifier mounted on the radiator by means of the hooks 21, which are inserted into the lateral holes 22, made at different heights of the sides of the box 1 for different radiator dimensions.

[0051] The air humidifier is installed with the rear open side 3 of the box 1 on the front side of the radiator, with the body of the radiator completely covering the rear open part 3 of the box 1, causing the heat radiation from the radiator to heat the diffuser 6, the fan 7 and the top part of the evaporative filters 5 located above the water tank 4.

[0052] During operation, the fan 7 draws in air heated by the radiator through the rear open side 3 of the box 1, then warm air enters the diffuser 6, gets evenly distributed in it over the entire area of the wet evaporative filter 5 located at the top of the box 1 above the water tank 4, after which warm air passes freely through the cells 10 in the evaporative filter 5, gets saturated with moisture and exits the vertical rectangular box 1 through the slots 2 on the front side of the vertical rectangular box 1.

[0053] The effect of the warm air created by the radiator on the evaporative filter 5 allows for an increase in the rate of evaporation of moisture from its surface, with the box 1 and the fan 7 being compact enough, for a reduction of energy consumption and noise level, in comparison with other known air humidifiers operating according to the same scheme but without using thermal energy generated by a radiator or other household air heater. It also allows for increased room humidification efficiency due to the uniform distribution of humid air together with convection currents created by the radiator.

[0054] The use of air heated by a radiator for forced blowing of evaporative filters makes it possible to use

less efficient fans in comparison with known humidifiers.

[0055] The use of the heated air for forced blowing of the evaporative filters 5 by the fan 7 allows for an even distribution of the air humidified by the device throughout the room, since the warm moist air coming out of the slots 2 in the front of the box 1 participates in the natural convection currents inside the room created by the radiator.

[0056] The air flow from the fan is directed forward, that is, the air is supplied from the radiator side, which allows the evaporative filter to be blown with warm air heated from the radiator, which also contributes to an increase in the rate of evaporation of moisture from the evaporative filter. In addition, the location of the air humidifier on the radiator with the fan on increases the rate of passage of air masses through the heating radiator, which also leads to an increase in heat transfer from the radiator and acceleration of natural convection in the room.

[0057] The air humidifier in accordance with the claimed invention has increased evaporation surface, due to the free passage of air through the evaporative filter and slots of the body, allows for an increase in the rate of air passage through the evaporative filter, and this leads to an increase in the rate of separation of water molecules from the surface of the evaporative filter, thereby increasing the efficiency of air humidification in the room. The air humidifier has a small size and low energy consumption.

Claims

1. An air humidifier comprising a body in a form of a box with slots at a top of a front side and an open rear side, a water tank located at a bottom of the box, an evaporative filter a top part of which is located and fixed in the box and a lower part of which is located in the water tank, **characterized in that** the air humidifier has a diffuser and a fan rotatable in a vertical plane, installed and fixed in a narrow inlet of the diffuser, wherein the diffuser is located behind the evaporative filter in the upper rear open side of the box, fixed in the box and pressed with a wide outlet part to the evaporative filter, which has cells for a passage of air through it, wherein the lower part of the evaporative filter is fixed in the water tank.
2. The humidifier according to claim 1, **characterized in that** it has at least one additional evaporative filter and at least one additional fan diffuser which are placed in parallel with the evaporative filter and the fan diffuser.
3. The humidifier according to claim 1, **characterized in that** the narrow inlet of the diffuser is manufactured on perimeter as round, the wide outlet of the diffuser is manufactured on perimeter as rectangular or square, and the diffuser is manufactured as a hol-

low truncated cone.

4. The humidifier according to claim 3, **characterized in that** the diffuser has at least one strap to fasten the fan, said strap being mounted on diameter of the round narrow inlet of the diffuser. 5
5. The humidifier according to claim 1, **characterized in that** the cells for the passage of air through the evaporative filter are manufactured as honeycombs. 10
6. The humidifier according to claim 1, **characterized in that** the cells for the passage of air through the evaporative filter are manufactured as holes. 15
7. The humidifier according to claim 1, **characterized in that** the box has holes in the front side to supply water into the water tank.
8. The humidifier according to claim 1, **characterized in that** it has float water level gauges installed in the tank. 20
9. The humidifier according to claim 1, **characterized in that** the water tank is manufactured from a transparent plastic. 25
10. The humidifier according to claim 8, **characterized in that** the box has windows in the front side for visual inspection of the float water level gauges. 30
11. The humidifier according to claim 1, **characterized in that** it has a fastener to a heating radiator or to a heater. 35
12. The humidifier according to claim 9, **characterized in that** the fastener has hooks and the box has holes for the hooks on lateral sides. 40

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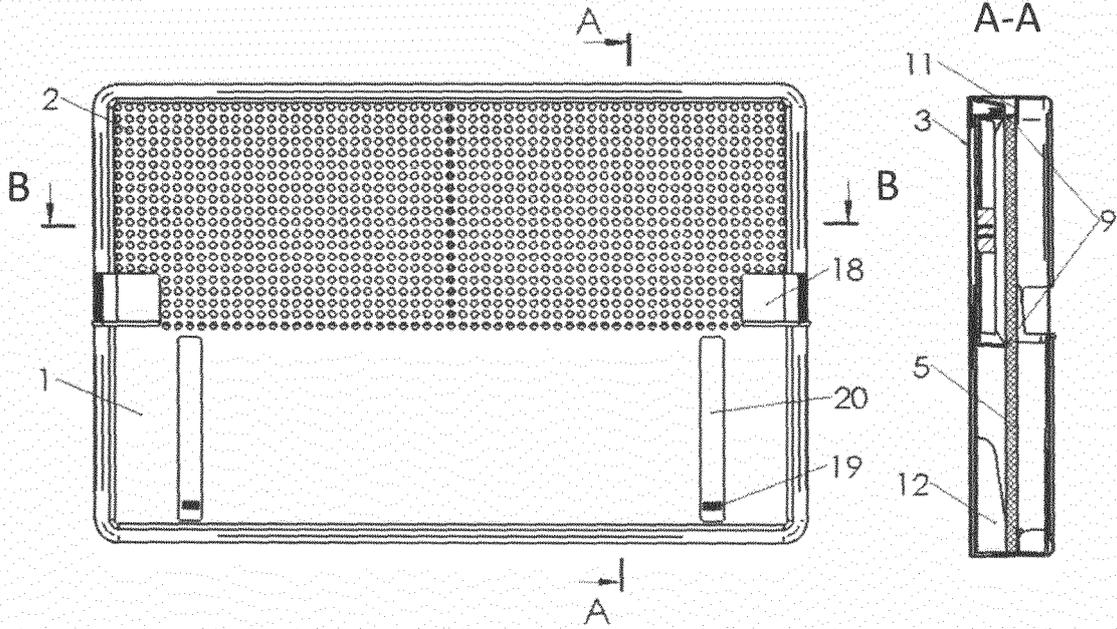


Fig. 1

Fig. 2

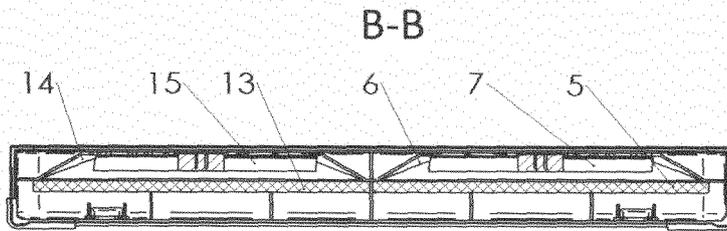


Fig. 3

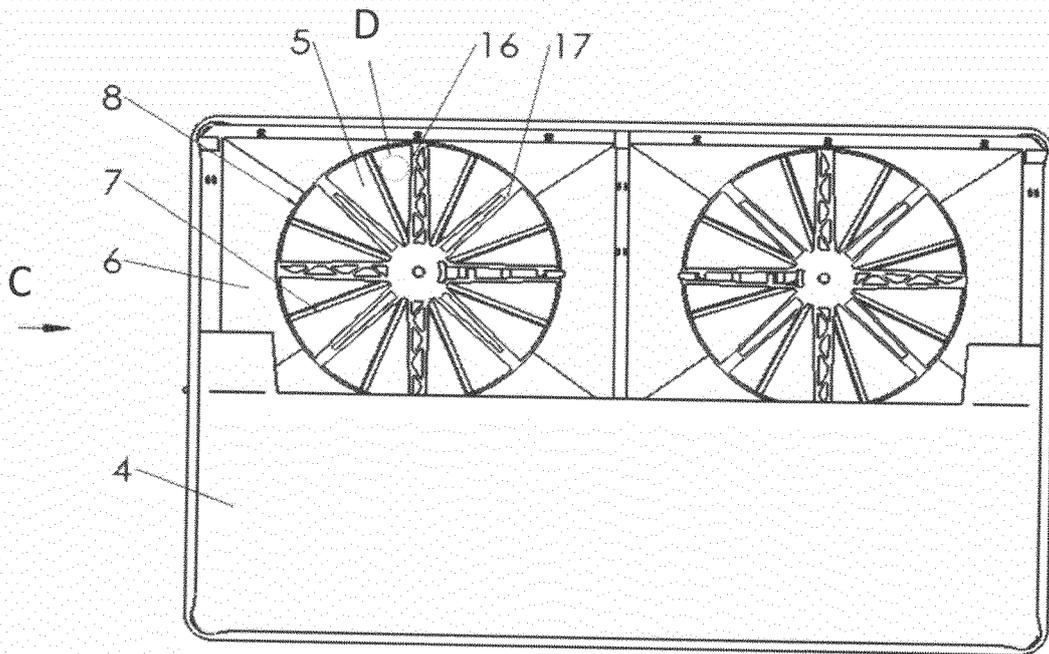


Fig. 4

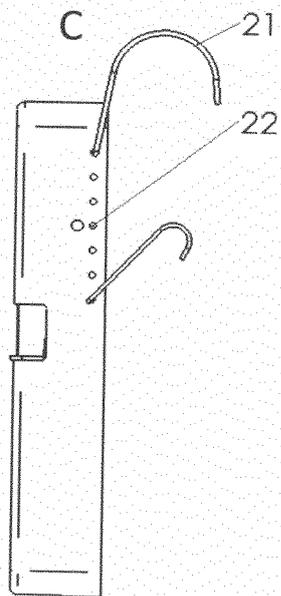


Fig. 5

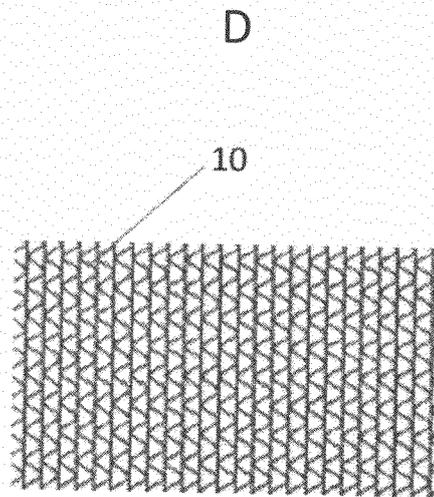


Fig. 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU 2020/050072

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A. CLASSIFICATION OF SUBJECT MATTER
F24F 6/02 (2006.01)
According to International Patent Classification (IPC) or to both national classification and IPC

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B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
F24F 6/02, 6/00, 13/00
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

15

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PatSearch (RUPTO internal), Espacenet, DWPI, PAJ, USPTO

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0027760 A1 (LYON ROLAND) 29.04.1981, fig.3-6, description page 4, line 15 - page 5 line 35	1-12
A	JP 2003/014261 A (SHARP KK) 15.01.2003	1-12
A	EP 2320149 A1 (DAIKIN IND LTD) 11.05.2011	1-12
A	RU 2125210 C1 (TOO "ISPYTATELNY TSENTR "POLITEST") 20.01.1999	1-12

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Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents:
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Date of the actual completion of the international search 05 August 2020 (05.08.2020)	Date of mailing of the international search report 06 August 2020 (06.08.2020)
Name and mailing address of the ISA/ RU	Authorized officer
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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- RU 2283459 C2 [0002]
- DE 8326722 U1 [0004]
- RU 160861 U1 [0007]