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(11) **EP 1 400 191 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
24.03.2004 Bulletin 2004/13

(51) Int Cl.7: **A47C 27/00, A47C 27/14**

(21) Application number: **03076480.7**

(22) Date of filing: **15.05.2003**

(84) Designated Contracting States:
**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IT LI LU MC NL PT RO SE SI SK TR**
Designated Extension States:
AL LT LV MK

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(30) Priority: **17.09.2002 BE 200200543**
29.01.2003 BE 200300065

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(54) **Perforation device for a mattress layer**

(57) The present invention relates to a device (9) for providing a series of perforations (23) in a mattress layer (22), which device (9) at least comprises a punch (14) with punching pins (15) arranged in a specific matrix pattern and being positioned opposite a piercing die (16) with holes (19) arranged in rows and columns according

to the same matrix pattern, in line with the aforesaid punching pins (15). The present invention furthermore relates to a method for providing a series of perforations (23) in a mattress layer (22), using such a device (9); as well as to an upper mattress (2) made of latex foam. More in particular, the present invention relates to the use of such an upper mattress (2).

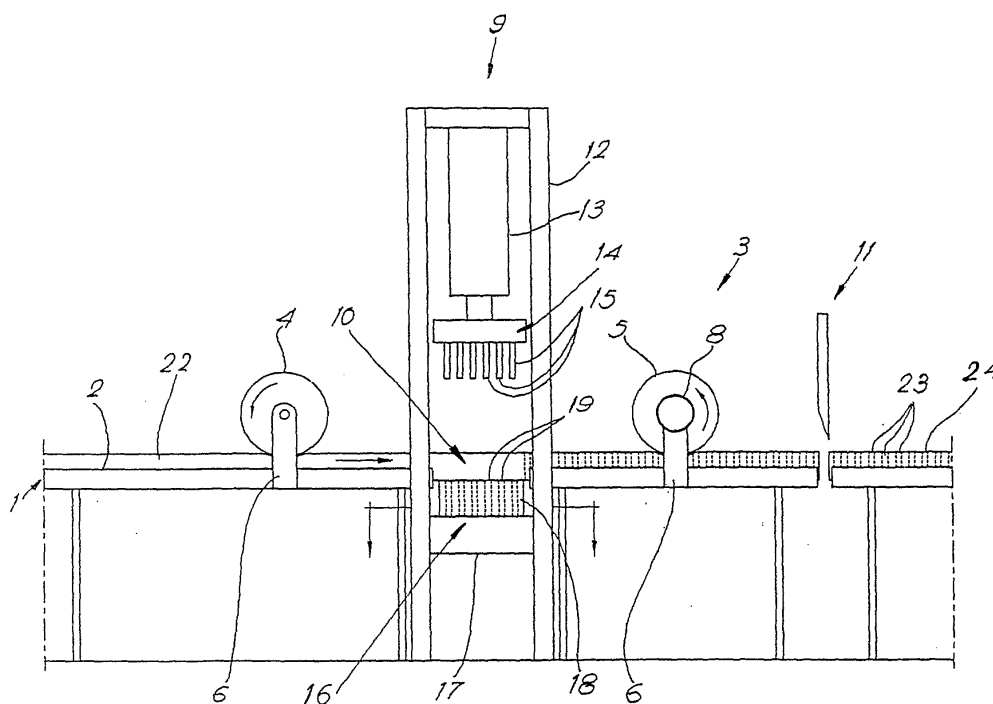


Fig. 1

Description

[0001] The present invention relates to a device for providing a series of perforations in a mattress layer, which device at least comprises a punch with punching pins arranged in a specific matrix pattern and being positioned opposite a piercing die with holes arranged in rows and columns according to the same matrix pattern, in line with the aforesaid punching pins. The present invention furthermore relates to a method for providing a series of perforations in a mattress layer by using such a device; as well as to an upper mattress made of latex foam. More in particular, the present invention relates to the use of such an upper mattress.

[0002] It is a known fact that perforations in the mattress layer can enhance the comfort of the person lying on the mattress and improve the moisture discharge of the mattress, in which connection it can be mentioned in particular that people on average secrete up to 1 litre of sweat a night while sleeping. Said moisture is discharged into the surrounding atmosphere as a result of a good ventilation of the mattress, which in itself makes the mattress feel drier, which in turn enhances the sleeping comfort of the user of the mattress. If a moist mattress is insufficiently provided with moisture-discharging means, the mattress will be susceptible to fungoid growth. The provision of additional ventilation in the mattress gives the mattress a higher sense of comfort, and in addition ensures a longer life of the mattress. Furthermore it is known in that people make frequent movements while sleeping, and the shifts in the body weight on the mattress produce a so-called pumping movement, which in turn leads to a satisfactory ventilation and canalisation of the moisture.

[0003] The aforesaid perforations are usually provided according to a specific matrix pattern in the mattress layer, either over the entire surface area of the mattress layer or only in specific zones, after the latex layer has been formed.

[0004] Latex foam of itself has a unique open cell structure, which means that millions of microscopically small interconnected air bubbles in the latex foam provide a good ventilating effect. There are two methods of obtaining latex foam in accordance with the well-known Dunlop process. According to a first method, moulding elements such as waffle irons are used, with latex foam being poured into a closed mould provided with aluminium pins to ensure a good heat conduction, and subsequently being vulcanised, washed and dried into an end product. As a result of the presence of the aluminium pins in the closed mould, the mattress (the end product) comprises vertical, continuous recesses that ensure a proper ventilation of the mattress. According to this method, mattresses having a thickness of up to 20 cm can be produced, with the thickness mainly being limited by the speed at which the heat can be introduced into the core of the latex material. The second method for producing latex foam according to the well-known Dun-

lop process is the pouring of latex foam on an endless conveyor belt, followed by vulcanisation, washing and finally drying. The maximum height of the mattress built up of latex foam is approximately 5 cm, because heat cannot be introduced into the core of the latex material sufficiently quickly due to the absence of aluminium pins on the conveyor belt. Thus, owing to the absence of the aluminium pins on the conveyor belt, the latex plate that is obtained does not have any vertical, continuous channels. In order to obtain a good ventilation in such a mattress layer yet, the mattress plate is provided with perforations.

[0005] The devices for providing such perforations that are known from the prior art consist of a punch with punching pins arranged in a specific matrix pattern on a punching block and being positioned opposite a piercing die with holes being arranged in the same matrix pattern, in line with the aforesaid punching pins.

[0006] With these known devices, the piercing die consists of as many blocks as there are holes, each block being provided with only one hole, which blocks are arranged in rows and columns in a common framework.

[0007] One drawback of these known devices is the fact that a relatively large spacing must be maintained between the holes in the piercing die so as to prevent the walls of the individual mattress blocks surrounding the holes becoming too thin, which would increase the risk of the blocks tearing open or breaking during the perforating of the mattress layer, with all the consequent inconveniences and drawbacks.

[0008] Another drawback of the fact that the spacing between the holes must not be smaller than a predetermined value with the known devices is that this requirement also imposes limitations as regards the spacing between the perforations in the mattress layer, as a result of which the possibilities of increasing the comfort of the person lying on the mattress and the moisture discharge of the mattress layer by reducing the spacing between the perforations are relatively limited.

[0009] A first aspect of the present invention is to provide a method and a device for providing a series of perforations in a mattress layer, in which perforations are formed in the mattress layer in such a manner that said perforations are spaced considerably more closely than has been possible so far according to the prior art, and that without the reliability of operation of the device being affected.

[0010] Another aspect of the present invention is to provide an upper mattress which exhibits very favourable characteristics as regards the comfort of the person lying on the mattress and the moisture discharge.

[0011] Another aspect of the present invention is to provide a method and a device for providing a series of perforations in a mattress layer, in which an upper mattress is obtained whose closed cell structure is visible at the upper side and the lower side thereof.

[0012] The present invention as referred to in the in-

roduction is characterized in that the piercing die is substantially composed of one or more solid die blocks, each provided with several holes.

[0013] An advantage of a device according to the invention is the fact that a piercing die comprising several holes in one and the same solid die block is much more robust than in the known devices, as a result of which the holes in the piercing die can be spaced relatively closely, making it possible when using such a device according to the invention to realise mattress layers comprising perforations which can be spaced relatively closely at need.

[0014] Special embodiments of the present invention will become apparent from the description of the Figures herein; said embodiments are furthermore defined in the subclaims.

[0015] The method for providing a series of perforations in a mattress layer, using the present device, is characterized in that the method comprises the following steps:

- i) providing a mattress layer of latex foam,
- ii) passing the mattress layer obtained in step i) between the punch and the piercing die,
- iii) moving punching pins in downward direction into the underlying holes of the piercing die, and
- iv) moving the punch upwards again.

[0016] In a special embodiment, it is preferred to repeat steps ii)-iv) after completion of step iv), with steps iii)-iv) being carried out in specific zones of the mattress layer.

[0017] In order to obtain an optimum comfort of the person lying on the mattress and a satisfactory moisture discharge, it is preferable to provide a mattress layer in step i) in which specific zones at the upper side of the upper surface of the mattress layer are profiled.

[0018] The improved upper mattress according to the present invention, which upper mattress is made of latex foam, is characterized in that the vulcanised layer of latex foam is provided with perforations in at least one zone of the upper surface thereof and with a profile in at least one zone of said upper surface.

[0019] Preferably, the aforesaid perforations are formed in zones near those parts of a user's body that secrete the most sweat, mainly the neck, the back and the thighs.

[0020] The advantage of this is that the body moisture can be discharge directly via the aforesaid perforations, which is achieved in part as a result of the changes in the user's position, which produced movements of air through the perforations, thus effecting a natural ventilation of the upper mattress.

[0021] The perforations thus prevent moisture remaining accumulated within the mattress too long, which might lead to fungoid growth and further unpleasant effects.

[0022] The profiles present in specific zones at the up-

per side of the upper layer of the mattress enhance the sleeping comfort of the user, because the mattress feels softer in said zones, depending on the shape and the dimensions of said profiles.

[0023] A suitable selection of the zones comprising perforations alternating with zones comprising profiles will lead to an upper mattress which meets each and every requirement of an exacting user as regards sleeping comfort. Special embodiments of the present upper mattress are defined in the subclaims.

[0024] In order to provide a better understanding of the invention, a preferred, non-limitative embodiment of a device according to the invention for perforating a mattress layer will be described hereinafter with reference to the accompanying drawings, in which:

Figure 1 is a schematic side elevation of a device according to the invention;

Figure 2 is a top plan view of Figure 1;

Figure 3 is a larger-scale sectional view along the line III-III in Figure 1;

Figure 4 shows the device of Figure 1, in another position thereof;

Figure 5 shows a variant of Figure 3;

Figure 6 is a schematic, perspective view of an improved upper mattress according to the invention in this simplest form thereof;

Figure 7 is a sectional view along the line II-II in Figure 6;

Figure 8 is a sectional view of a mattress used in combination with an improved upper mattress according to the invention;

Figure 9 is a sectional view similar to the view of Figure 8, in this case during use of the mattress, however;

Figure 10 shows an embodiment of a mattress according to Figure 8; and

Figure 11 is a larger-scale view of the part indicated at F6 in Figure 10.

[0025] The Figures 1-4 show a device according to the invention, which mainly consists of a table 1 having upright side edges 2; a driving mechanism 3 in the form of rollers 4 and 5, respectively, which are arranged in spaced-apart relationship a certain distance above the top of the table 1, and which are mounted in supports 6-7 positioned opposite each other on either side of the table 1, with the roller 5 being driven by a motor 8; a punching device 9, which is positioned near a transverse recess 10 in the table 1 between the aforesaid rollers 4-5, and which extends across the width of the table 1; and a cutting device 11, which is disposed some distance away from the roller 5 at the location of a second transverse recess in the table 1.

[0026] The punching device 9 mainly consists of a stand 12; a punch 14 suspended from said stand 12 by means of a hydraulic cylinder 13, which punch is provided with a series of punching pins 15 arranged in a

specific matrix pattern, and a piercing die 16 positioned opposite said punch 14, which is attached to said stand by means of a framework 17, in such a manner that the upper surface of the piercing die 16 lies in the same plane as the upper surface of the top of the table 1.

[0027] According to the invention, the piercing die 16 is in this case made of one solid die block 18, in a special embodiment five such solid die blocks may be used, each provided with several holes 19 in line with the aforesaid punching pins 15, more specifically in the same matrix pattern as the punching pins 15, comprising a relatively small number of rows 20 extending across the width of the table 1 and a relatively large number of columns 21 extending in the longitudinal direction of the table 1.

[0028] The operation and the use of the device according to the invention, which are very simple, are as follows.

[0029] In the illustrated embodiment, the device is disposed at the end of the production line for manufacturing a continuous mattress layer 22 of latex foam or the like, in which, as is shown in Figures 1 and 2, the mattress layer 22 is moved over the table 1 between the punch 14 and the piercing die 16 by the driving mechanism 3, more in particular by the driven roller 5.

[0030] The motor 8 of the driven roller 5 is stopped temporarily each time a series of perforations 23 is to be provided in said continuous mattress layer 22, so that the mattress layer is held in a fixed position, after which, as is shown in Figure 4, the cylinder 13 of the punching device 9 is driven to move the punching pins 15 downwards into the underlying holes 19 of the piercing die 16, so that the punching pins 15 are driven through the mattress layer 22 in a manner which is known.

[0031] As a result of the arrangement of the punching pins 15 and the holes 19 in a matrix, single rows of perforations 23 extending across the width of the mattress layer 22 are formed in a relatively narrow strip of the mattress layer 22 in question with each stroke.

[0032] After such a strip has been punched, the punch 14 is moved upwards again, after which the mattress layer 22 is moved a suitable distance ahead over the table 1 by means of the driving mechanism 3 and the punch is moved downwards again in order for a next strip to be punched.

[0033] In this way the continuous mattress layer 22 is provided with perforations 23 strip after strip in a semi-continuous process.

[0034] Pieces 24 of the perforated mattress layer 22 are cut to the desired length by means of the aforesaid cutting device 11, which pieces 24 can subsequently be used in the production process for composing mattresses.

[0035] An important advantage of the fact that the piercing die 16 is made of one solid die block 18 is that this makes it possible to space the holes 19 of the piercing die 16 relatively closely, as a result of which perforations 23 arranged in a relatively dense matrix pattern

can be realised with one single punching movement, which may be advantageous in particular cases in connection with the comfort of a person lying on a mattress provided with such a piece of perforated mattress layer 24.

[0036] Although the pieces of mattress layer 24 are shown to be provided with perforations 23 over the entire surface thereof in the Figures, it is quite possible to provide such pieces of mattress layer 24 with perforations only in specific zones in alternative embodiments, with zones provided with perforations and zones not provided with perforations being arranged in alternating relationship, in which case the punch 14 and the piercing die 16 do not necessarily have to extend across the entire width of the mattress layer 22 to be perforated. Preferably, however, the piercing die 16 will extend across the entire width of the zone of the mattress layer 22 that is to be perforated.

[0037] Furthermore it is quite possible for the rows and columns of the matrix patterns of the punching pins 15 and the holes 19 not to extend perpendicularly to each other but at a particular angle with respect to each other.

[0038] Figure 5 shows a variant of a piercing die 16 according to the invention, in which the piercing die 16 is composed of several solid die blocks 18, each provided with holes 19 arranged in a matrix comprising several rows and columns of holes, which are arranged side-by-side in a continuous row in a common framework 17.

[0039] It will be understood that a piercing die 16 according to the invention may also be composed of die blocks 18 comprising several aligned holes 19, which may form part of a respective row or column of the matrix pattern of the piercing guide 16.

[0040] Figures 6 and 7 schematically show an improved upper mattress according to the invention in the simplest form thereof.

[0041] In this embodiment, the layer 1 is a rectangular layer of latex foam having a specific thickness. The upper surface 2 of the layer 1 is provided with profiles 4 in particular zones 3, for example in the form of corrugations extending in the crosswise direction of the layer 1, over the entire width thereof, with perforations 6 being provided in the intermediate zones 5, which perforations form a connection between the upper surface 2 and the lower surface 7 of the layer 1, with the zones 3 and the zones 5 thus alternating in the longitudinal direction of the mattress.

[0042] Figures 8 and 9 show an embodiment of a mattress, in this case consisting of two layers arranged one on top of the other, viz. an improved upper mattress or layer 1 of latex foam as described above, and a full lower layer 8.

[0043] Figure 9 clearly shows that the zones 2 provided with perforations 6 are located near those parts of a user's body 9 where the user secretes the most sweat, viz. the neck 10, the back 11 and the thighs 12. At these locations the bodily fluid is indeed directly discharged in

downward direction through the perforations 6, so that the latex foam layer 1 that is in contact with the user's body 9 will remain dry at all times, and consequently will not be affected by fungoid growth or the like.

[0044] The varying thickness of the layer 1 in the profiles zones 3 makes the mattress feel softer or harder in said zones 3, as desired, depending on the shape and the dimensions of the corrugations.

[0045] Figures 10 and 11 show a variant of an embodiment of a mattress in which, in this case, the improved upper mattress or layer 1 of latex foam is arranged on top of an elastic lower layer 13 composed of spring elements 14 arranged in side-by-side relationship, for example in the form of metal coil springs, elastic elements of plastic material or the like, in which case a protective layer 15, for example in the form of a mattress cover made of a layer of a textile such as felt, jute or the like, is preferably arranged between the layer 1 of latex foam and the lower layer 13.

[0046] The present invention is by no means limited to the embodiments described and shown herein by way of example; an improved upper mattress according to the invention can be realised in various forms and dimensions without departing from the scope of the invention.

Claims

1. A device for providing a series of perforations in a mattress layer, which device at least comprises a punch (14) with punching pins (15) arranged in a specific matrix pattern and being positioned opposite a piercing die (16) with holes (19) arranged in rows (20) and columns (21) according to the same matrix pattern, in line with the aforesaid punching pins (15), **characterized in that** the piercing die (16) is substantially composed of one or more solid die blocks (18), each provided with several holes (19).
2. A device according to claim 1, **characterized in that** each die block (18) comprises a matrix of holes (19) comprising several rows (20) and columns (21).
3. A device according to claim 1 or 2, **characterized in that** the piercing die (16) is composed of two or more die blocks (18).
4. A device according to any one of the preceding claims, **characterized in that** the piercing die (16) extends across the entire width of the zone of the mattress layer (22) that is to be perforated.
5. A method for providing a series of perforations in a mattress layer, using a device as defined in any one or more of the preceding claims, **characterized in**

that the method comprises the following steps:

- i) providing a mattress layer of latex foam,
 - ii) passing the mattress layer obtained in step i) between the punch (14) and the piercing die (16),
 - iii) moving punching pins (15) in downward direction into the underlying holes (19) of the piercing die (16), and
 - iv) moving the punch (14) upwards again.
6. A method according to claim 5, **characterized in that** steps ii)-iv) are repeated after completion of step iv).
 7. A method according to any one or more of the preceding claims 5 - 6, **characterized in that** steps iii)-iv) are carried out in specific zones of the mattress layer.
 8. A method according to any one or more of the preceding claims 5 - 7, **characterized in that** a mattress layer is provided in step i) in which specific zones at the upper side of the upper surface (2) of the mattress layer are provided with a profile (4).
 9. An upper mattress obtained by carrying out the method as defined in any one or more of the claims 5 - 8.
 10. An upper mattress made of latex foam, **characterized in that** the vulcanised layer (1) of latex foam is provided with perforations (6) in at least one zone (5) of the upper surface (2) thereof and with a profile (4) in at least one zone (3) of said upper surface (2).
 11. An upper mattress according to claim 10, **characterized in that** said zones (3-5) extend across the width of the mattress and **in that** the zones (5) provided with perforations (6) and the zones (3) provided with a profile (4) alternate in the longitudinal direction.
 12. An upper mattress according to claim 11, **characterized in that** the zones (5) provided with perforations (6) are located near those parts of a user's body (9) that secrete the most sweat, in particular the neck (10), the back (11) and the thighs (12).
 13. An upper mattress according to any one or more of the preceding claims 9 - 12, **characterized in that** said profile (4) is in the form of a pattern of corrugations.
 14. An upper mattress according to claim 13, **characterized in that** the corrugations of said pattern of corrugations extend in the crosswise direction of the mattress.

15. An upper mattress according to any one or more of the claims 9 - 14, **characterized in that** the upper mattress has a closed cell structure along the upper surface (2) and the lower surface (7) thereof.

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16. Use of an upper mattress according to any one or more of the claims 9 - 15 on a spring construction.

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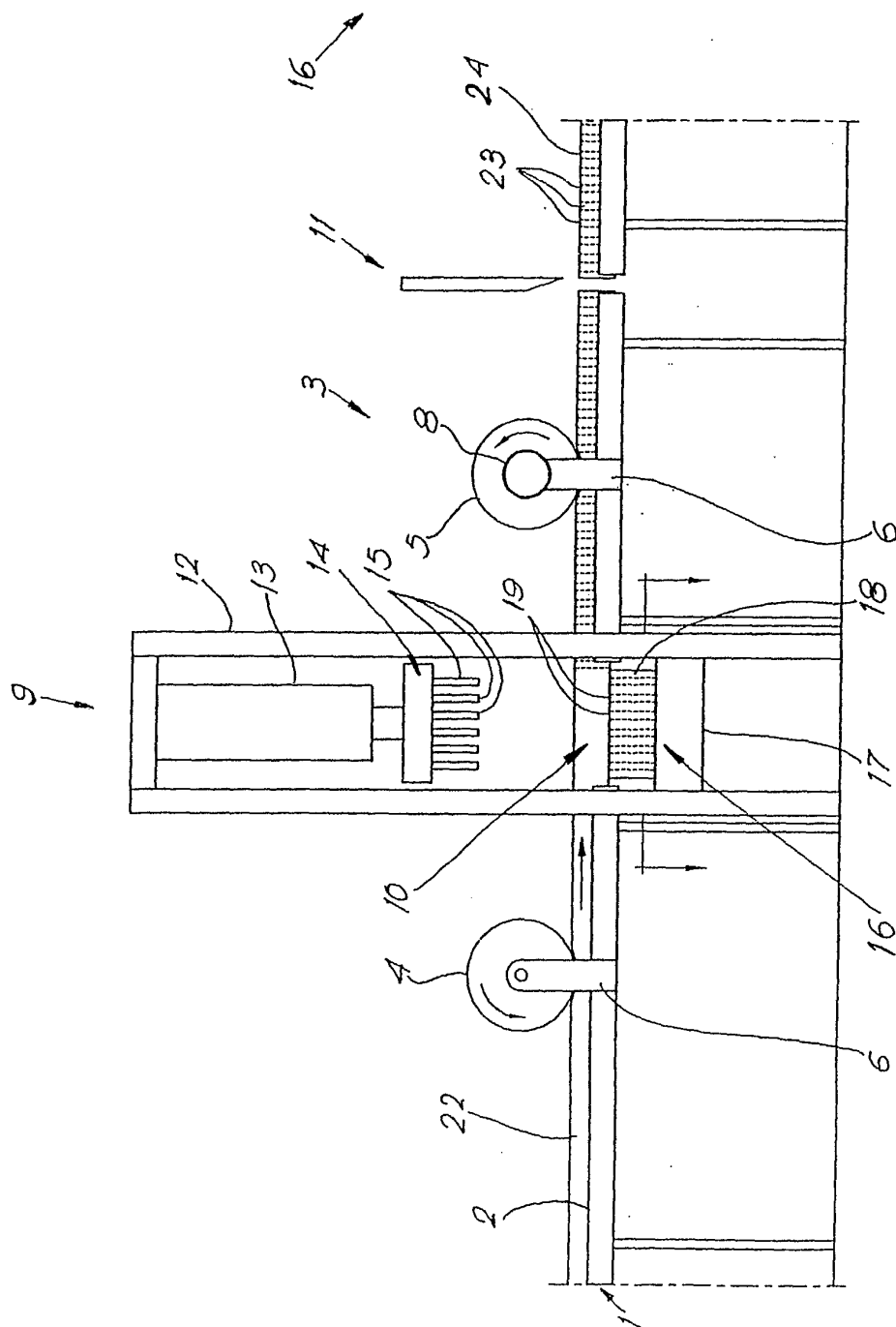


Fig. 1

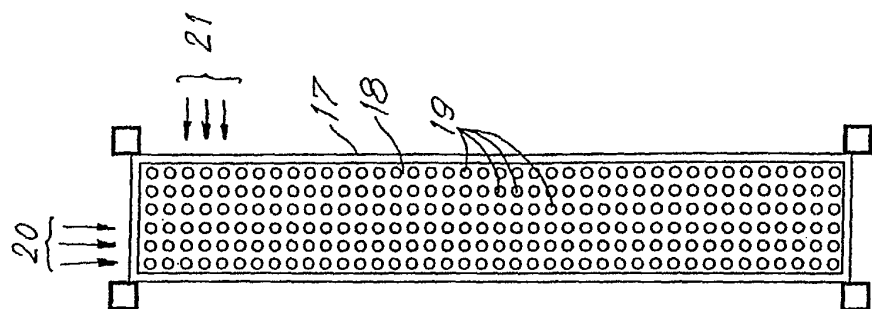


Fig. 3

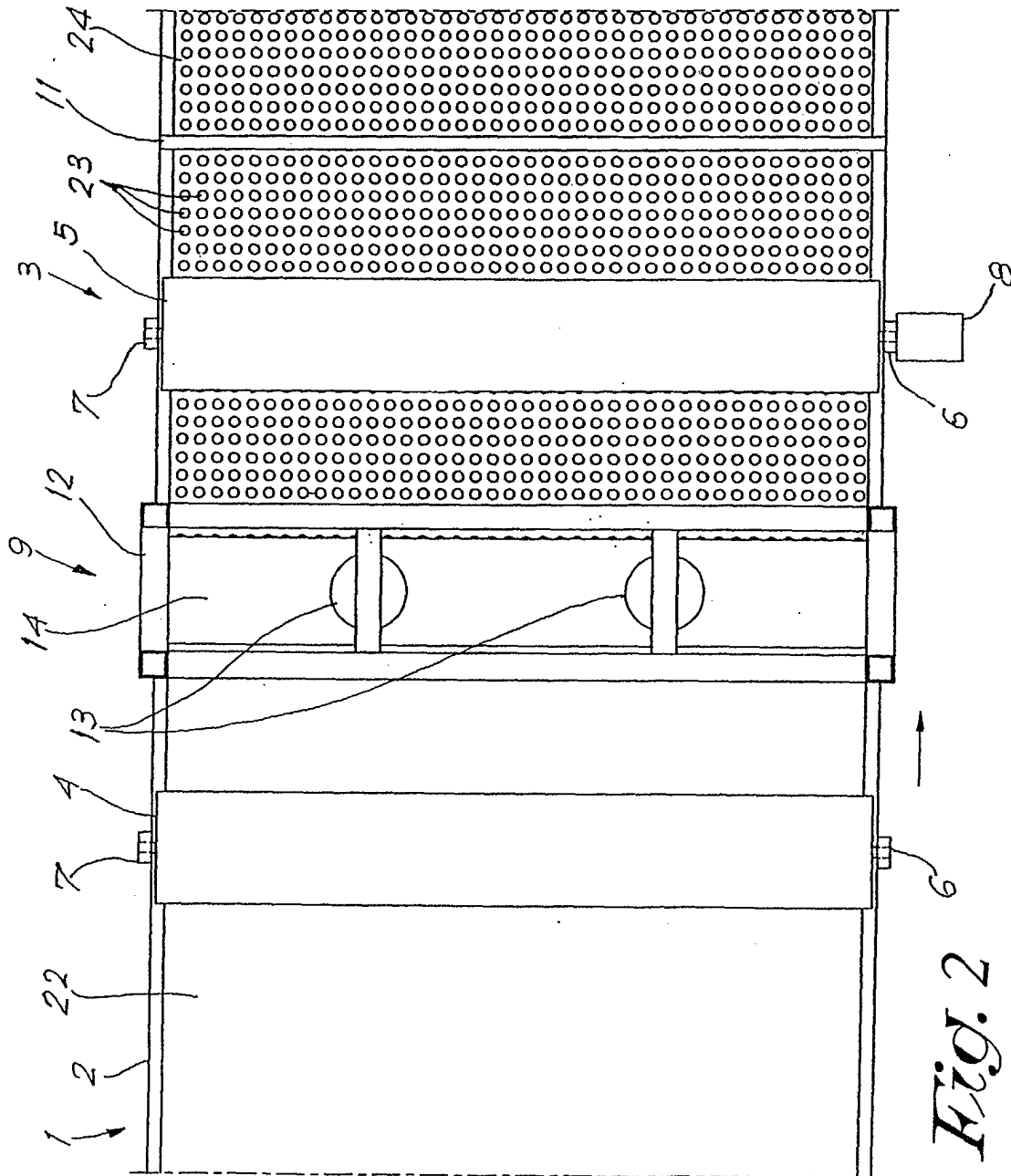


Fig. 2

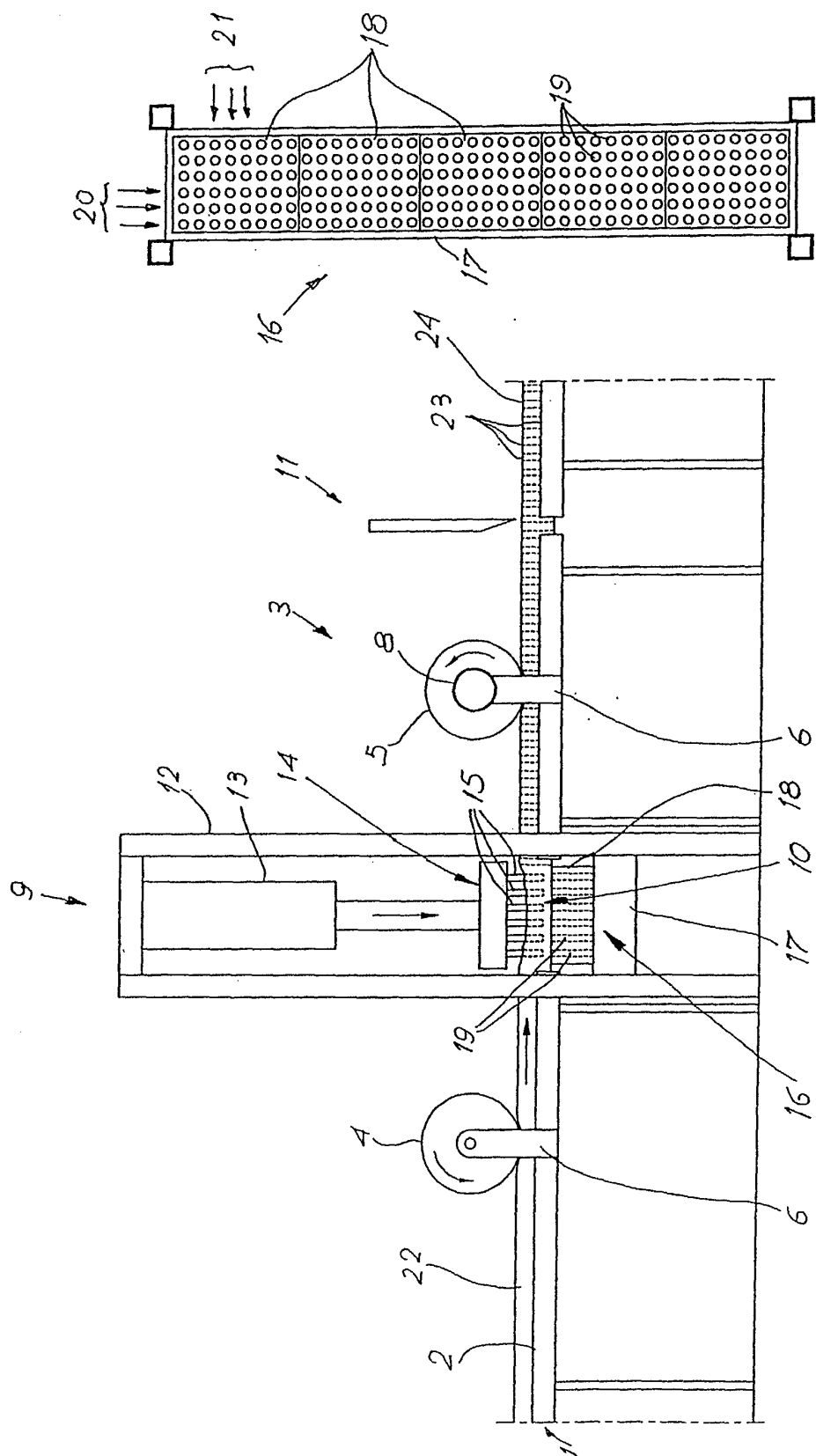
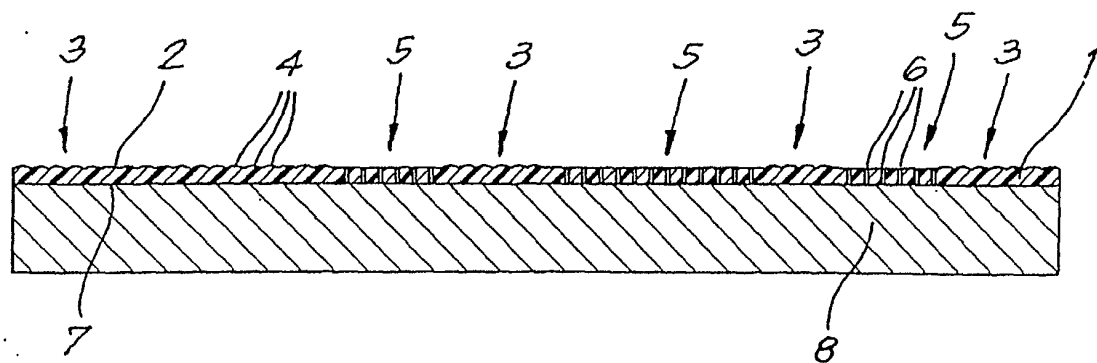
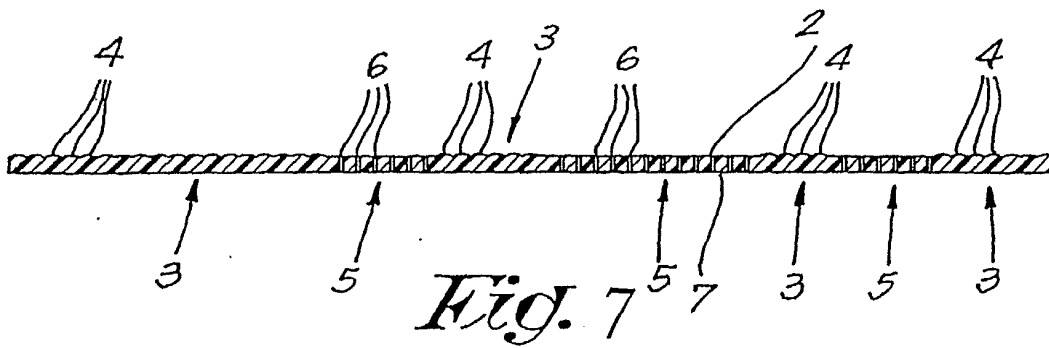
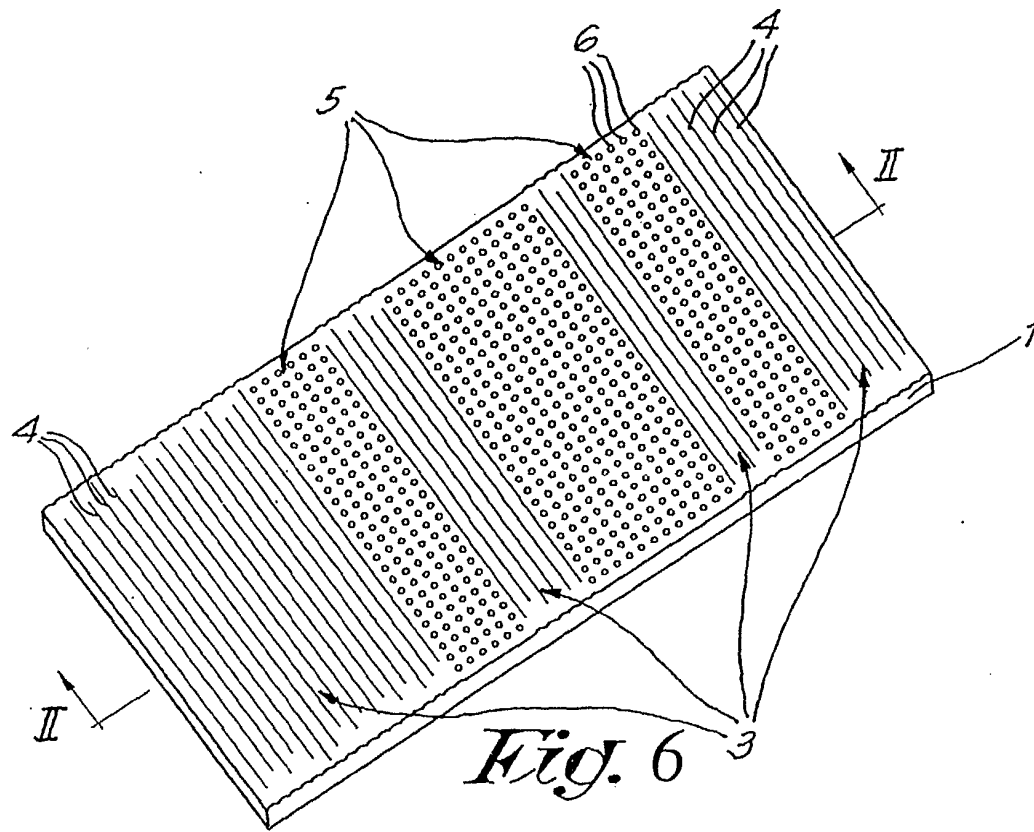


Fig. 5

Fig. 4



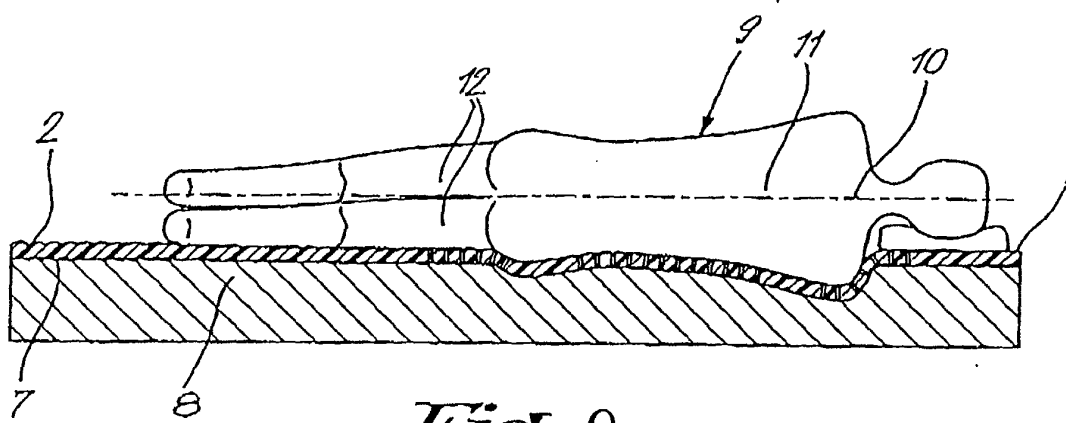


Fig. 9

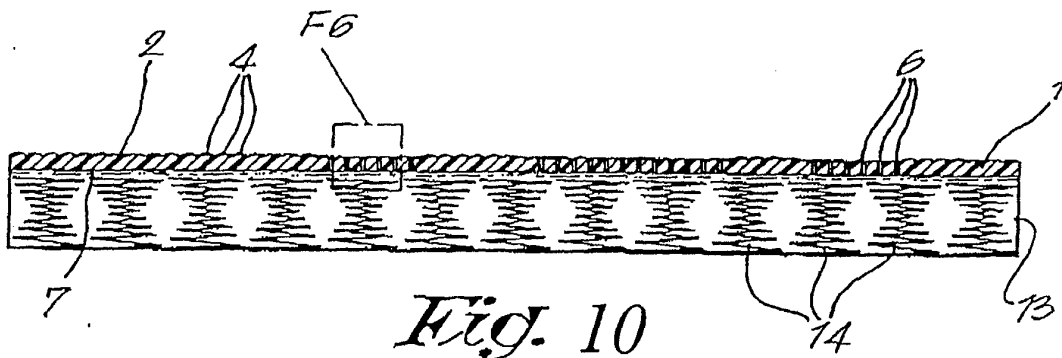


Fig. 10

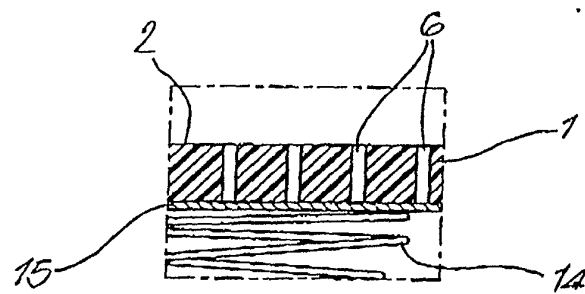


Fig. 11