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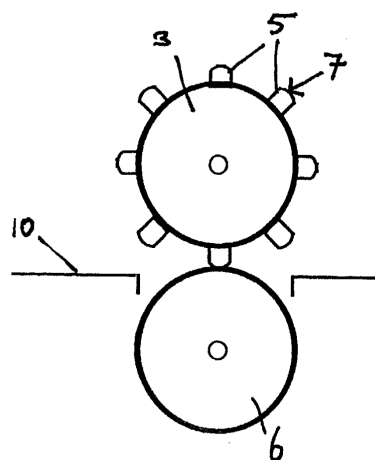
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54 Device and method for making holes in deformable foam blocks.

57 Device for creating holes in deformable foam blocks such as mattress bodies, wherein the device is equipped with a rotatable punch-roll body (3) designed to compress the blocks (1) and thereby punch holes (2) in the blocks (1). The invention further relates to a method for creating holes in deformable foam blocks, particularly mattresses, wherein the foam blocks (1) are compressed by a rotating punch-roll body (3), said punch-roll body being configured to punch holes (2) in the blocks (1) during the compression of the blocks (1).



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The content of this patent corresponds to the description originally filed with claim(s) and any drawings.

Title: Device and method for making holes in deformable foam blocks

The present invention relates to a device for making holes in deformable foam blocks, such as mattress bodies.

The invention also pertains to a method for making holes in deformable foam blocks, in particular mattresses.

Such a device and method are known from practice. The known device is equipped with a number of cylindrical, hollow drill bodies. The blocks are positioned one by one in front of the drill bodies, which then drill holes in the blocks.

A drawback of the known device and method is that it requires a relatively long time to create the holes in the blocks. This is primarily due to the drilling process itself, which, as a result of the accompanying up-and-down movements of the drill bodies, is a relatively slow operation. Furthermore, the drill bodies are inactive for a certain period of time, during which dead time a new block is positioned in front of the drill bodies while a processed block is removed.

An additional disadvantage of drilling the holes is the relatively high level of noise produced, which can lead to hearing damage for the operating personnel, for example. Moreover, a drilling device is relatively maintenance-sensitive. Additionally, drilling is disadvantageous because it typically requires a relatively large amount of drilling lubricant to be used.

Furthermore, the known device and method only allow for the creation of holes with a circular cross-section in the blocks. Therefore, certain attractive hole shapes desired by consumers, such as angular, heart-shaped, star-shaped, or similar shapes, cannot be produced with this device and method.

In addition, a disadvantage of the known device and method is that they generally only allow for the creation of holes that extend in one particular direction, often perpendicular, in the blocks. Another direction is only possible after a laborious adjustment of the device, which requires a significant amount of time and investment.

The present invention aims to overcome the drawbacks of the known device and method. Specifically, the invention aims to provide a device and method for creating holes in foam blocks relatively quickly.

According to the invention, the device of the type described in the preamble is characterized by the inclusion of a rotatable die-roll body designed to compress the blocks and punch holes in them.

By configuring the die-roll body to compress the foam blocks and simultaneously punch holes in them during rotation, the die-roll body can efficiently create the holes in the blocks while compressing them. Therefore, this device can provide a relatively large quantity of foam blocks with holes within a given time period. An additional advantage is that the device can also crush the foam blocks during the compression and punching process. This crushing breaks cell walls within the foam of the foam blocks, resulting in a relatively open cell structure that enhances the comfort of the blocks during use. Since a punching process is used to create the holes, the aforementioned disadvantages of using a drilling device and performing a drilling process are avoided. This device can create the holes in a relatively quiet manner. Furthermore, the device is relatively easy to maintain. Furthermore, the shape of the holes, at least in cross-section, can be varied to a large extent depending on how the die-roll body is configured to punch the holes in the blocks.

Preferably, the device is also equipped with counter-punching means positioned opposite the die-roll body, which are designed to cooperate with the die-roll body for the purpose of compressing the blocks and punching the holes in them.

For example, the punching can be carried out at essentially the same position, with the blocks fed to the die-roll body and the counter-punching means. This eliminates the need to move the die-roll body for the purpose of punching the blocks. Therefore, the device can be installed and used in a relatively small space. The counter-punching means may include a counter-punching body, which provides a relatively simple configuration of the counter-punching means. By the cooperation of the die-roll body and the counter-punching body, the holes can be punched relatively quickly in the blocks.

According to a further embodiment of the invention, the die-roll body and the counter-punching body are provided with an adjustable drive for independently rotating these roll bodies.

In this way, these two roll bodies can be rotated independently, allowing the angular velocities of the roll bodies to be controlled independently. Preferably, the device is equipped with a controller that is designed to control the drive for the purpose of regulating the roll

rotation angular velocities of the roll bodies. This enables relatively precise and automatic control of the roll rotation angular velocities, or if desired, adjustments can be made.

Surprisingly, it has been found that by varying the angular velocities of the two roll bodies relative to each other, the direction in which the holes extend in the blocks can be varied. Therefore, the angular velocities can be chosen in such a way that the holes extend substantially perpendicular to the blocks. On the other hand, angular velocities can be selected where the holes extend diagonally in the blocks. Furthermore, the angular velocities can be kept substantially constant or varied during the punching process, so that the holes extend in the same direction or different directions in each block.

Preferably, the device is equipped with block feeders that are designed to feed the blocks to be punched to the die-roll body and the counter-punching means along an imaginary feeding surface. With the help of these feeders, the blocks can be quickly and automatically supplied to the die-roll body and the counter-punching means. This allows for the holes to be created in the blocks through a continuous process.

Surprisingly, it is found that the mentioned imaginary feeding surface can also determine the shape of the punched holes or the direction in which the holes extend in the blocks. Therefore, the mentioned feeding surface can enclose a non-perpendicular angle with an imaginary plane in which the centerlines of the die-roll body and the counter-punching body are located, allowing for the desired hole shape to be obtained. The mentioned angle, which the feeding surface forms with the plane containing the centerlines of the die-roll body and the counter-punching body, can, for example, be chosen in such a way that the holes are punched substantially perpendicular in each block by the die-roll body. Additionally, the mentioned angle can be kept substantially constant or varied during the punching process, so that the holes extend in the same direction or different directions in each block. Furthermore, a combination of adjusting the angle of the feeding surface together with adjusting the angular velocities of the roll bodies relative to each other can be used, especially when the counter-punching means include a counter-punching body, to achieve a desired hole shape.

According to a further embodiment of the invention, the die-roll body is provided with at least one punching sleeve extending from an outer circumference of the die-roll body, wherein a distal end of each punching sleeve facing away from the die-roll body is equipped with a cutting edge for the purpose of punching the holes.

The shape of the punching sleeve determines, among other things, the shape of the holes punched by it. Since the shape of this punching sleeve can be varied to a large extent, the shapes of the holes to be punched can be varied accordingly.

The invention further provides a die-roll body, apparently intended for use in a device according to any one of claims 1-11 and/or a method according to any one of claims 12-19.

With this die-roll body, the mentioned device can be assembled in a straightforward manner, and the method according to the invention can be carried out easily.

Further embodiments are described in the dependent claims.

The invention will be elucidated below based on an exemplary embodiment and the accompanying drawings, wherein:

Figure 1 schematically shows a side view of an exemplary embodiment of the invention;

Figure 2 shows a top view of the side view depicted in Figure 1;

Figure 3 illustrates a first step of creating holes in a foam block;

Figure 4 illustrates a second step of creating holes in a foam block;

Figure 5 shows a side view of a foam block with holes;

Figure 6 shows a top view of the foam block depicted in Figure 5; and

Figure 7 shows a side view of an alternative method for creating holes in a foam block.

Figures 1 and 2 depict an exemplary embodiment of a device for creating holes 2 in deformable foam blocks 1. The device is equipped with a die-roll body 3 designed to compress the blocks 1 and punch holes 2 in them. The device further includes a counter-punching body 6 positioned opposite the die-roll body 3, which is designed to cooperate with the die-roll body 3 for the purpose of compressing the blocks 1 and punching the holes 2.

The rotation axes of the die-roll body 3 and the counter-punching body 6 are parallel to each other. The distance between these two roll bodies 3, 6 is such that the blocks 1 are compressed between them. The die-roll body 3 and the counter-punching body 6 are equipped with an adjustable, undisclosed drive for independently rotating these roll bodies 3, 6. The device is further provided with a controller designed to control the drive of the roll bodies 3, 6.

For the purpose of punching the holes 2, an outer circumference 4 of the die-roll body 3 is provided with punching sleeves 5 extending from this outer circumference 4. A distal end of each punching sleeve 5, facing away from the die-roll body 3, is equipped with a cutting edge 7 for the purpose of punching the holes 2. The cutting edges 7 are designed in such a way that they

smoothly punch the holes 2 in the blocks when the blocks 1 are compressed between the die-roll body 3 and the counter-punching body 6. The counter-punching body 6 is made of a suitable material to prevent damage to the punching sleeves 5 during punching.

The device is further equipped with block feeders 10 to feed the blocks 1 to be punched to the mentioned roll bodies 3, 6 along a feeding surface V and in a feeding direction T. These feeders 10 can be implemented in various ways, for example, as a feeding platform, a feeding conveyor, or the like.

Figure 3 illustrates a first step for creating holes 2 in a block 1. The two roll bodies 3 and 6 are rotated by the mentioned drive with angular velocities v_3 , v_6 , of which at least the direction is indicated by arrows v_3 and v_6 in the figure. Meanwhile, the block 1 is fed to the roll bodies 3, 6 along the feeding surface V in the feeding direction T.

Figure 4 shows a second step of the process, where the block 1 is passed between the roll bodies 3, 6 and compressed by them. During this process, the holes 2 are punched in the block 1 through the cooperation of the punching sleeves 5 of the die-roll body 3 with an outer circumference of the counter-punching body 6. Preferably, the angular velocities v_3 , v_6 of the roll bodies are chosen in such a way that the punched holes 2 extend in a desired direction in the block 1. Figures 5 and 6 show a possible result of this method, where the holes 2 are primarily punched perpendicular to the block 1. Particularly for relatively thick foam blocks 1, for example, with a thickness ranging from 1 cm to 400 cm, it may be desired to have different angular velocities v_3 , v_6 for the roll bodies in order to punch the holes 2 perpendicular to the blocks 1.

Figure 7 illustrates an alternative embodiment of the device for creating holes 2 in the foam blocks 1. The device is equipped with guide rollers 12 that guide each block 1 to be fed along a block feeding surface V' together with the feeders 10, in a feeding direction T', towards the roll bodies 3, 6. The block feeders 10 in this case are arranged such that the feeding surface V' forms a non-right angle α with the plane W in which both centerlines of the die-roll body 3 and the counter die-roll body 6 are located. The mentioned non-right angle α is chosen such that the punched holes 2 extend in a desired direction in the block 1, which can be desirable especially for relatively thick blocks 1 and at equal roll body angular velocities v_3 , v_6 .

In addition to independently varying the mentioned parameters roll body angular velocity v_3 , v_6 and the angle α that the feeding surface V' forms with the plane W, a combination of

varying these parameters v_3 , v_6 , a is possible to obtain desired hole shapes. Furthermore, these parameters v_3 , v_6 , a can be kept constant during the compression of a single block 1, so that the holes 2 in that block 1 extend predominantly in the same direction within the block 1.

Conversely, the mentioned parameters v_3 , v_6 , a can also be varied non-constantly during the compression of a single block 1, resulting in variation of the hole shape of the holes 2 within that block.

The advantage of the device shown in the figures is that the holes 2 can be made in the foam blocks 1 through a continuous process. Moreover, the punching process is relatively fast, particularly compared to a drilling process. Therefore, with this device, a relatively large quantity of foam blocks 1 can be provided with holes 2 relatively quickly. Additionally, the hole shape of the holes 2 can be varied relatively easily.

Preferably, the device is equipped with unloading means, not shown, to remove material punched from the blocks 1 from the punch tubes 5. These unloading means can be provided with fluid supply means to supply fluid into the punch tube for displacing the material from the punch tube. The material can, for example, be easily blown out of each punch tube 5 by means of air supply means.

It is understood that the invention is not limited to the described embodiments. Various modifications are possible within the scope of the invention.

For instance, the die-roll body 3 and the counter die-roll body 6 can be implemented in different ways, such as cylindrical, conical, or the like.

Furthermore, the counter die-roll body 6 can also be designed to punch holes 2 in the blocks 1 during the compression of the blocks 1, for example, by providing the counter die-roll body 6 with punch tubes 5 that can cooperate with the outer circumference of the die-roll body 3.

Moreover, a foam block 1 can be bent in a direction parallel to the centerline of the die-roll body 3 during feeding to obtain a specific desired hole shape 2.

In addition, the punch tubes 5 can have different shapes in cross-section, such as cylindrical, angular, star-shaped, heart-shaped, or the like. The tubes 5 can also be designed, for example, to punch silhouettes of brands, specific figures, symbols, animals, or the like into the blocks 1.

Furthermore, the punch tubes 5 can be fixed or detachably attached to the die-roll body. Detachable attachment is advantageous for quickly replacing damaged tubes 5 and/or replacing the tubes 5 with differently shaped tubes 5 for punching holes 2 with a different hole shape.

Moreover, the cutting edge 7 of each punch tube 5 can be implemented in various forms, such as smooth, serrated, arc-shaped, or a combination of these or other forms. The shape of the cutting edge 7 is preferably such that it enables a good punching operation.

The shape of each of the foam blocks 1 can vary and is not limited to the shape of the block shown in the figures.

The foam blocks 1 can be intended, for example, for making mattresses, heat-insulating and/or sound-insulating panels. The foam blocks can consist of compressed foam flakes made of a plastic foam.

CLAIMS

1. Device for making holes in deformable foam blocks such as mattress bodies, characterized in that the device is provided with a rotating die-roll body (3) designed to compress the blocks (1) and thereby punch holes (2) in the blocks (1).
2. Device according to claim 1, characterized in that the device is also provided with counter punch means (6) positioned opposite the die-roll body (3), which are designed to cooperate with the die-roll body (3) for compressing the blocks (1) and punching the holes (2) in the blocks (1).
3. Device according to claim 2, characterized in that the counter punch means comprise a counter die-roll body (6).
4. Device according to claim 3, characterized in that the die-roll body (3) and the counter die-roll body (6) are provided with an adjustable drive for independently rotating these roll bodies (3, 6).
5. Device according to claim 4, characterized in that the device is equipped with a control system that is designed to control the drive for regulating the roll rotation angular speeds (v_3 , resp. v_6) of the roll bodies (3, resp. 6).
6. Device according to any one of claims 2-5, characterized in that the device is provided with block feeding means (10) that are designed to feed the blocks (1) to be punched to the die-roll body (3) and the counter punch means (6) along an imaginary feeding surface (V ; V').
7. Device according to claims 3 and 6, characterized in that the mentioned feeding surface (V') forms a non-perpendicular angle (α) with an imaginary plane (W) in which the centerlines of the die-roll body (3) and the counter die-roll body (6) are located.
8. Device according to any of the preceding claims, characterized in that the die-roll body (3) is provided with at least one punching tube (5) extending from the outer circumference (4) of the die-roll body (3), wherein one end of each punching tube (5), facing away from the die-roll body (3), is provided with a cutting edge (7) for the purpose of punching the holes (2).
9. Device according to claim 8, characterized in that the device (10) is provided with removal means for removing material punched from the blocks (1) from the punching tube (5).

10. Device according to claim 9, characterized in that the removal means are provided with fluid supply means for supplying fluid into the punching tube (5) to displace the material from the punching tube (5).
11. Device according to any of the preceding claims, characterized in that each block (1) to be punched has a thickness in the range of 1 cm-400 cm.
12. Method for applying holes in deformable foam blocks, particularly mattress bodies, characterized in that the foam blocks (1) are compressed by a rotating die-roll body (3), which is designed to punch the holes (2) in the blocks (1) during the compression of the blocks (1).
13. Method according to claim 12, characterized in that the die-roll body (3) is brought into a substantially fixed rotational position, such that the die-roll body (3) obtains a specific angular velocity (v_3), wherein the blocks (1) are passed between the die-roll body (3) and opposing counter-punch means (6), wherein the die-roll body (3) and the counter-punch means (6) cooperate for the compression of the blocks (1) and the punching of the holes (2) in the blocks (1).
14. Method according to claim 13, characterized in that the counter-punch means comprise a counter-punch roll body (6), which is brought into rotation with a specific roll rotation angular velocity (v_6) for compression, wherein the roll rotation angular velocity (v_6) is directed opposite to the rotational direction of the roll rotation angular velocity (v_3) of the die-roll body (3).
15. Method according to claim 14, characterized in that the angular velocities (v_3 , v_6) of the die-roll body (3) and the counter-punch roll body (6) differ from each other in such a way that the punched holes in the blocks extend in a different direction in the blocks than the direction obtained when the angular velocities (v_3 , v_6) of the roll bodies (3, 6) are equal to each other.
16. Method according to claims 14 or 15, characterized in that the mentioned angular velocities (v_3 , v_6) are set relative to each other so that the holes (2) are predominantly punched perpendicularly into each block (1) by the die-roll body (3).
17. Method according to any of claims 14-16, characterized in that the angular velocity (v_3) of the die-roll body (3) is greater than the angular velocity (v_6) of the counter-punch roll body (6).

18. Method according to claim or at least claim 14, characterized in that each foam block (1) is fed to the die-roll body (3) and the counter-punch roll body (6) along an imaginary feeding surface (V'), wherein the imaginary feeding surface (V') extends non-perpendicular to a plane (W) in which the centerlines of both the die-roll body and the counter-punch roll body are located.
19. Method according to at least claim 18, characterized in that the imaginary feeding surface (V') along which each foam block (1) is fed to the die-roll body forms such an angle (a) with the plane containing the centerlines of the die-roll body (3) and the counter-punch roll body (6) that the holes (2) are predominantly punched perpendicularly into each block (1) by the die-roll body (3).
20. Die-roll body, apparently intended for use in a device according to any of claims 1-11 and/or in a method according to any of claims 12-19.

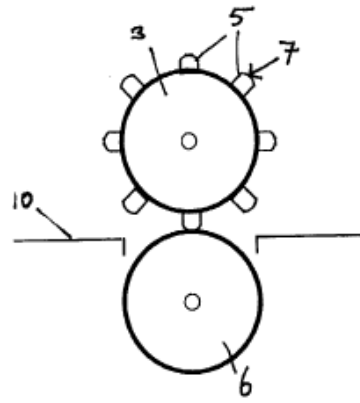


Fig. 1

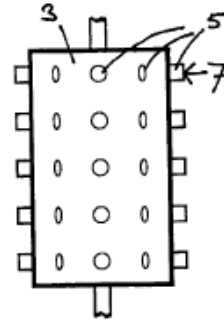


Fig. 2

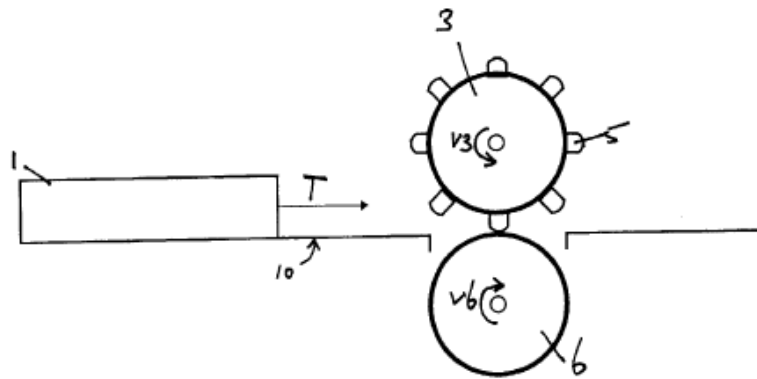


Fig. 3

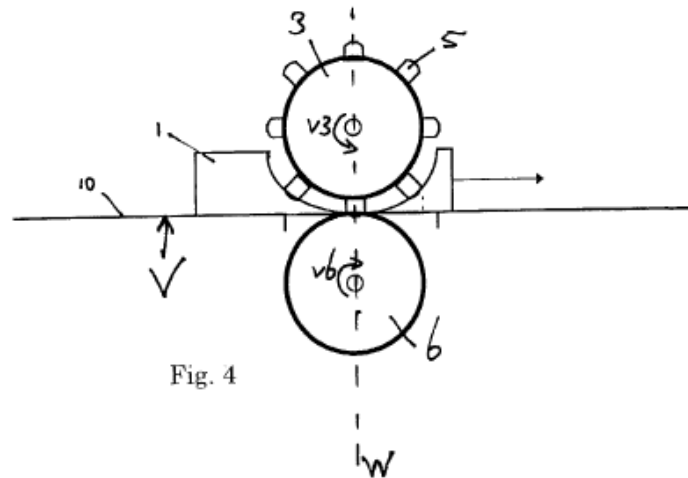


Fig. 4

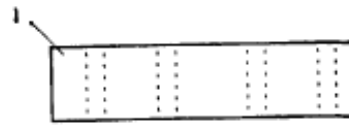


Fig. 5

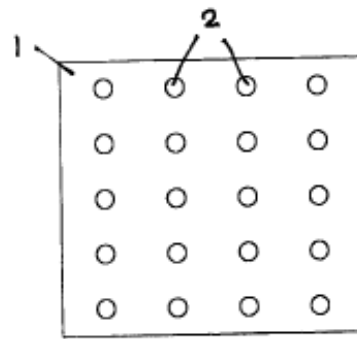


Fig. 6

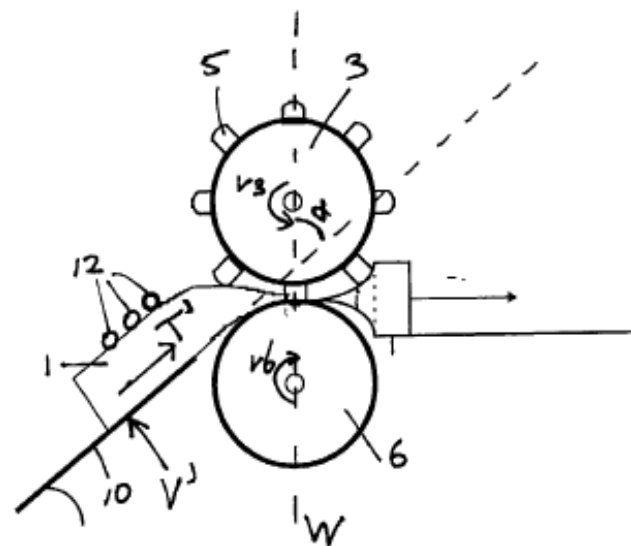


Fig. 7



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