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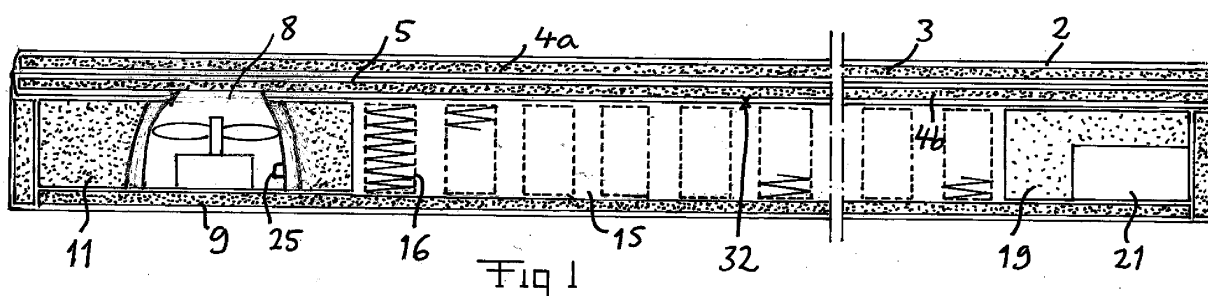
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(54) **A TOP MATTRESS**

(57) A top mattress (1) has at least parts of an upper limitation thereof forming support surfaces for a person lying thereon designed to have a good ability to let air through. At least one opening (8) to the exterior is arranged in the mattress for communicating with an inner side of said air-permeable parts of said upper limitation. A suction device (10) is arranged inside a mattress por-

tion located at a foot end (9) of the mattress. The interior of the mattress is adapted to allow said suction device in operation to draw air outside said support surfaces through said air-permeable parts and through the interior of the mattress out thereof through said opening for drawing air away from said support surfaces through the suction device.



Description

FIELD OF THE INVENTION AND BACKGROUND ART

[0001] The present invention relates to a mattress configured to provide upper support surfaces through an upper limitation thereof for and carry a person lying on the mattress, in which at least parts of said upper limitation forming said support surfaces are designed to have a good ability to let air through.

[0002] When a person is lying on a normal mattress, especially for sleeping, this person is normally covered by a bed quilt for not getting too cold. However, when the quilt has a thermal insulation capacity sufficient to keep said person warm the regions of said upper limitations under the quilt will be too warm due to the body temperature of said person heating said upper limitation of the mattress and the high thermal insulation present with respect to the person through the mattress. This means in its turn that the person easily becomes excessively hot and secretion of sweat arises in the body parts bearing against the support surfaces. The heat regulation of the person's body has then to be influenced by moving the arms and legs and changing the body position during the sleep, which will accordingly be disturbed and the rest by that not efficient. On the other, the humid environment formed next to said upper support surfaces of the mattress means that depositions of cuticle from the person lying on the mattress gets moist and soft and perfectly suited as nutrition for mites, which may live and propagate in this environment. The excrement of such mites are strongly allergenic. Another serious problem is that when persons have to stay on said mattress for a longer time since they are bound to a bed for different reasons, such as a temporarily or a lengthy disease, unpleasant odours then usually occur from the space above the mattress.

[0003] It is already known to seek a remedy to these inconveniences in many different ways, such as by arranging different types of fans, such as table fans, spray the mattress with mite killing preparations and so on. It is also known through US patent 2 493 067 to blow warm air up through the mattress on the person lying thereon, which may then enable a thinner bed quilt, but most of the problems disclosed above with respect to the thermal environment around the person being unfavourable for sleeping conditions will still be there.

SUMMARY OF THE INVENTION

[0004] The object of the present invention is to provide a mattress of the type defined in the introduction being improved in at least some aspect with respect to such mattresses already known.

[0005] This object is according to the invention obtained by providing a mattress having the features of appended claim 1.

[0006] By the new approach to suck air from said upper

support surfaces of the mattresses by means of a said suction device arranged inside a mattress portion located at the foot end of the mattress, it gets possible to obtain a thermal comfort for a person resting on the mattress of a considerably better type than already known. It will be possible to have a thick bed quilt covering a person lying on the mattress and still removing heat radiated by body parts in question of the person at such a rate that secretion of sweat of the person has not to be started. This means that the body of said person may be kept dry without getting cold and there will be no reason for moving arms and legs and changing sleeping position for controlling heat regulation of the body. This means that longer periods of deep sleep may be obtained. Accordingly, the aim to create a homogenous climate under the bed quilt is substantially obtained by this, since the temperature experienced at the contact surface to the mattress is lowered and the temperature experienced up toward the bed quilt by a thicker bed quilt may be raised.

[0007] Furthermore, the fact that the humidity of the air in the space above the support surfaces of the mattress may be kept on an acceptably low, normal level, means that depositions of cuticle resulting in the bed will get dry and hard and by that inedible to mites, which will experience their living conditions being radically impaired. Accordingly, the invention makes the two most important mechanism for heat loss more efficient, namely dry heat transport and evaporated heat transport, which both are retarded by conventional bed clothes and mattresses to such an extent that the heat balance of the body of vital importance is made difficult. By the location of said suction device inside a mattress at a foot end thereof, this may be obtained without disturbing a person lying on the mattress through the operation of said suction device.

[0008] Another advantage of a top mattress according to the present invention is that it will be possible to move said mattress from one location to another without any particular difficulty contrary to different types of ventilated beds already known.

[0009] Another advantage of a mattress according to the present invention is that when used in a hot environment, such as in countries around the equator, a higher room temperature may be accepted owing to the operation of said suction device than otherwise, so that great amounts of energy may be saved by reducing the power of air-conditioning apparatuses or turning them off. Energy may also be saved in colder countries by the possibility to have a very thick bed quilt compensating for a lower room temperature while not making the environment in the region of the upper support surfaces of the mattresses too hot through the operation of said suction device.

[0010] According to an embodiment of the invention the mattress comprises an arrangement configured to control the power supplied to said suction device. Such an arrangement makes it possible to adapt the operation of a suction device to various parameters, such as the room temperature in the free space around the mattress,

the person using the mattress etc.

[0011] According to another embodiment of the invention said suction device is configured to assume a state of low power operation or a state of active operation. The state of low power operation may be assumed when there is no need for lowering the temperature in the region of said upper support surfaces of the mattress but only a wish to keep these regions dry, and for instance when no person is lying on the mattress. Said suction device is according to another embodiment to the invention configured to run continuously. This means that said upper support surfaces and the surrounding thereof may be continuously kept dry while for instance being in said state of low power operation when no person is resting on the mattress for saving energy and be kept dry and at a desired temperature when a person is resting on the mattress.

[0012] According to another embodiment of the invention the mattress comprises a first temperature sensor configured to sense the temperature of air sucked through the mattress by said suction device and a second temperature sensor configured to sense the room temperature in a free space surrounding the mattress, and said arrangement is configured to control said suction device depending upon information from said first and second sensors. This means that the suction device may be controlled to obtain an optimum relationship between said two temperatures sensed.

[0013] According to another embodiment of the invention said arrangement is configured to control said suction device to change from said low power operation state to said active operation state when the temperature sensed by said first temperature sensor exceeds the temperature sensed by said second temperature sensor by a predetermined value, such as 1°C, 2°C or 3°C. This means that the low power operation state saving energy may be maintained as long as the difference of said temperatures is not too high, but the operation state will change to said active state when there is a need for this for preventing the temperature of the regions under a person lying on the mattress to be unpleasant high resulting in excessive sweat transpiration of said person.

[0014] According to another embodiment of the invention the arrangement comprises means allowing an adjustment of a target temperature of the air sensed by said first temperature sensor to be reached by the operation of the suction device once the suction device has assumed said active operation state.

[0015] According to another embodiment of the invention said means allowing an adjustment of said target temperature is configured to allow an adjustment of said target temperature to a value of 25-35°C. This results in a possibility to adjust the cooling effect obtained through said suction according to the individual wishes of the persons using the mattress and other conditions, such as clothing of said person.

[0016] According to another embodiment of the invention said suction device comprises a fan member having

a number or revolutions depending upon the power supplied thereto. In a further development of this embodiment the mattress comprises at least one channel connected to the exhaust side of the fan member, defined by sound absorbing material, for example polyurethane, so as to suppress noises generated by the operation of said fan member. This means that the suction device may be operated at a rather high level without disturbing a person lying on the mattress and trying to sleep.

[0017] According to another embodiment of the invention said at least one channel extends from said fan member located centrally at the foot end of the mattress inside the mattress transversally with respect to the longitudinal direction of the mattress for letting air out through lateral surfaces and/or bottom surfaces and/or the end surface at the foot end of the mattress. Thus, the air sucked through the mattress will leave the mattress through large surfaces resulting in a low air speed preventing generation of noises and drafts disturbing a said person.

[0018] According to another embodiment of the invention the mattress is turnable by 180° about the longitudinal axis thereof so as to make a bottom surface thereof located opposite to said upper support surface to act as an alternative upper support surface, at least parts of an alternative upper limitation of the mattress so formed are designed to have a good ability to let air through and have a similar construction as the upper limitation of the ordinary upper support surface of the mattress, and said opening connected to the exhaust side of the suction device is connected to the inner side of the mattress so as to blow air out through said alternative upper support surfaces in a turned state of the mattress. This makes it possible to use the mattress to blow air onto a person lying on the mattress would that be desired and experienced pleasant by a said person. Which of the two large surfaces of the mattress to be used as support surface may then be selected depending upon the temperature in the room where the mattress is located and the physiological and psychological characteristics of said person. To use the mattress for blowing air onto a person resting thereon is desired when it is extremely hot in the room where the mattress is used. When using the mattress to blow air onto a person it will not be possible to control the air flow (fan power) other than manually, and that would then also be enough.

[0019] According to another embodiment of the invention said airpermeable parts are surrounded by an airtight material for concentrating the flows of air from the region of said support surfaces through said parts, and at least parts of the interior of the mattress are air-tightly delimited with respect to the exterior for only allowing communication with the exterior through said opening and said parts. This results in an efficient operation of the suction device. The suction capacity of the suction device gets by this efficient exactly where this is needed, so that the suction power required for a given amount of air transported away per time unit from the region of the contact surfaces between a person resting on the mat-

tress and the mattress gets low and by that energy for driving the suction device may be saved, but this may primarily be dimensioned to work comparatively quiet, which of course is desired when the person resting on the mattress wants to sleep.

[0020] According to another embodiment of the invention said airpermeable parts constitute a restricted region of the upper limitation of the mattress, and this region substantially corresponds to the support surfaces adapted to receive and support any body part of a person resting on the mattress. Said region may then according to another embodiment of the invention be restricted to the support surfaces adapted to receive and support the trunk and the head of a person lying on the mattress. Too high temperatures of these body parts are particularly disturbing the sleep of a person, so that it may be suitable to restrict the suction of air to the contact surface these have to said upper support surfaces of the mattress.

[0021] According to another embodiment of the invention said airpermeability may be obtained by arranging through-holes through a substantially air-tight material layer. All the embodiments relating to the air-permeable parts of the upper limitation forming the upper support surfaces may be realised for said alternative upper limitation of said turnable mattress for controlling how air sucked into the mattress from below is blown out towards body portions of the person lying on the mattress. According to another embodiment of the invention the mattress comprises a cavity arranged at a head end of the mattress and opening laterally, and this cavity is configured to receive an arrangement for regulating the power of said suction device, power means and cabling at least during transport of the mattress. This makes it possible to transport the mattress according to the invention in the same way as a conventional mattress having no possibility to regulate the environment close to the upper support surfaces of the mattress.

[0022] Further advantages as well as advantageous features of the invention will appear from the description following below.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] With reference to the appended drawings, below follows a specific description of a mattress according to an embodiment of the invention cited as an example.

[0024] In the drawings:

Fig 1 is a simplified sectional view through a mattress according to an embodiment of the invention,

Fig 2 is a perspective view of parts of the mattress shown in Fig 1 with some parts removed for illustrating some inner parts of the mattress,

Fig 3 is a perspective view showing a mattress according to Fig 1 in use on a bed, and

Fig 4 is a view illustrating how the mattress according to Fig 1 may be carried along for being moved from one location of use to another.

DETAILED DESCRIPTION OF AN EMBODIMENT OF THE INVENTION

[0025] A mattress 1 according to an embodiment of the invention will now be described while making reference simultaneously to Figs 1-3. The mattress includes an elastic bag-like covering 2 of textile being air-permeable, soft and wear resistant and surrounding the rest of the mattress for keeping the different parts thereof protected. The covering 2 may be opened to get access to the interior thereof through a zipper 30. A layer 3 of open foam is arranged under the top part of said covering 2. This layer is made of a soft and elastic material having an open structure with a good air-permeability both horizontally and vertically, such as reticulated polyurethane foam. An air-tight and elastic layer 4a is arranged under the layer 3 of open foam. The layer 4a is provided with through-holes 6 in a restricted region substantially corresponding to parts of upper support surfaces 7 of the mattress adapted to receive and support the trunk and the head of a person lying on the mattress. A further layer 5 with a good air-permeability is arranged under the layer 4a and functions as a channel layer. This layer 5 may have the properties as the layer 3 but is preferably slightly harder for not being obstructed by the pressure of a body resting on the mattress and the negative air pressure caused by a suction device disclosed further below. A further air-tight layer 4b is arranged under the layer 5 and this layer has an opening 8 at the foot end 9 of the mattress.

[0026] A suction device in the form of a fan member 10 is arranged in a foam block 11 with a rather high density for good sound silencing properties with the suction side connected to said lower opening 8 of the air-tight layer 4b. The fan member 10 has circumferential exhaust openings 12 connected to two channels 13 arranged in said foam block 11 and having an extension including turns so as to suppress noises generated by the operation of the fan member 10. The channels 13 extend from the fan member 10 located centrally transversely with respect to the longitudinal direction of the mattress and end close to opposite lateral sides of the mattress for letting air out through lateral surfaces, bottom surfaces (air-permeable bottom plate 17) and end surfaces at the foot end of the mattress as shown through the arrows A in Figs 2 and 3. Thus, air will leave through lateral surfaces of the mattress, accordingly through large surfaces resulting in a low velocity of the airflow. A mid portion 15 of the mattress includes pocket springs 16 for supporting the upper parts of the mattress and making it comfortable for a person lying on the mattress.

[0027] The mattress further comprises a foam block 19 of medium hardness at the head end 20 and having a cavity 21 opening laterally for receiving an arrangement

22 for regulating the power of the fan member 10, power means 23 and cabling 24 at least during transport of the mattress. The power means 23 includes preferably a transformer and rectifier for delivering a direct voltage of for instance 12V to said arrangement 22 controlling the power supplied to the fan member. Thus, the fan member may just as well be connected to a 12V battery would it be desired to use the mattress for instance onboard a boat.

[0028] The fan member is preferably configured to run continuously either in a state of low power operation, for instance 2W, or a state of active operation at a power of for instance up to 15W.

[0029] The mattress further comprises a first temperature sensor 25 configured to sense the temperature of the air sucked through the mattress and is here arranged inside the house of the fan member 10 on a circuit-card with a micro processor controlling the fan member, and a second temperature sensor 26 configured to sense the room temperature in the free space surrounding the mattress. The arrangement 22 may be configured to control the fan member 10 to change from said low power operation state to said active operation state when the temperature sensed by the first temperature sensor 25 exceeds the temperature sensed by the second temperature sensor by a predetermined value, such as 1°C, 2°C or 3°C. Said micro processor receives temperature information from the two sensors 25, 26 and is programmed to control the fan member to change to active operation state when the temperature difference sensed exceeds for instance 3°C and then change back to low power operation state when said difference falls below 3°C again. The arrangement is provided with means 27 allowing adjustment of a target temperature of the air sensed by said first temperature sensor once the suction device has changed from low power operation to active operation state. This target temperature may be well above the temperature at which said state change appears and thus be individually controlled by acting upon said means 27 according to the wishes of the person using the mattress. If for instance the second temperature sensor senses a room temperature of 22°C the state change will take place at a temperature of 24°C sensed by the first temperature sensor, and the fan member 10 may then be controlled towards a target temperature of for instance 30°C of the air reaching said first temperature sensor. Accordingly, the fan member will run at low power operation when no person is lying on the mattress and the temperature sensors will show the same temperature and then keep the upper support surfaces of the mattress dry and cool. When a person lies down on the mattress the temperature sensed by the first temperature sensor will increase and when it reaches a predetermined value the arrangement will switch the fan member to said active operation state. If a person lying on the mattress wish to have a strong cooling effect said target temperature is adjusted to be very low, for instance 25°C, whereas it may be adjusted to be 35°C if the person wishes to have

a weak cooling effect. The arrangement may through said means 27 also be controlled to override any information from said temperature sensors in positions of a minimum and a maximum power supplied to the fan member obtained by hand control of a person using the mattress.

[0030] The mattress of this embodiment may have a weight of 10 kg and a thickness of 9 cm and be rolled together into a roll with a diameter of approximately 45 cm, which may be carried along in a suitable bag 28 as schematically illustrated in Fig 4.

[0031] The function of the mattress according to the invention appears from the above description but will now be briefly summarised. When a person carrying the mattress as shown in Fig 4 arrives to a bed in which he wants to sleep he may roll out the mattress upon a bed frame as shown in Fig 3. The cavity 21 is then opened and the arrangement 22 with regulating means 27 and temperature sensor 26 is placed close to the bed, for instance on a chair, and the power means 23 is connected to a socket. The fan member will then start to run at a low power operation state. When the person lies down on the mattress and possibly covers himself with a bed quilt the temperature in the region of said first temperature sensor 25 will rise and the arrangement 20 will change the operation state of the fan member 10 to active. This means that air will be sucked through the airpermeable layer 3 spreading the air flow and ensuring that the through-holes 6 of the layer 4a are not obstructed and then through these holes and through the channel layer 5 to the opening 8 in the layer 4b of air-tight material and then be blown out through the channels 13 and further to lateral surfaces and the bottom of the mid portion of the bed without causing any noise disturbing the sleep of said person. Said arrangement 22 may also be provided with a timer making it possible to the person to obtain a switching of the power supplied to the fan member to a lower power, for instance two hours before the person is expected to wake up, for slightly increasing the temperature sensed by the person when waking up. The mattress may also have a microphone 31 and an accelerometer 32 connected to the arrangement or adapted to communicate with a smart phone through a suitable app. This makes it possible also for hospitals to lend the mattress to people having sleeping problems so as to collect data during their sleep for analysis.

[0032] The invention is of course not in any way restricted to the embodiment described above, but many possibilities to modifications thereof would be apparent to a person with ordinary skill in the art without departing from the scope of invention as defined in the appended claims.

[0033] The first temperature sensor may be supplemented by a moisture sensor sensing the moisture degree of the air sucked by the fan member and increasing the power of the fan member when the moisture degree of said air sucked through the fan member is abnormally high so as to reduce unpleasant experience of sweat from the body of a person resting on the mattress. Thus,

such a moisture sensor may be used for refining the regulation of the suction device.

[0034] The air-permeable parts of the upper limitation of the mattress may as an alternative to said through-holes in the upper air-tight layer be achieved by having a more or less air-tight layer without such holes in a rest state but which opens up where a body of a person apply most pressure when lying on the mattress.

[0035] The pocket springs in the mid portion may be replaced by a thicker, for instance 35 mm, foam layer having an open structure.

[0036] The suction device of the mattress may have more than one fan member, and such fan members may be arranged in any conceivable way, such as in series or in parallel.

[0037] That the mattress comprises a suction device does in this disclosure also cover that the mattress is provided with more than one fan member. Two fan members may for example be arranged in parallel or in series for increasing the power of the suction device. It would then also be possible to have one fan member for drawing air from an upper support surface of the mattress and one for blowing out air through an upper support surface of the mattress. These may then be controlled so that the one blowing is switched on when the one sucking does not manage to keep the temperature below a predetermined level. One of the fan members will then operate at the time.

Claims

1. A top mattress configured to provide upper support surfaces (7) through an upper limitation thereof for and carry a person lying on the mattress, in which at least parts of said upper limitation forming said support surfaces are designed to have a good ability to let air through, **characterized in that** at least one opening (8) to the exterior is arranged in the mattress for communicating with an inner side of said air-permeable parts of said upper limitation, that the mattress comprises a suction device (10) configured to be arranged inside a mattress portion located at a foot end (9) of the mattress, and that the interior of the mattress is adapted to allow said suction device (10) in operation to draw air outside said support surfaces (7) through said air-permeable parts and through the interior of the mattress out thereof through said opening (8) for drawing air away from said support surfaces through the suction device.
2. A top mattress according to claim 1, **characterized in that** it comprises an arrangement (22) configured to control the power supplied to said suction device (10).
3. A top mattress according to claim 1 or 2, **character-**

ized in that said suction device (10) is configured to assume a state of low power operation or a state of active operation.

4. A top mattress according to any of the preceding claims, **characterized in that** said suction device (10) is configured to run continuously.
5. A top mattress according to at least claim 2, **characterized in that** it comprises a first temperature sensor (25) configured to sense the temperature of air sucked through the mattress (10) by said suction device and a second temperature sensor (26) configured to sense the room temperature in a free space surrounding the mattress, and that said arrangement (22) is configured to control said suction device (10) depending upon information from said first and second sensors.
6. A top mattress according to claims 3-5, **characterized in that** said arrangement (22) is configured to control said suction device (10) to change from said low power operation state to said active operation state when the temperature sensed by said first temperature sensor (25) exceeds the temperature sensed by said second temperature sensor (26) by a predetermined value, such as 1°C, 2°C or 3°C.
7. A top mattress according to claim 5 or 6, **characterized in that** it comprises means (27) allowing an adjustment of a target temperature of the air sensed by said first temperature sensor (25) to be reached by the operation of the suction device (10) once the suction device has assumed said active operation state.
8. A top mattress according to claim 7, **characterized in that** said means (27) allowing an adjustment of said target temperature is configured to allow an adjustment of said target temperature to a value of 25-35°C.
9. A top mattress according to any of the preceding claims, **characterized in that** said suction device (10) comprises a fan member having a number of revolutions depending upon the power supplied thereto.
10. A top mattress according to claim 9, **characterized in that** it comprises at least one channel (13) connected to the exhaust side of the fan member (10), defined by sound absorbing material (11), for example polyurethane, so as to suppress noises generated by the operation of said fan member.
11. A top mattress according to claim 10, **characterized in that** said at least one channel (13) extends from said fan member (10) located centrally at the foot

end (9) of the mattress inside the mattress transversally with respect to the longitudinal direction of the mattress for letting air out through lateral surfaces and/or bottom surfaces and/or the end surface at the foot end of the mattress.

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12. A top mattress according to any of claims 1-10, **characterized in that** the mattress is turnable by 180° about the longitudinal axis thereof so as to make a bottom surface thereof located opposite to said upper support surface to act as an alternative upper support surface, that at least parts of an alternative upper limitation of the mattress so formed are designed to have a good ability to let air through and have a similar construction as the upper limitation of the ordinary upper support surface of the mattress, and that said opening (8) connected to the exhaust side of the suction device (10) is connected to the inner side of the mattress so as to blow air out through said alternative upper support surfaces in a turned state of the mattress.

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13. A top mattress according to any of the preceding claims, **characterized in that** said air-permeable parts (5) are covered by an air-tight material (4a) for concentrating the flows of air from the region of said support surfaces (7) through said parts, and that at least parts of the interior of the mattress are air-tightly delimited with respect to the exterior for only allowing communication with the exterior through said opening (8) and said parts.

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14. A top mattress according to any of the preceding claims, **characterized in that** said air-permeable parts constitute a restricted region of the upper limitation of the mattress, and that this region substantially corresponds to the support surfaces (7) adapted to receive and support any body part of a person resting on the mattress.

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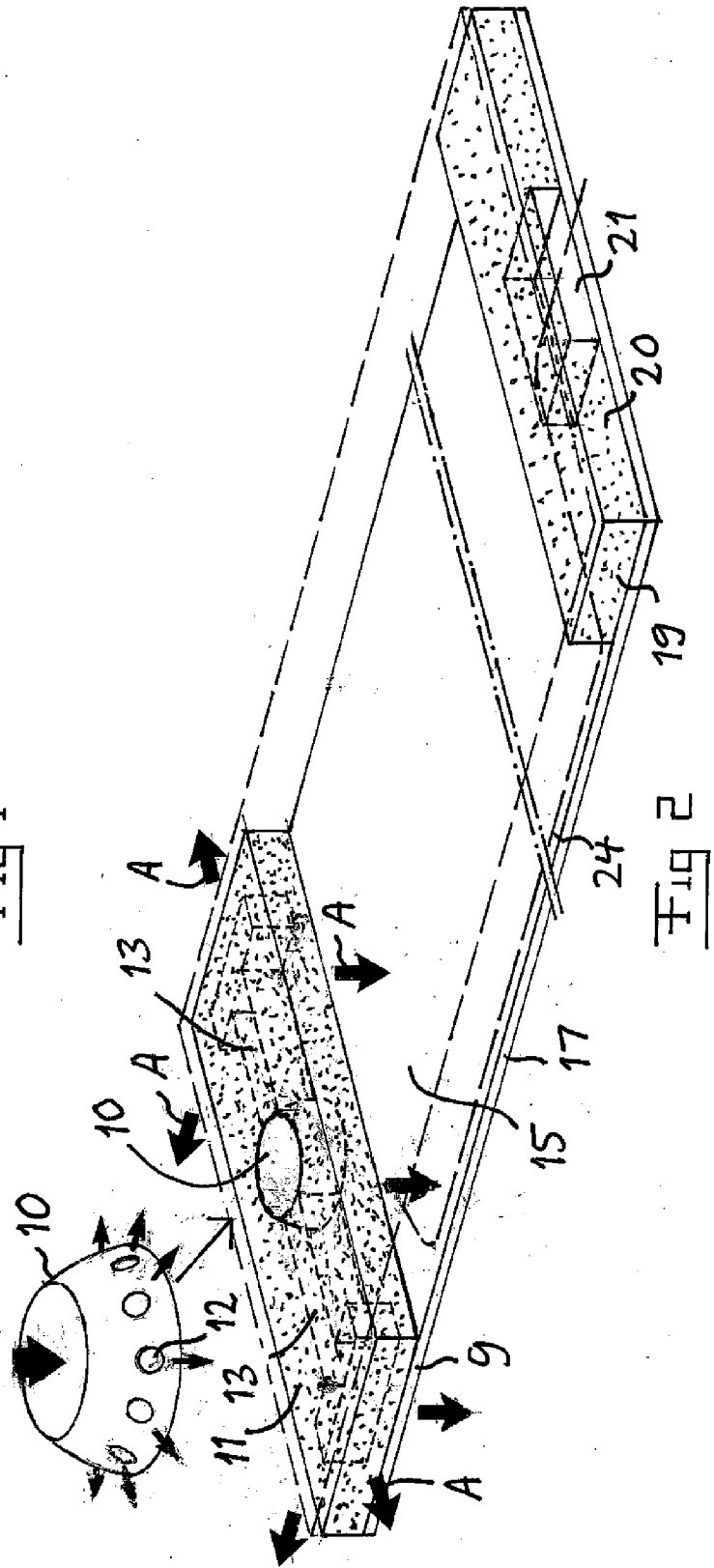
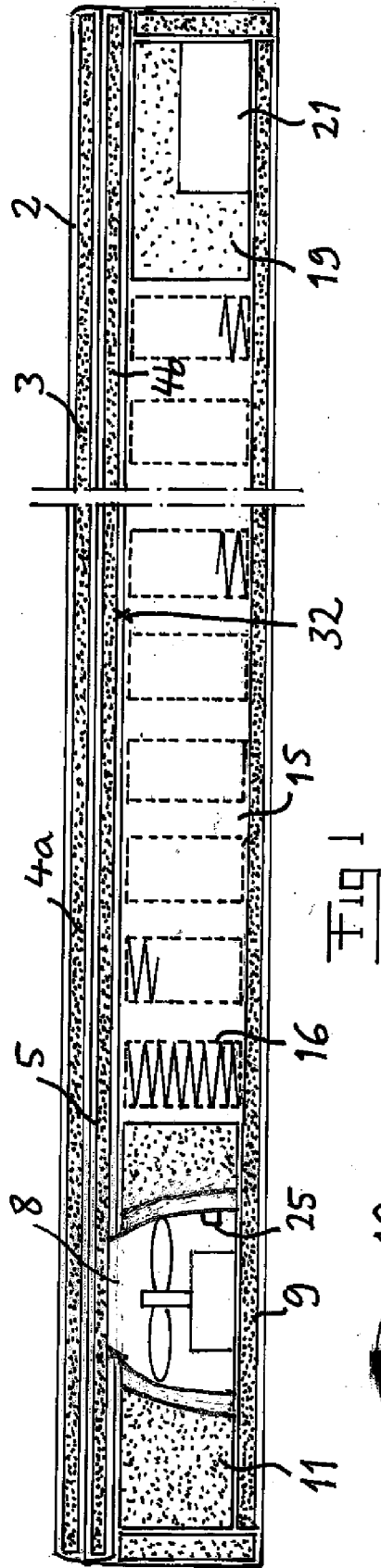
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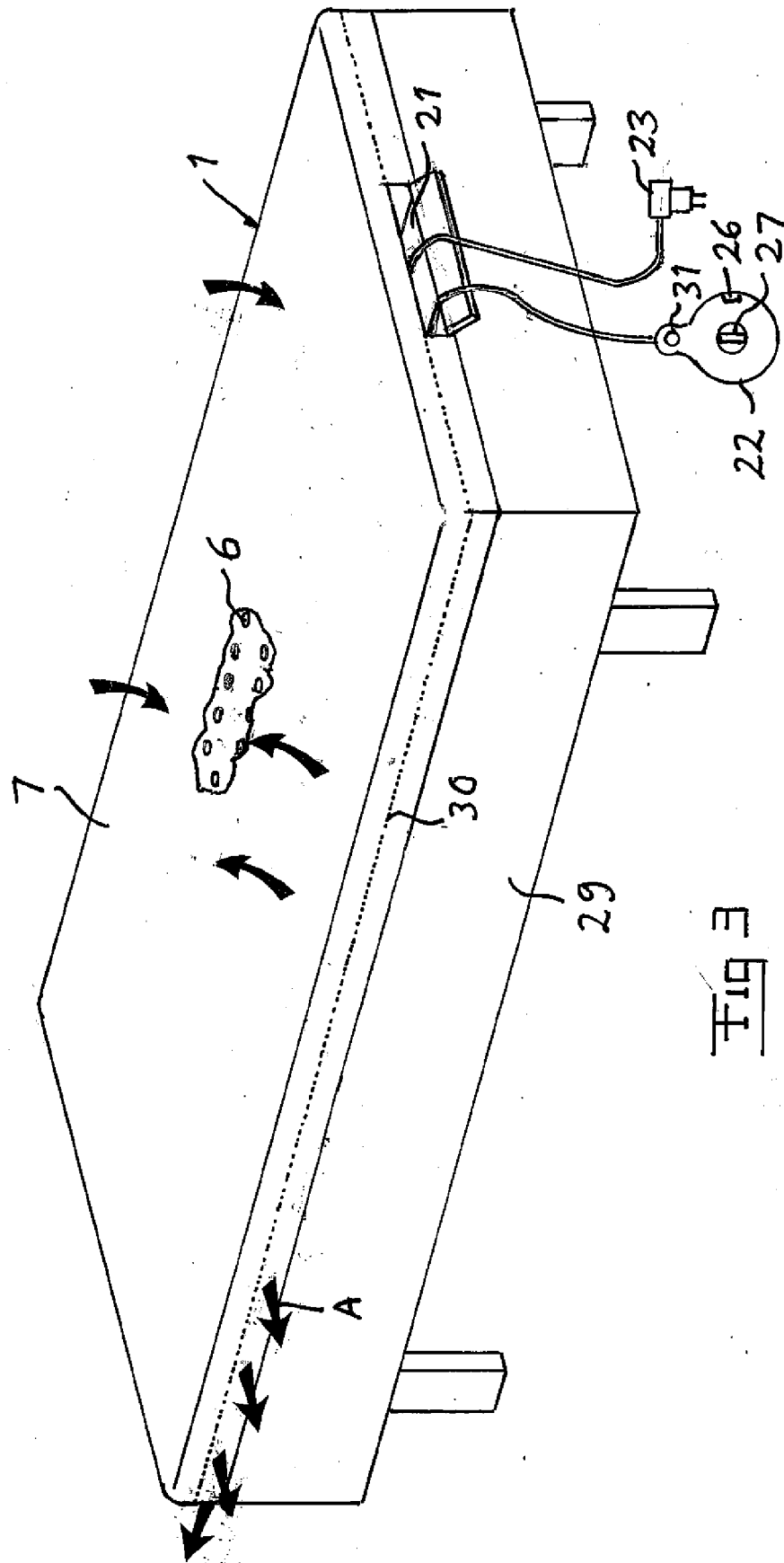
15. A top mattress according to claim 14, **characterized in that** said region is restricted to the support surfaces (7) adapted to receive and support the trunk and the head of a person lying on the mattress.

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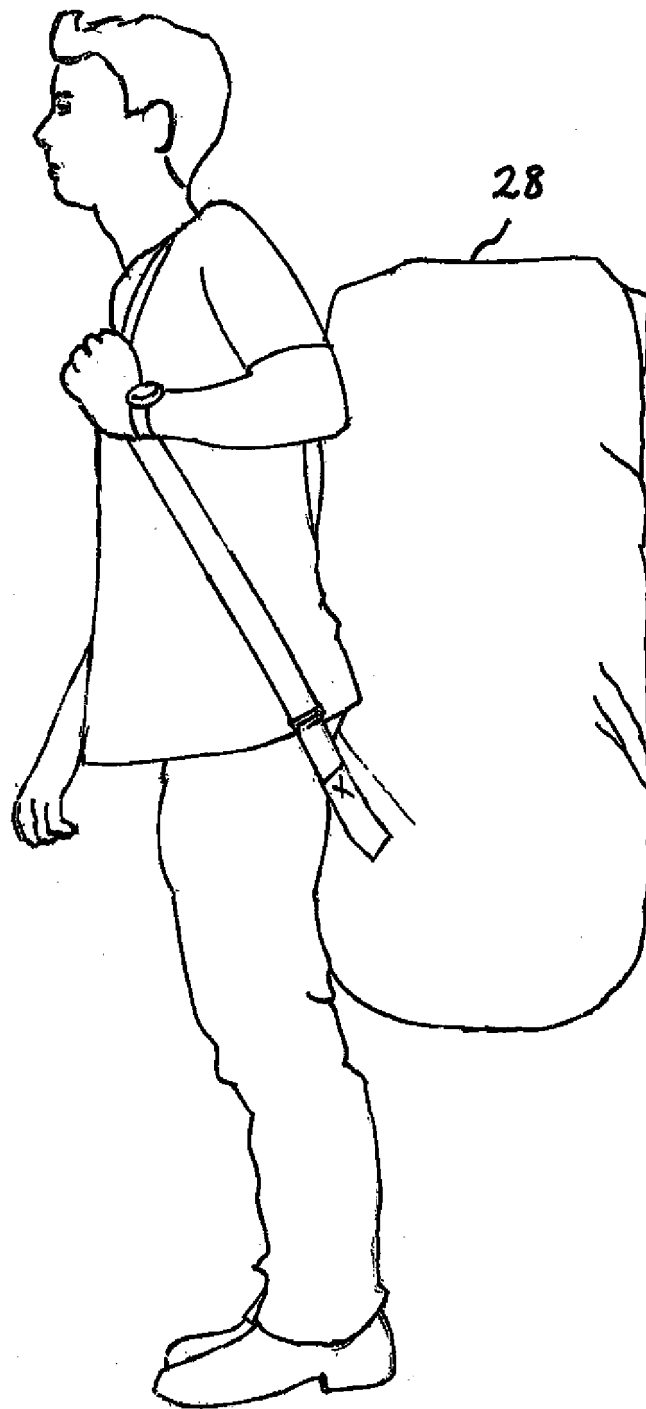


Fig 4



EUROPEAN SEARCH REPORT

Application Number
EP 15 17 2536

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 14 October 2015	Examiner Amghar, Norddin
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 15 17 2536

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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