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Remarks:
Amended claims in accordance with Rule 137(2) EPC.

(54) **Air mover device**

(57) The invention discloses an air mover device (1) for drying damp walls or wall portions (4) by at least one air mover (6). Said air mover generates airflow which is controllable by an adjusting unit (40). The adjusting unit (40) is designed so that the airflow can be automatically controlled toward any direction in the room.

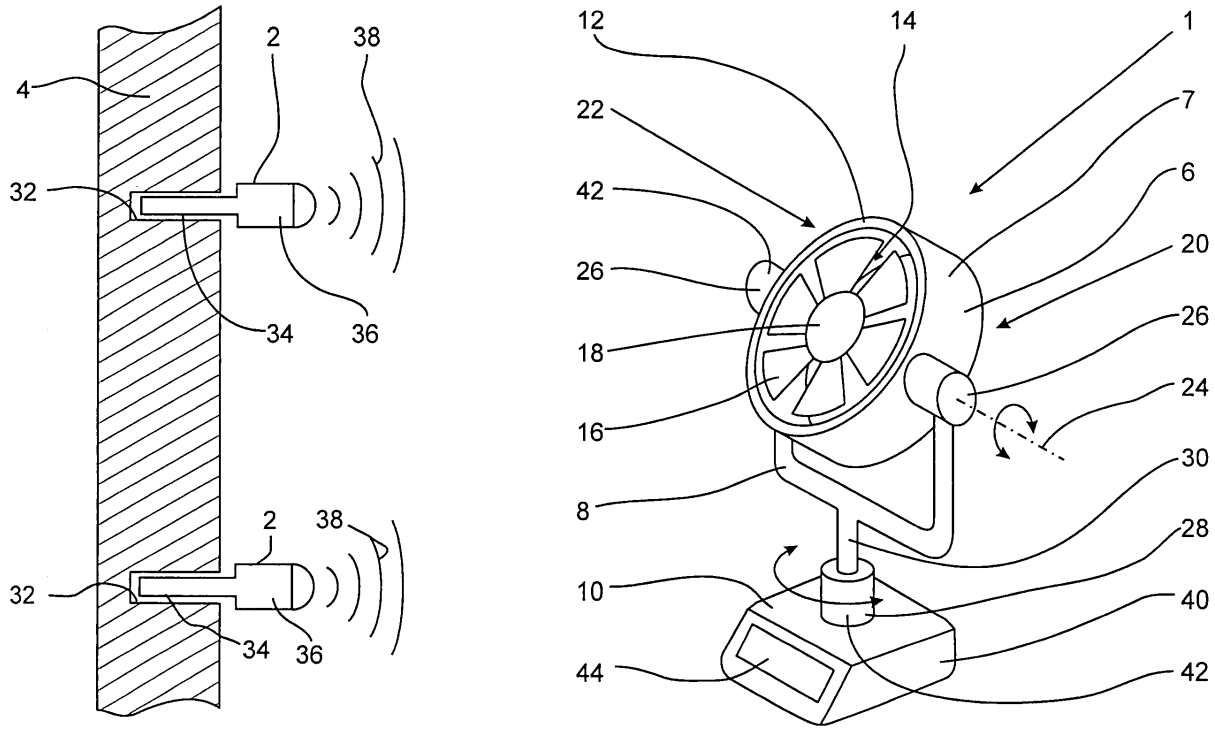

fig. 1

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Description

[0001] The invention relates to an air mover device and a method of controlling such air mover device.

[0002] In publication U.S. 2005/0257394 A1 an air mover device for drying damp rooms is disclosed. Said device comprises a housing having an air inlet and an air outlet. A rotor which generates airflow between the air inlet and the air outlet is arranged in the housing. Upstream of the air outlet a turbine driven by a motor is disposed, the airflow generated by the rotor absorbing waste heat from the motor. Thus, hot air flows through the air outlet into the room to be dried. Moreover, air is pumped through a passage via the turbine. The passage is connected to a base plate spaced apart from a floor of the room, whereby air provided between the floor and the base plate is sucked toward the passage. A convective flow occurs between the floor and the base plate to remove the humidity prevailing in the floor.

[0003] This solution has the drawback that such air mover device has an extremely complex structure and requires a large amount of energy to drive the rotor and the turbine.

[0004] Compared to that, it is the object underlying the invention to provide an air mover device and a method of controlling such air mover device for inexpensive and energy-saving drying of damp areas in rooms, such as walls, ceiling or floors.

[0005] This object is achieved by an air mover device in accordance with the features of claim 1 and by a method of controlling such air mover device according to the features of the claims 13 and 14.

[0006] In accordance with the invention, an air mover device includes - for drying a surface, especially a damp wall or wall portion - at least one air mover for generating airflow. The airflow is controllable by an adjusting unit which has such configuration that the airflow is automatically controllable into any direction of the room.

[0007] This solution has the advantage that high dynamics of the ambient air are developed by varying the airflow into any directions of the room, whereby dehumidifying of the walls or wall portions is accelerated by reason of high convection. Energy is saved by the more rapid drying process of the walls or wall portions.

[0008] Preferably the adjusting unit is controlled by an Electronic Control Unit (ECU), thus allowing control, for instance, of different motion patterns of the airflow.

[0009] Advantageously at least one sensor is provided which serves especially for detecting humidity and/or a temperature of a wall, a wall portion or other surfaces. The airflow is controlled in response to a measuring signal of the at least one sensor transmitted to the ECU.

[0010] In this way, during a motion pattern, the airflow can be directed primarily to a damp area of the wall measured by the sensor and the wall can be dehumidified substantially in this area by convection. If the temperature and/or humidity value of the wall then falls below a predetermined value, the air mover can be switched off, for instance, in order to save energy.

[0011] Preferably a plurality of sensors is provided for measuring the humidity of one or more walls or wall portions, whereby it is possible, for example, to always direct the airflow to the dampest wall portion or the dampest wall.

[0012] The measuring signal can be transmitted extremely flexibly through wireless connection from the sensor to the ECU. This is carried out, for instance, electromagnetically, optically or acoustically. Also, a wire connection could be used between the sensor and the ECU and in this way, compared to the wireless connection, a transmitter and a receiver could be saved.

[0013] A position of the at least one sensor can preferably be transmitted to the ECU via a GPS signal received by the sensor or is manually entered into the ECU via a control panel.

[0014] In a further embodiment of the invention, the air mover includes a rotor driven by an electric motor which is movable by the adjusting unit for varying the flow direction of the airflow.

[0015] In order to pivot the rotor into all directions of the room, preferably a first swivel axis extending approximately transversely to a drive axis of the rotor and a second swivel axis extending approximately transversely to the first swivel axis are provided.

[0016] It is preferred that the rotor is pivoted by conventional and inexpensive geared motors assigned to the swivel axes.

[0017] The swivel axes may be operatively connected to a respective rotary encoder to determine the current flow direction of the airflow. Said rotary encoders then report the respective swivel angle to the ECU.

[0018] At least one further air mover may be provided to generate a further airflow, the latter then being aligned with respect to the first airflow so as to form turbulence in the room.

[0019] In order to permit an extremely flexible drying of a wall or a wall portion the flow direction and/or the flow rate and/or the temperature of the airflow is controllable. The flow rate is then varied, for instance, by the rotational speed of the rotor and the temperature can be adjusted, for example, by a heater operatively connected to the airflow.

[0020] In a first preferred method of controlling an air mover device the airflow is directed approximately in the direction of the sensor reporting the highest reading of humidity. In this way, drying of a wall or a wall portion is possible within a short drying period, as the convection due to the airflow is most efficient in the area of the highest humidity, which entails saving of energy.

[0021] In a further preferred method the airflow is alternately directed approximately toward each sensor, the period of flow during which the airflow is directed approximately to one of the sensors depending on the measured humidity of said sensor or all sensors. The advantage is that walls or wall portions exhibiting high humidity can be aired during a longer flow period than walls or wall por-

tions exhibiting less humidity which, in turn, results in a short drying period and, consequently, in saving of energy.

[0022] In a further especially simple method the airflow is varied in a pattern predetermined by the ECU.

[0023] Other advantageous further developments of the invention are the subject matter of further subclaims.

[0024] Hereinafter a preferred embodiment of the invention is illustrated by way of schematic drawing. The drawings show:

Fig. 1 a perspective view of an air mover device including pertinent sensors; and

Fig. 2 a flow diagram of a method of controlling such a air mover device.

[0025] In the figure 1 an air mover device 1 comprising two sensors 2 according to an embodiment is shown in a perspective view. The sensors 2 are fixed to a surface 4 shown in sections, which are, for instance, damp areas in rooms, such as walls, wall portions, ceiling or floors. The at least one air mover device 1 preferably serves for the drying of damp walls or wall portions of a room or other surfaces during construction, for instance in order to eliminate damage of a building by water.

[0026] The air mover device 1 comprises an air mover 6 having a rotor unit 7 which is pivoted through a fixing bracket 8. The fixing bracket 8 in turn is rotatably mounted to a base 10.

[0027] The rotor unit 7 has a hollow cylindrical rotor housing 12 encompassing a rotor 14 or rather fan, wherein a housing axis and a rotor axis extend substantially coaxially with respect to each other. The rotor 14 includes plural blades 16 fixed to a rotor head 18. The rotor 14 is driven, for instance, by an electric drive motor not shown in the figure.

[0028] An airflow extending approximately axially with respect to the rotor axis of the rotor 14 is generated by rotation of the rotor 14. The air is conveyed from the rotor 14 via an inlet 20 of the rotor housing 12 to an outlet 22. The hollow cylindrical rotor housing 12 has a bearing on the flow direction of the airflow downstream of the outlet 22.

[0029] The rotor housing 12 is pivoted about a first swivel axis 24 between the approximately U-shaped fixing bracket 8. The swivel axis 24 extends approximately perpendicularly to the housing axis or rotor axis. At least one or two electric geared motors 26 disposed at end portions of the fixing bracket 8 support and swivel the rotor housing 12.

[0030] The fixing bracket 8 is supported at the base 10 via a further geared motor 28 and by the geared motor 28 is rotatable about a second swivel axis 30. The latter is arranged approximately perpendicularly to the floor area and to the first swivel axis 24. Through the geared motors 26, 28 the rotor unit 7 is rotatable about the swivel axis 24 and about the swivel axis 30 of the fixing bracket 8 in all directions of the room so that the airflow can be aligned in any direction.

[0031] The airflow generated by the rotor 14 serves for drying the damp surfaces 4. For this purpose, the airflow is directed to a surface 4 to be dried. In this way, a convective flow is generated at the surface and thus the surface 4 is dehumidified.

[0032] In order to accelerate the drying process of the damp surface 4, several sensors 2 are provided, two of said sensors 2 being exemplified in the figure. The sensors 2 include a rod-shaped sensor portion 34 inserted in a recess 32 of the surface 4 respectively. Said sensor portion 34 is used for measuring the relative humidity and/or temperature in the surface 4 in the area of the recess 32. Thus the arrangement of the sensor portion 34 in the recess 32 is needed for creating a microenvironment to measure the temperature and relative humidity in particular in a brick of the wall. The sensor 2 moreover has a sensor unit 36 projecting away from the surface 4 and including a transmitter through which the reading - i.e. the humidity and/or temperature of the wall portion - is transmitted as measuring signal 38. The measuring signal 38 is received and processed by an Electronic Control Unit (ECU) 40 disposed in the base 10 of the air mover 6. The ECU 40 can also be a separate device positioned in an additional housing.

[0033] For determining the position of the rotor unit 7 and, thus, for determining the flow direction of the airflow rotary encoders 42 are provided. The latter detect the swivel angle and the swivel direction of the rotor unit 7 with respect to the two swivel axes 24, 30. They are arranged, for instance, in the area of the geared motors 26, 28. The swivel angle and the swivel direction are transmitted to the ECU 40 in the form of an electric signal.

[0034] The directions of the rotor unit 7 and/or the airflow to the respective sensors 2 are stored in the ECU 40. For this purpose, the rotor unit 7 is alternately aligned toward each sensor 2 prior to the start of a drying process and the respective position of the rotor unit 7 - detected by the rotary encoders 42 - is stored along with a sensor identification of a respective sensor 2 in a memory connected to the ECU 40. The data are stored by the fact that, after a respective alignment of the rotor unit 7 toward one of the sensors 2, a user confirms them through a control panel 44 connected to the ECU 40 and the corresponding swivel angles of the rotor unit 7 and the sensor identification of the sensors 2 are then stored in the memory.

[0035] It is also possible that the position of the sensors 2 is determined by a Global Positioning System (GPS). To this effect, each sensor 2 transmits its GPS position to the ECU 40 which then can swivel the rotor unit 7 in the direction of each sensor 2.

[0036] At predetermined time intervals or non-stop the ECU 40 receives the measuring signal from each sensor 2 and processes the same. Accordingly, the sensor 2 measuring the highest humidity is determined, for instance. Then the ECU 40 controls the rotor unit 7 via the

geared motors 26, 28 so that the airflow passes in the direction of the sensor 2 having the highest measuring value for humidity.

[0037] It is supposable that the ECU 40 delivers a signal to the outside, for instance to a hand-held phone, with several information, for instance the actual condition of the drying process ("moisture in %" or "end of operation, room dry"). The delivering of the signal can be made by a GSM (Global System for Mobile Communication) module which is connected with the ECU 40.

[0038] Different methods of controlling the air mover device 1 are possible for rapid and thus energy-saving drying of the damp walls 4, which will be explained hereinafter.

[0039] Figure 2 shows a flow diagram of a method of controlling the air mover device 1. In this method in a first process step 46 the ECU 40 calculates the highest reading of humidity and in a second process step 48 the airflow generated by the air mover 6 is directed by the ECU 40 approximately in the direction of the sensor 2 reporting the highest reading of humidity. The higher the humidity in the wall portion, the more humidity is removed by convection. These steps 46, 48 are repeated shown by the arrow 50 in figure 2. Thus, if the reading of humidity of the sensor 2 falls below the reading of humidity of another sensor 2 which is spaced apart therefrom, the ECU 40 directs the airflow to the other sensor 2. Thus, the airflow always points to the direction in which the highest humidity of the surface 4 is measured and thus the largest quantity of humidity can be removed, whereby rapid and thus energy-saving drying of the surface 4 is permitted.

[0040] In another method the air mover 6 alternately directs the airflow approximately in the direction of each sensor 2. In this case, the period of flow during which the airflow passes in the direction of a sensor 2 depends on the humidity measured by said sensor 2 in proportion to the readings of humidity of the other sensors 2. For instance, the higher the humidity measured by a sensor 2, the longer is also the flow period during which the respective wall portion is aired by the airflow. The flow period is calculated by the ECU 40.

[0041] It is also possible to program the air mover device 1 via the control panel 44 independently of the sensors 2. In this way, the user can determine a particular motion pattern of the airflow.

[0042] Furthermore, also several air mover devices 1, for example two, can be employed. They can be arranged in a room in such way that turbulence occurs.

[0043] The air mover 6 in figure 1 can also have an integrated heater controlling the airflow temperature. Thus the sensors 2 can relay information about the airflow temperature to the ECU 40 which can decide whether the addition of thermal energy from the integrated heater is required. If the airflow is heated by the integrated heater the fan speed of the air mover 6 can change the air-off temperature of the airflow. The higher the fan speed the lower the temperature of the heated airflow. Alternatively it could be controlled the heater on/off time, for example by a constant airflow or fan speed.

[0044] The invention discloses an air mover device for drying damp walls or wall portions by at least one air mover. Said air mover generates airflow which is controllable by an adjusting unit. The adjusting unit is designed so that the airflow can be automatically controlled toward any direction in the room.

List of reference numbers:

[0045]

1	air mover device
2	sensor
4	surface
6	air mover
7	rotor unit
8	fixing bracket
10	base
12	rotor housing
14	rotor
16	blade
18	rotor head
20	inlet
22	outlet
24	swivel axis
26	geared motor
28	geared motor
30	swivel axis
32	recess
34	sensor portion
36	sensor unit
38	measuring signal
40	ECU
42	rotary encoder

44 control panel

46 process step

48 process step

50 arrow

Claims

1. An air mover device for drying at least one surface (4) comprising at least one air mover (6) by which an airflow controllable by an adjusting unit (26, 28) is generateable, **characterized in that** the airflow is controllable automatically by the adjusting unit (26, 28) to any direction in the room.

2. An air mover device according to claim 1, wherein the adjusting unit (26, 28) is controlled by an Electronic Control Unit (ECU) (40).

3. An air mover device according to claim 2, wherein at least one sensor (2), especially for detecting humidity and/or temperature of the at least one surface (4) is provided and wherein the airflow is controlled in response to a measuring signal (38) of the at least one sensor (2) transmitted to the ECU (40).

4. An air mover device according to claim 3, wherein a plurality of sensors (2) is provided at the at least one surface (4).

5. An air mover device according to claim 3 or 4, wherein the measuring signal (38) is transmitted from the at least one sensor (2) to the ECU (40) electrically, electronically, optically or acoustically with or without wire connection.

6. An air mover device according to any one of the claims 3 to 5, wherein a position of the at least one sensor (2) is detectable automatically by the ECU (40), especially via a GPS signal, or stored by a control panel (44) connected to the ECU (40).

7. An air mover device according to any one of the preceding claims, wherein the air mover (6) includes a rotor (14) adapted to be pivoted by the adjusting unit (26, 28) for varying the direction of the airflow in the room.

8. An air mover device according to claim 7, wherein the rotor (14) is adapted to be pivoted about a first swivel axis (24) extending approximately transversely to a drive axis and about a second swivel axis (30) extending approximately transversely to the first swivel axis (24).

9. An air mover device according to claim 8, wherein the rotor (14) is pivoted about the swivel axes (24, 30) via geared motors (26, 28).

10. An air mover device according to claim 8 or 9, wherein a respective rotary encoder (42) is operatively connected to a swivel axis (24, 30) to measure a pivoting angle, the respective pivoting angle being reported to the ECU (40).

11. An air mover device according to any one of the preceding claims, comprising two air movers (6), wherein the two airflows thereof are aligned such that turbulence is formed especially in a room defined by the surfaces (4).

12. An air mover device according to any one of the preceding claims, wherein the direction of flow and/or the flow rate and/or the temperature of the airflow are controllable.

13. A method of controlling an air mover device according to anyone of the claims 4 to 12, wherein the airflow is directed approximately toward the sensor (2) reporting the highest reading of humidity and/or of temperature.

14. A method of controlling an air mover device according to any one of the claims 4 to 12, wherein the airflow is alternately directed approximately toward each sensor (2), the period of flow during which the airflow points approximately to the direction of one of the sensors (2) being dependent on the humidity and/or temperature measured by said sensor (2) or by all sensors (2).

Amended claims in accordance with Rule 137(2) EPC.

1. An air mover device for drying at least one surface (4) comprising at least one air mover (6) by which an airflow controllable by an adjusting unit (26, 28) is generateable, **characterized in that** the airflow is controllable automatically by the adjusting unit (26, 28) to any direction inspace.

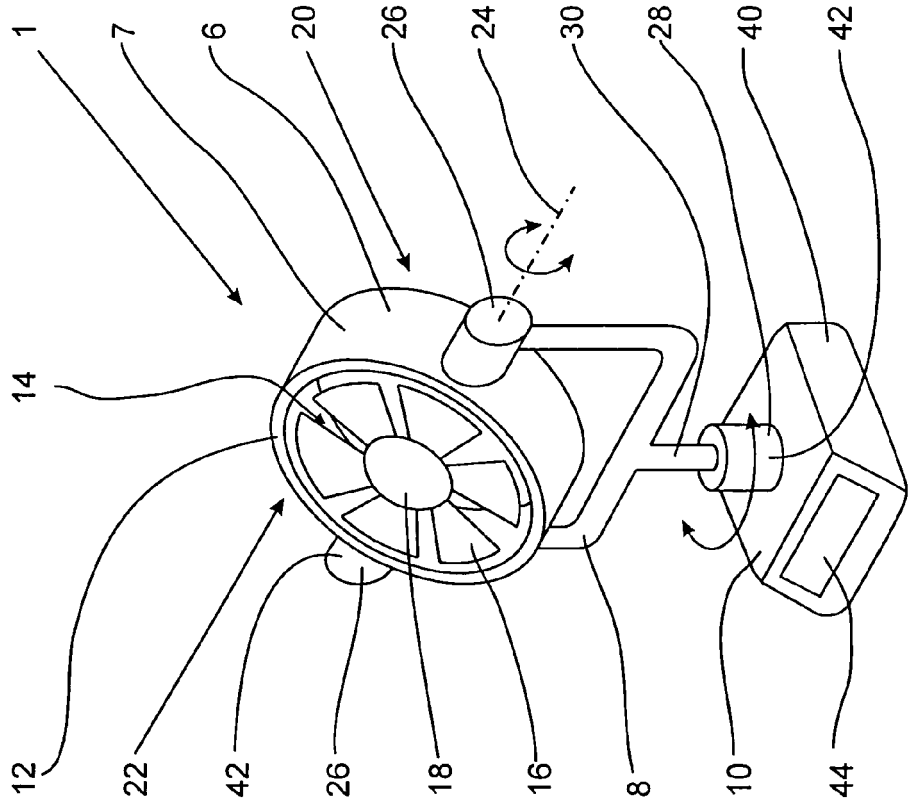
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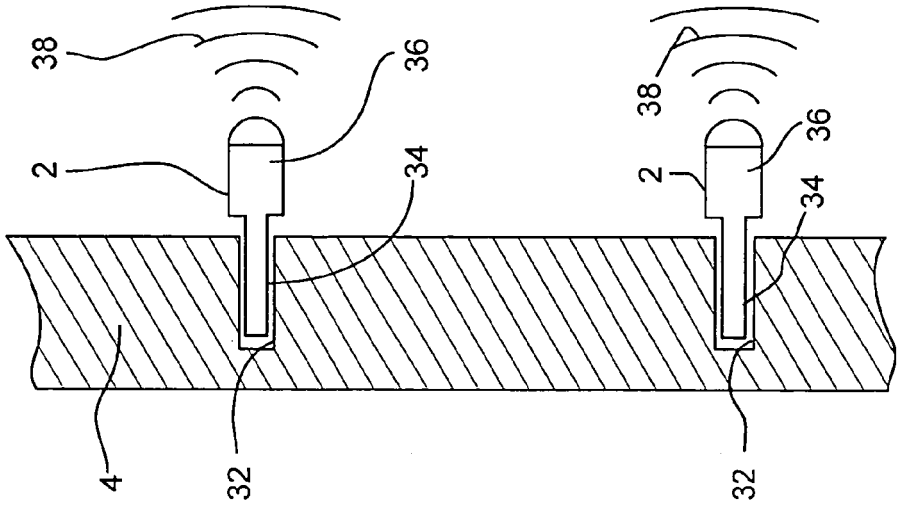
fig. 1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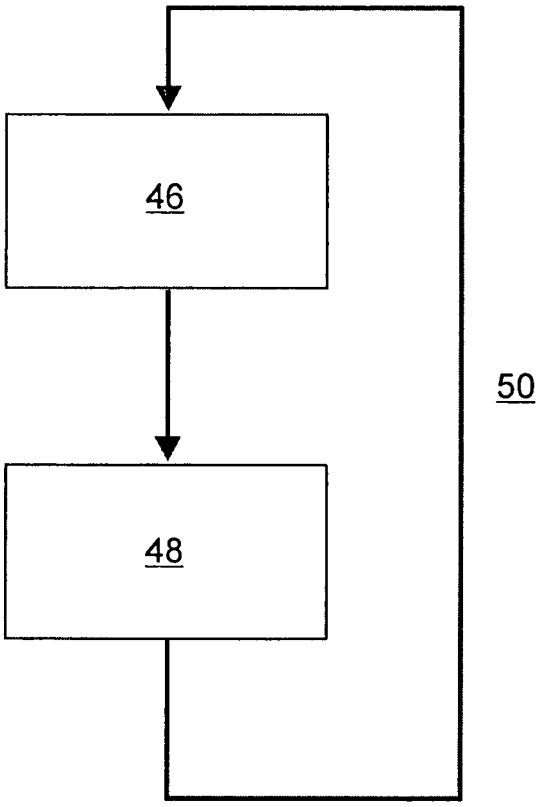

fig. 2

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	6 January 2010	Silvis, Henk

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EUROPEAN SEARCH REPORT

Application Number
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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