(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 262 989 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
03.01.2018 Bulletin 2018/01

(51) Int Cl.:
A47G 9/10 *(2006.01)*

(21) Application number: **16176528.4**

(22) Date of filing: **27.06.2016**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
MA MD

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(54) AIRFLOW CONTROL FOR HEAD SUPPORT

(57) The invention relates to a Head support (2), particularly a pillow, comprising:
- an comfort element (29) comprising a resting surface (R) for a head of a sleeping individual to rest on;
- air supply means (28) with one or more air holes (281) configured to discharge air towards the resting surface (R) or to draw in air from the resting surface (R);
- one or more fluid connections (4) to provide an airflow to or from the air supply means (28).

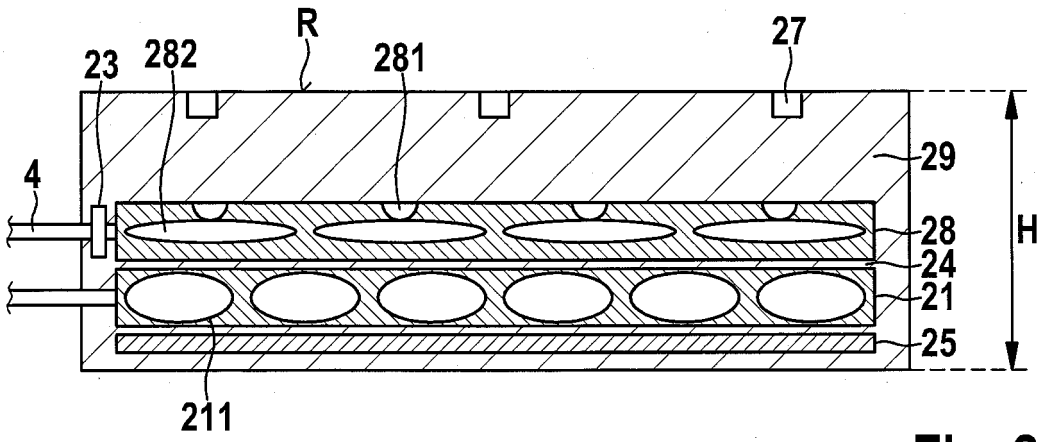


Fig. 2

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Description

Technical field

[0001] The present invention relates to head supports, in particular pillows. Furthermore, the present invention relates to measures for controlling an airflow around a head of an individual resting on a head support.

Related art

[0002] There are many issues causing insomnia in sleeping individuals. Apart from various disorders, also a too warm or too cold head temperature of an individual's head might be cause for discomfort and sleeplessness during the night. Research studies have shown that particularly cooling the head of the sleeping individual contributes to overcome primary insomnia.

[0003] Conventional head supports, such as pillows, include soft material, such as downs or foam, to provide a comfortable resting surface. However, the soft material usually contains encapsulated air e.g. in air bubbles so that head supports have a relatively poor heat conduction. Particularly, from the portion of the resting surface of the pillow the head is resting on, heat cannot be duly dissipated due to the poor heat conductivity characteristics of the air kept in the pillow material. So, especially if the ambient temperature is over 25°C, this will lead to heat accumulation and a resulting head temperature which contributes to sleeplessness of the individual resting on the pillow.

[0004] From document CA 2,203,764, a cooling pillow is disclosed which has a container insert which provides a continuous cool pillow surface and absorbs a pillow user's lost metabolic heat. The container insert is composed of a soft vinyl bag which snugly surrounds a fluid-saturated porous foam core. A resealable valve allows fluid to be added to or removed from the container insert at will so that the temperature can be adjusted.

[0005] Document US 2014/0026320 A1 discloses a climate controlled seat, bed or other assembly configured to receive a person includes a blower and two or more thermoelectric devices or other conditioning fluid modules. A control system for the seat or bed is configured to continuously discharge air from the blower through the thermoelectric devices. The thermoelectric devices may be sequenced between an activated and a deactivated position so that a desired cooling and/or cooling effect can be maintained.

[0006] It is an object of the present invention to improve the dissipation of accumulated heat from a head support caused by metabolic heat generation in a head of an individual resting thereon so that the temperature of the head can be adjusted. Furthermore, it may be an object to improve the condition of air surrounding a head lying on a resting surface.

Summary of the invention

[0007] This object has been achieved by the head support according to claim 1 and the head support system according to the further independent claim.

[0008] Further embodiments are indicated in the depending subclaims.

[0009] According to a first aspect a head support, particularly a pillow, is provided comprising:

- a comfort element comprising a resting surface for a head of a sleeping individual to rest on;
- air supply means with one or more air holes configured to discharge air towards the resting surface or to suck in air from the resting surface;
- one or more fluid connections to provide an airflow to or from the air supply means.

[0010] One idea of the present invention is to control the temperature of a head lying on the head support and/or a condition of an atmosphere around the head by providing an airflow through air holes of an air supply means arranged in the head support. The airflow is directed to the resting surface of the head support so that heat dissipated by the head and accumulated in the head support can be conveyed to the environment. Furthermore, also a heated airflow can be transferred to the air holes so that a head of an individual resting on the resting surface can be warmed to help the individual falling asleep. Substantially, the airflow can be provided in an opposite direction so that air is drawn in from the resting surface via the air holes.

[0011] At least a portion of the comfort element which is placed between the air holes and the resting surface may be made of a gas permeable material, particularly including at least one of a gas permeable flexible foam, fabric, downs, fibers, and feathers. So air can flow through the gas permeable material to the outer environment thereby dissipating body heat introduced into the comfort element by the head of the individual resting thereon. The combination of the air holes and the air permeable comfort element serves to evenly spread and direct the airflow through the comfort element towards the resting surface so that e.g. heat can be dissipated from the comfort element or airflow with conditioned air can be provided around the head of the sleeping individual. So, if the temperature of the head support is too low, heated air can be served by the air outlet so that the resting layer is evenly heated and the resting area on which the head is lying on the head support can be warmed up.

[0012] Also the comfort element may include channels for guiding the airflow between the one or more air holes and the resting surface.

[0013] In one embodiment, it may be provided that the air supply means includes a layer having one or more air distribution chambers each having the one or more air holes. The air distribution chambers can be selectively supplied by the airflow so that airflow passed through the

air holes is only directed to or from a portion of the resting surface associated to the location of the respective air distribution chamber.

[0014] In a further embodiment, the air supply means may include a layer of one or more air tubes formed as or with loops embedded in or below the comfort element, wherein the one or more air tubes each have one or more of the air holes.

[0015] According to a further embodiment the air supply means may have one or more composite foam elements, wherein in each of the composite foam elements one or more air holes of the air supply means are provided so that air is distributed through the respective composite foam elements to or from the resting surface.

[0016] A plurality of neighbored composite foam elements is provided so that airflow between the composite foam elements is blocked. Particularly, the composite foam elements are glued to form an arrangement of composite foam elements.

[0017] According to an embodiment the air holes may be directed to the resting surface.

[0018] Furthermore, groups of one or more air holes may be arranged in association with portions of the resting surface wherein the groups of air holes are in connection with a respective one of the fluid connections.

[0019] Moreover, the airflow control means may be provided to selectively direct airflow to or from the groups of one or more air holes.

[0020] It may be provided that the air supply means include an air mat with one or more air distribution chambers each connected with one of the groups of air holes.

[0021] Moreover, one or more temperature sensors may be provided between the air supply means and the resting surface or at the resting surface to provide a temperature indication of the head resting on the resting surface.

[0022] The temperature sensors may be arranged in an array or any other even distribution which is configured so that, when a head lies on the resting surface, at least one of the temperature sensors detects a temperature change caused by dissipated body heat.

[0023] According to a further aspect a head support system is provided comprising the above head support and a control unit, wherein the control unit comprises:

- an air pump for providing an airflow to or from the head support so as to supply air to the air supply means or to draw in air via the air holes in the air supply means from the head support;
- a control means which is configured to variably control the air pump to selectively supply the airflow.

[0024] Furthermore, the control means may be configured to control the airflow, particularly in a variable manner, depending on a temperature indication detected between the air supply means and the resting surface.

[0025] Moreover, the control means may be configured to control the airflow so as to selectively direct the airflow to one or more of the groups of the air holes which are associated to the portion of the resting surface on which a head of an individual has been detected.

[0026] An air conditioning unit may be provided in the fluid connection to the head support wherein the air conditioning unit is configured and configured to at least one of:

- heat up or cool down the air of the airflow provided by the air pump, particularly under control of the control means;
- control humidity of the airflow, particularly to enrich air with humidity;
- to add oxygen to the airflow to increase the oxygen level of the airflow;
- to add aromatic scents or aerosols; and
- to ionize the airflow.

wherein the control means the control means is configured to control the condition of the airflow, particularly depending on one or more of a daytime, an ambient temperature, a body condition of the individual resting on the head support.

[0027] Furthermore, Head support system according to any of the claims 11 to 14, wherein the control means (33) is configured to control the temperature of the airflow provided to the head support (2) based on a user input and particularly based on an ambient temperature.

Brief description of the drawings

[0028] Embodiments are described in more detail in conjunction with the accompanying drawings in which:

Figure 1 shows a schematic diagram of a head support system including air conditioning of an airflow;

Figure 2 shows a cross-sectional view through a head support across a width direction;

Figure 3 shows a cross-sectional view through the head support across a height direction for illustrating the arrangement of the air outlets;

Figure 4 shows a cross-sectional view through a further embodiment of a head support across a height direction for illustrating the air supply means as a looped air tube; and

Figure 5 shows a cross-sectional view through a further embodiment of a head support across a height direction for illustrating the air supply means as an arrangement of composite foam elements.

Description of embodiments

[0029] Figure 1 shows a temperature-controlled head support system 1 with a head support 2 and a control

unit 3. In the present embodiment, the control unit 3 is separated from the head support 2, but can also be integrated in the head support 2 as a whole or parts of it. Between the head support 2 and the control unit 3 is a fluid connection 4 comprising one or more flexible pipes or tubes to convey air to and from the head support 2.

[0030] The control unit 3 has an air pump 31. The air pump 31 may be configured to suck in air from the environment of the control unit 3 to provide an airflow through the head support 2 via the fluid connection 4. Furthermore, the air pump 31 can be variable controlled to adapt the airflow strength. In one embodiment the air pump 31 can generate an airflow from an opening 311 to the head support 2 and in another embodiment or another operation mode the air pump 31 can generate an airflow from the head support 2 to the opening 311 in the control unit 3.

[0031] The control unit 3 may further have an air conditioning system 32 arranged in the fluid connection 4. The air conditioning unit 32 may be configured to condition, i.e. to heat up/cool down the air of the airflow and also may be configured to adapt the humidity level of the airflow and/or to enrich the airflow with substances, such as oxygen, scents, aromatic aerosols or the like and/or to provide ionization of the airflow. The conditioned air is preferably transported as airflow through the fluid connection 4 to the head support 2.

[0032] Furthermore, the control unit 3 has a control means 33, such as a microprocessor, which may be configured to control the air pump 31 and the air conditioning unit 32 so as to control the amount of air (the strength of the airflow) conveyed through the fluid connection 4 and/or its temperature and/or its humidity level by respectively controlling the air conditioning unit 32. Furthermore, it may be provided that the level of adding scents and ionization is controlled by the control means 33.

[0033] Input means 34, such as a user input, such as buttons 341 and/or a touch screen 342 or the like may be provided to input settings for the amount of airflow and/or the air condition to be set. Particularly, the control unit 33 may be configured to variably set the airflow strength (e.g. by controlling electrical power applied to the air pump), the air temperature and the air humidity with respect to the settings provided by a user via the input means 34. So, the user of the head support system 1 may select the airflow strength and the conditioning of the airflow of the head support 2, such as the air temperature of the airflow, according to their own desire.

[0034] Figure 2 shows a cross-sectional view through the head support 2 across its width direction W. The head support 2 may have a substantially square cross-sections regarding to its height direction H and regarding to its width direction W. Furthermore, the head support 2 has a resting surface R for a head of an individual to rest on.

[0035] Apart from the function of providing air conditioning of the head support 2, the head support 2 may be configured to provide an actuation to move the head of an individual resting thereon. This may have the effect to prevent or stop sleeping disorders, such as snoring or sleep apnea.

[0036] The head support 2 may be built in layers substantially arranged in parallel to the resting surface R. One of the layers may comprise an active layer 21. The active layer 21 is configured to selectively adjust the height h of the head support 2 section by section, i.e. sectionwise, so that different portions of the resting surface R can be selectively raised or lowered. The active layer 21 may comprise the number of actuator elements 211 which can be separately operated to adjust the section height of the head support 2. The actuator elements 211 can have various arrangements and may be adjacent or neighbored to each other. The actuator elements 211 may be operated by the control means 33 according to a predetermined control scheme provided to prevent or stop sleeping disorders.

[0037] The actuator elements 211 may be provided as air chambers which can be filled, inflated or deflated with air provided by the air pump 31 or alternatively a separate air pump in the control unit 3 via respective ones of the fluid connections 4. In particular, the air chambers 211 may be connected with the air pump 31 by individual tubes/pipes of the fluid connection 4 or, alternatively, by a single pipe/tube fluid connection 4 wherein for each air chamber 211 a valve of an airflow control means 23 is associated to selectively inflate the air chamber 211 or release air from the air chamber 211. It is beneficial to use the single air pump 31 for both providing the airflow of conditioned air to the head support 2 for air condition control (respectively for providing an airflow from the head support 2 to the air pump 31) and for providing supply air for inflating and an air suction for deflating the air chambers 211 of the active layer 21.

[0038] Above or under the active layer 21, a sensing layer 24 may be provided to detect a position of a head lying on the resting surface R. The detection may e.g. be performed by detecting pressure implied on a portion of the resting surface R of the head support 2. Alternatively, the head position may be detected contactlessly. For instance, the position of the head resting on the resting surface R may be detected by a capacitive measurement or any other bioradar means for detecting distances between an electrical element, such as an electrode, an electrode arrangement or an antenna, to the head and performing an evaluation to obtain the head position. If an individual rests his/her head on the head support 2, the sensing layer 24 is configured to detect the area of the resting surface the head is resting on as the head position so that the actuator elements 211 of the active layer 21 can be selectively operated by the control means 33 to apply a sectional height change of the head support on the head to move it. The control means 33 may be configured to initiate the actuation when a snoring or a sleeping apnea of the individual resting on the head support is detected.

[0039] To direct the actuation of the actuator elements 211 towards the resting surface R, a stiffening layer 25 may be provided under the active layer 21 so that the

height deformation of the actuator elements 211 is directed towards the associated portion of the resting surface R. The active layer 21 and/or the stiffening layer 25 may be impermeable for air so as to support guidance of the airflow to and from the resting surface R.

[0040] As also shown in the cross sectional view of Figure 3, substantially above the active layer 21, an air supply layer 28 as one alternative for an air supply means is provided. The air supply layer 28 has a number of air holes 281. The air supply layer 28 may be provided as a mat connected to the fluid connection 4.

[0041] The air supply layer 28 may have a single air distribution chamber. The air distribution chamber 282 is configured to receive air supplied by the air pump 31 and to evenly direct the airflow through the air holes 281 which serve as air outlets. In case the airflow is directed from the head support 2 to the air pump 31 the air distribution chamber 282 serve to collect the drawn in air through the air holes 281 (as air inlets) and guide it via the respective fluid connection 4 to the control unit 3.

[0042] Alternatively, the air supply layer 28 can be divided into air supply sections, particularly according to the sections defined by the actuator elements 211 so that the air supply sections are arranged above and in association of each actuation element 211, respectively. So, the mat may have one or more air distribution chambers 282 forming the air supply sections.

[0043] The air distribution chambers 282 are configured to receive air supplied by the air pump 31 and to evenly direct the airflow through the air holes 281 which serve as air outlets. The air holes 281 may be evenly distributed on the air distribution chambers 282. In case the airflow is directed from the head support 2 to the air pump 31 the air distribution chambers 282 may serve to collect the drawn in air through the air holes 281 and guide it to the respective pipe/tube of the fluid connection 4. The air distribution chambers 282 may be connected to the control unit 3 by separate pipes/tubes of the fluid connection 4 to separately control airflow with respect to the air distribution chambers 282 or by a single pipe/tube fluid connection 4 wherein airflow may be directed and/or split to the respective air distribution chambers 282 by the airflow control means 23, which may include electrically controlled valves to selectively control and direct the airflow between the control unit 3 and the respective air distribution chamber 282. As described above the airflow control means 23 may also control the pipes/tubes of the fluid connection 4 the airflow to the air chambers 211 (actuation elements) selectively.

[0044] Between the resting surface R and the air supply layer 28, a soft comfort layer 29 is arranged as a possible comfort element. The comfort layer 29 may be made by a single layer or a plurality of layers all made of a gas permeable material so that air provided through the air holes 281 spreads in the comfort layer 29 and flows towards the resting surface R into the outer environment. In case of an opposite airflow air is drawn in through the resting surface R via the gas permeable comfort layer 29 through the air holes 281. Additionally or alternatively, cut-out air channels may be provided in the comfort layer between the resting surface R and the air holes 281.

[0045] When air is supplied through the air holes 281, a head resting on the resting surface R is surrounded by a slight airflow which provides a cooling or respectively a heating of the skin of the sleeping individual so that a calm and undisturbed sleep is supported. Furthermore, heat accumulated in the comfort layer 29 is dissipated from the comfort layer 29 via the resting surface R.

[0046] As shown in Figure 4, in an alternative embodiment, the air supply layer 28 may be formed with one or more air tubes 285 which are arranged in loops 286 or in a zigzag arrangement and which has holes 287 to form the air holes.

[0047] As shown in Figure 5, in an alternative embodiment, the air supply layer 28 may be formed with one or more composite foam elements 284 each connected with an air tube 288 selectively provided with an airflow by the air control means 23. The composite foam elements 284 are air permeable and serve to spread the airflow to the resting surface R of the head support 2. The composite foam elements 284 are adjacent to each other so that airflow between the composite foam elements 284 is prevented. Therefore, the composite foam elements 284 can be selectively provide an airflow through a selected portion of the resting surface R.

[0048] To control the airflow to each of the air supply sections, each of the air supply sections may be connected with a separate one of the fluid connections 4 to the control unit 3. In the control unit 3, there may be arranged a fluid control unit 37 which may have the same the function of the airflow control means 23 and is configured to direct and/or to split the airflow to the respective air distribution chambers 282.

[0049] The fluid control unit 37 has fluid connection with the inlet of the air pump 31, the outlet of the air pump and the fluid connections to the actuator elements 211.

[0050] The airflow control means 23 or the fluid control unit 37 can be controlled by the control means 33 so as to provide the airflow only to or from one or more of the air supply sections above which the head of the sleeping individual rests or is adjacent to it.

[0051] To condition the air in the air conditioning unit 32, a heating means 321 and a cooling means 322 may be provided which are arranged in the air stream supplied by the air pump 31 so that the air can be warmed up or cooled down before it is supplied to the head support 2. The heating means 321 may be provided as an electric heater unit with a heating surface along which the airflow provided by the air pump 31 flows. The cooling means 322 may include a cooling element such as a Peltier element with a cooling surface which is arranged in the airflow so that the airflow runs along the cooling surface. The heating means 321 and the cooling means 322 may be controlled by the control means 33.

[0052] Furthermore, the air conditioning unit 32 may

include a water reservoir 323 and a vaporization unit 324 which is configured to evaporate water to increase the humidity of the airflow provided to the head support 2.

[0053] Furthermore, the air conditioning unit 32 may include an ionization means 325 to ionize the air while flowing through the air conditioning unit 32. Alternatively or additionally the air conditioning unit 32 may include a scent means 326 to provide the airflow with aromatic scents or aerosols to improve smell of the air which may help the individual to sleep in or to wake up.

[0054] Furthermore, one or more temperature sensors 27 may be provided close to the resting surface R. The temperature sensors 27 are configured to provide a temperature indication to the control means 33 of the control unit 3 by means of electrical signal connections 41. The temperature sensors 27 may be arranged in an array or any other even distribution which has a density so that, when a head lies on the resting surface R at least one of the temperature sensors 27 detects an increased temperature caused by dissipated body heat which is accumulated in the respective portion of the head support 2. So, due to the reduced airflow between the air supply layer 28 and the portion of the resting surface R, on which the head lies on, a close to true head temperature of the head of the sleeping individual can be detected so that airflow to the air supply layer 28 may be controlled by the control means 33 depending on the measured head temperature.

[0055] By providing a plurality of temperature sensors 27 which are distributed over the resting surface R, the head temperature can be easily determined (in the control means 33) by comparing the temperature measurements of the temperature sensors 27. Usually, the maximum measured temperature may be assumed as the head temperature. In the control means 33, the head temperature can be used to determine the conditioning of the air in the air conditioning unit 32 depending of a setting provided by the user such as a desired head temperature. So the air temperature of the airflow can be set and determined whether the airflow shall be cooled down or warmed up. To better control the air conditioning unit 32, a temperature sensor 36 can be provided e.g. at the inlet 311 of the air pump 31 to provide an indication of the ambient temperature so that the control means 33 can determine the amount of heat or the amount of cooling to be applied to the airflow for the air supply layer 28. The temperature sensor 36 can be also arranged at a different location suitable to detect an indication of the ambient temperature.

[0056] Moreover, a further temperature sensor 37 may be provided in the fluid connection 4 between the air conditioning means 32 and the head support 2. So the temperature of the airflow provided by the air conditioning means 32 may be set by the user via the input means 34 so that the controlling means 33 may be configured to perform a temperature control for the airflow supplied to the head support 2.

[0057] One or more of the above described functions of the air conditioning means 32 may be controlled depending on the daytime so that a sleep-in and/or wake-up support can be supported by e.g. increasing or decreasing the airflow temperature for waking up and/or adding scents for sleeping in or waking up.

Claims

1. Head support (2), particularly a pillow, comprising:

   - an comfort element (29) comprising a resting surface (R) for a head of a sleeping individual to rest on;
   - air supply means (28) with one or more air holes (281) configured to discharge air towards the resting surface (R) or to draw in air from the resting surface (R);
   - one or more fluid connections (4) to provide an airflow to or from the air supply means (28).

2. Head support (2) according to claim 1, wherein at least a portion of the comfort element (29) which is placed between the air holes (281) and the resting surface (R) is made of a gas permeable material, particularly including at least one of a gas permeable flexible foam, fabric, downs, fibers, and feathers, and/or includes channels for guiding the airflow from the one or more air holes to the resting surface (R).

3. Head support (2) according to any of the claim 1 to 2, wherein the air supply means includes a layer having one or more air distribution chambers each having one or more of the air holes.

4. Head support (2) according to any of the claims 1 to 3, wherein the air supply means (28) includes a layer of one or more air tubes (285) formed as loops (286) embedded in or below the comfort element (29), wherein the one or more air tubes (285) each have one or more of the air holes (281, 287).

5. Head support (2) according to any of the claims 1 to 4, wherein the air supply means (28) has one or more composite foam elements (284), wherein in each of the composite foam elements (284) one or more air holes of the air supply means are provided so that air is distributed through the respective composite foam elements (284) to or drawn in from the resting surface (R).

6. Head support (2) according to any of the claims 1 to 5, wherein groups of one or more air holes are arranged in association with portions of the resting surface wherein the groups of air holes (281) are in fluid connection with a respective tube of the fluid connection (4).

7. Head support (2) according to claim 6, wherein the air supply means (28) include an air mat with one or more air distribution chambers each connected with one of the groups of air holes.

8. Head support (2) according to claim 6 or 7, wherein airflow control means (23) are provided to selectively direct airflow to or from the groups of one or more of the air holes (281).

9. Head support (2) according to any of the claims 1 to 8, wherein one or more temperature sensors (27) are provided between the air supply means (28) and the resting surface (R) or at the resting surface (R) to provide a temperature indication.

10. Head support (2) according to claim 9, wherein a plurality of the temperature sensors (27) are arranged in an array or any other even distribution which is configured so that, when a head lies on the resting surface (R), at least one of the temperature sensors (27) detects a temperature change caused by dissipated body heat.

11. Head support system comprising a head support according to any of the claims 1 to 10 and a control unit (3), wherein the control unit (3) comprises:

- an air pump (31) for providing an airflow to or from the head support (2) so as to supply air to the air supply means (28) or to draw in air via the air holes (281) in the air supply means (28) from the head support (2);
- a control means (33) which is configured to variably control the air pump (31) to selectively supply the airflow.

12. Head support system (1) according to claim 11, wherein the control means (33) is configured to control the airflow, particularly in a variable manner, depending on a temperature indication detected between the air supply means (28) and the resting surface (R).

13. Head support system (1) according to claim 11 or 12, wherein the control means (33) is configured to control the airflow so as to selectively direct the airflow to one or more of the groups of air holes (281) which are associated to the portion of the resting surface on which a head of an individual has been detected.

14. Head support system (1) according to any of the claims 11 to 13, wherein an air conditioning unit (32) is provided in the fluid connection (4) to the head support (2) wherein the air conditioning unit (32) is arranged in the airflow and configured to at least one of:

- heat up or cool down the air of the airflow provided by the air pump (31), particularly under control of the control means (33);
- control humidity of the airflow, particularly to enrich air with humidity;
- to add oxygen to the airflow to increase the oxygen level of the airflow;
- to add aromatic scents or aerosols; and
- to ionize the airflow;

wherein the control means (33) is configured to control the condition of the airflow, particularly depending on one or more of a daytime, an ambient temperature, a body condition of the individual resting on the head support.

15. Head support system (1) according to any of the claims 11 to 14, wherein the control means (33) is configured to control the temperature of the airflow provided to the head support (2) based on a user input and particularly based on an ambient temperature.

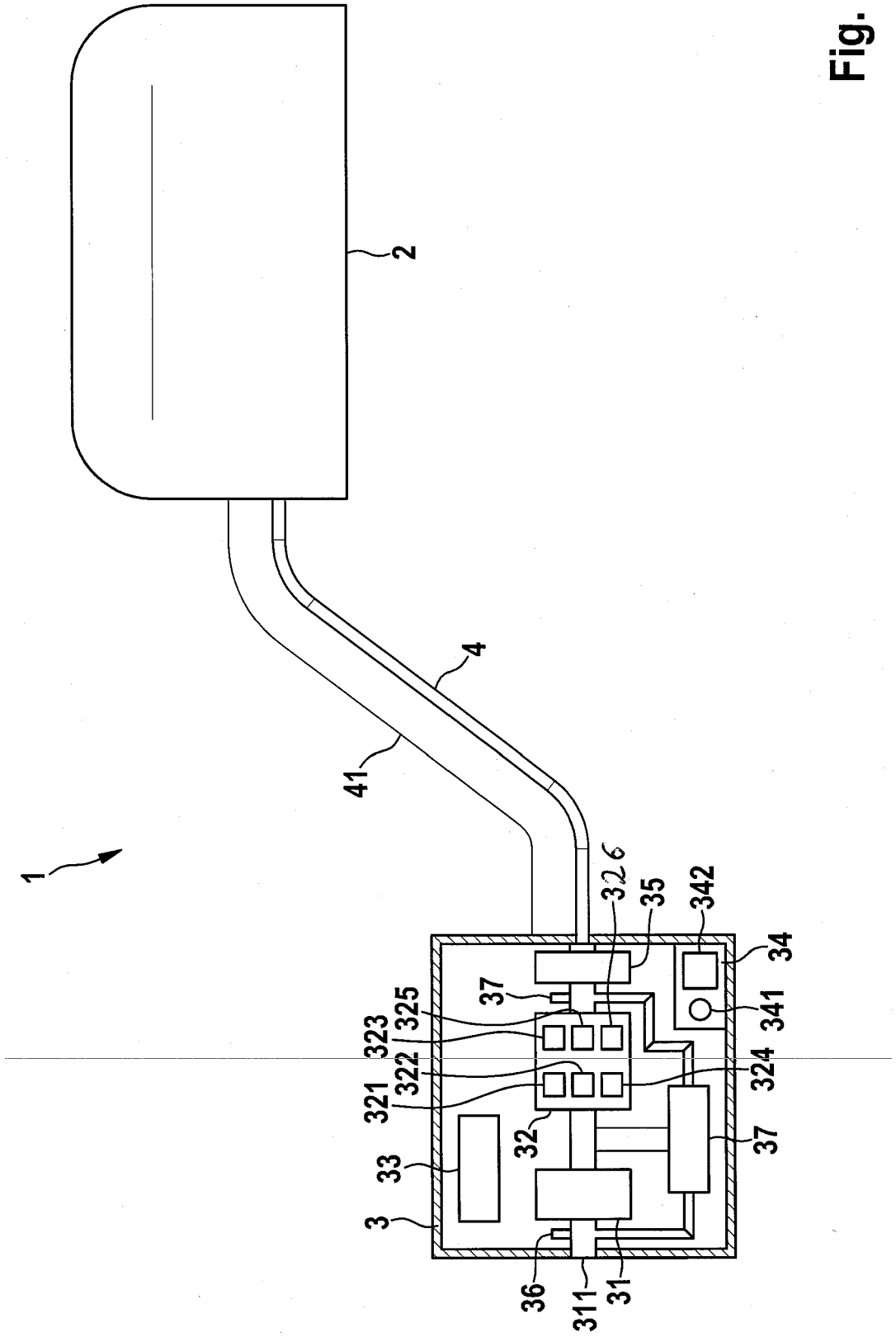


Fig. 1

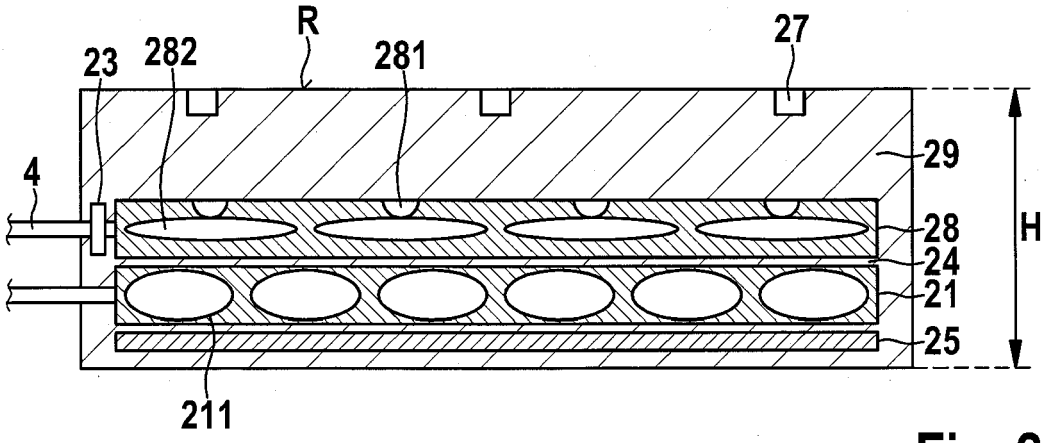


Fig. 2

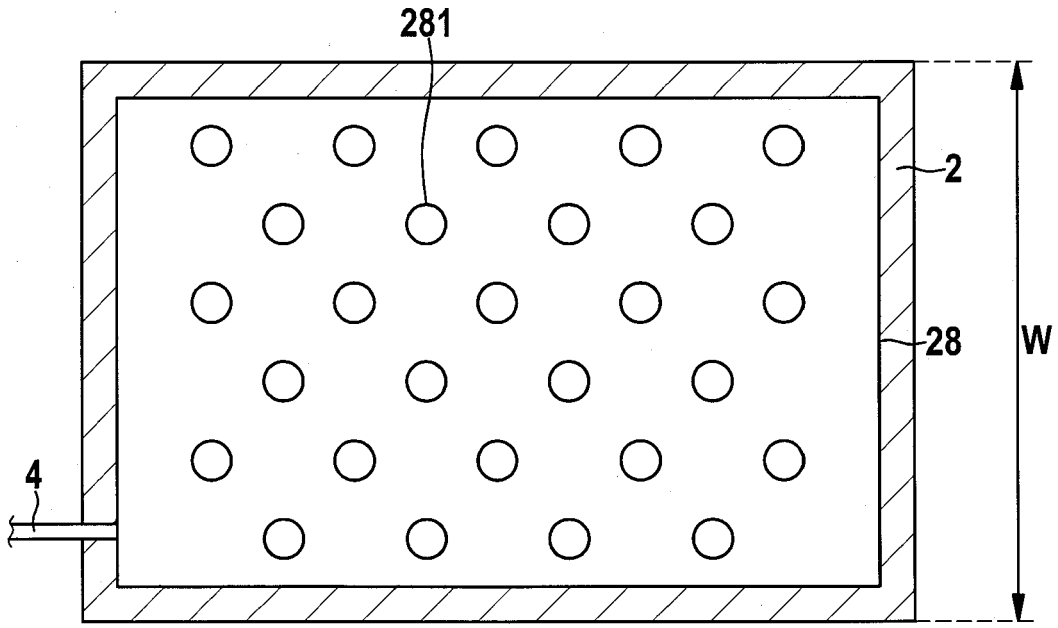


Fig. 3

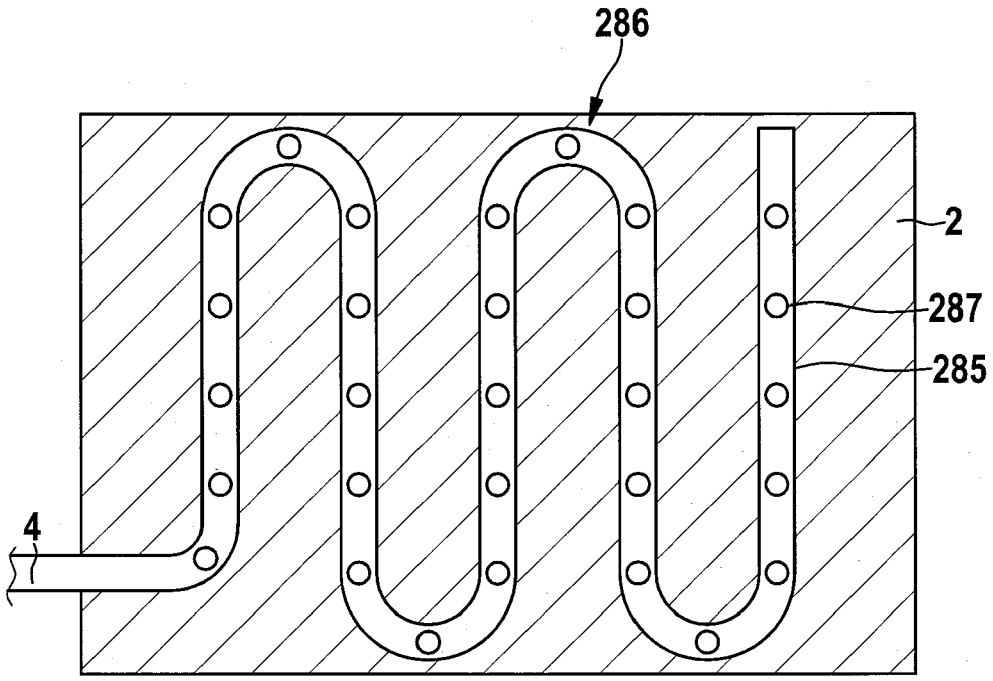


Fig. 4

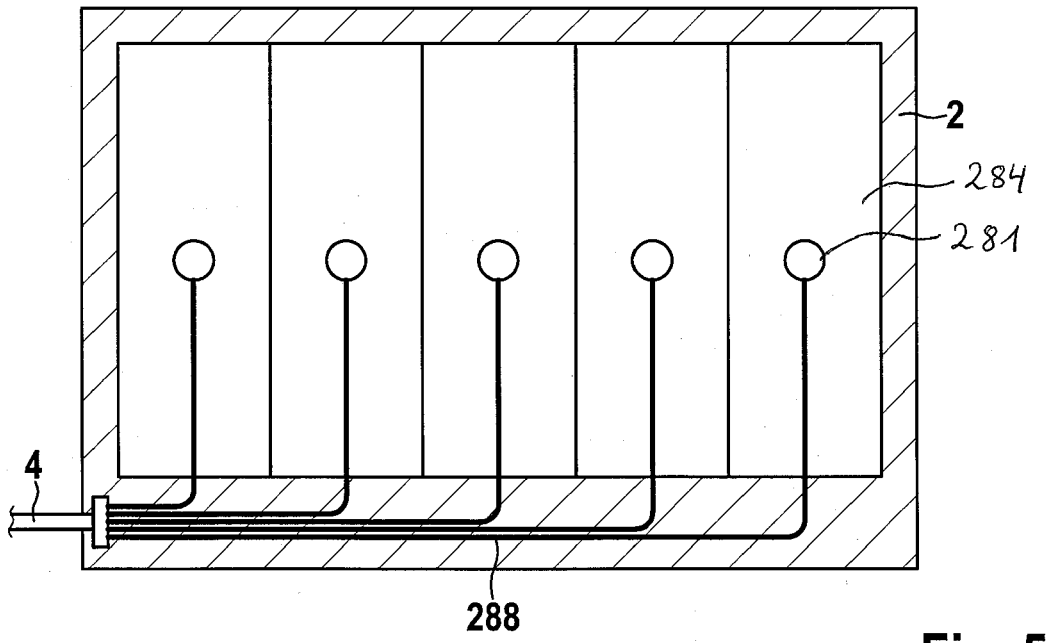


Fig. 5

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 16 17 6528

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search	Date of completion of the search	Examiner
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