



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
28.04.2010 Bulletin 2010/17

(51) Int Cl.:
B26F 1/02 (2006.01) B26F 1/24 (2006.01)

(21) Application number: **08167425.1**

(22) Date of filing: **23.10.2008**

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

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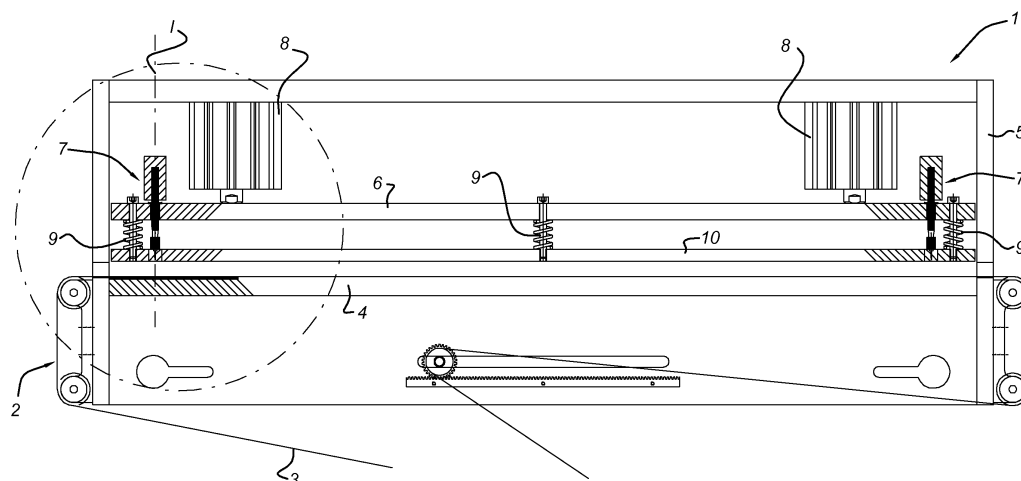
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(54) **Device for punching series of microperforations in film material**

(57) The invention relates to a device for punching series of perforations in a length of film material (3), like a polymer foil, comprising a planar support surface (4) for supporting said film material, a needle frame (6) mounted reciprocatingly movable above said support surface, said needle frame holding a series of needles (7) with their needle tips towards said support surface and which are mounted in said needle frame to be substantially freely movable in their longitudinal direction, said device further comprising an actuator (8) for reciprocate said needle frame towards said support surface for bringing the tips of said needles in contact with said support surface.

The invention further relates to a method for punching series of perforations in a length of polymer film, wherein a part of said polymer film is advanced over a support surface and is rested on said transport surface, a frame provided with a series of needles which are free moveable in their longitudinal direction is moved downward with the tips of the needles piercing the part of polymer film until they rest on said support surface, said frame is moved upward away from said polymer film until said needles are free from said polymer film, and said punctured part of polymer film is advanced further until a new part of un-punctured polymer film rests on said support surface.

Fig 1



Description

Background

[0001] The present invention relates to a device and a method for producing a series of microperforations in film material.

[0002] EP-A1-1.714.885 discloses a packaging apparatus which makes deep-drawn containers which are filled and sealed with a sealing film. The apparatus comprises a perforation device for providing said sealing film with series of perforations with a cross section of 20-50 microns. The device is not further described.

[0003] US-5,720,915 discloses an apparatus for perforating the smooth surface of open-cell plastic foam sheets. A thermoforming unit is provided with needles which are movable in a mould block. The needles are biased to be retracted in the mould block, and can be activated to extend out of the mould block for perforating the surface of a plastic foam sheet. The needles are not intended for perforating though the sheet.

[0004] There remains a need for a device which is able to provide film material with perforations.

Summary of the Invention

[0005] The invention aims to provide a device which can apply series of perforations to film material.

[0006] Another or alternative object of the invention is to provide a device which can apply series of perforations to film material at high speed.

[0007] According to a first aspect of the invention this is realized with a device for punching series of perforations in a length of film material, like a polymer foil, comprising a planar support surface for supporting said film material, a needle frame mounted reciprocatingly movable above said support surface, said needle frame holding a series of needles with their needle tips towards said support surface and which are mounted in said needle frame to be substantially freely movable in their longitudinal direction, said device further comprising an actuator for reciprocate said needle frame towards said support surface for bringing the tips of said needles in contact with said support surface.

[0008] The invention further provides to a method for punching series of microperforations in a length of polymer film, wherein a part of said polymer film is advanced over a planar support surface and is rested on said planar support surface, a frame provided with a series of needles which are free moveable in their longitudinal direction is moved downward with the tips of the needles piercing the part of polymer film until they rest on said planar support surface, said frame is moved upward away from said polymer film until said needles are free from said polymer film, and said punctured part of polymer film is advanced further until a new part of un-punctured polymer film rests on said planar support surface.

[0009] The invention further relates to a polymer film

material for use in food packaging, said film material having a food side directed towards the food to be packed, and an outside directed away from said food, said film material having a thickness of about 10-50 microns and comprising about 1-1600 microperforations per square metre, wherein said microperforations are about 50-300 microns in cross section and are tapered towards the outside.

[0010] This method, device provides the possibility of making well-defined microperforations in a film material at high speed and without damaging the film material. The method and device provide a specific polymer film material which has unique properties, in particular in the field of food packaging.

[0011] In this context, the tips of the needles are defined as the part at the end of a needle which is substantially conical.

[0012] The film material can be a single layer material, but also be a multi layer laminate. In many instances, the film material will be a polymer film, for instance used as a sealing film, for instance used in food packaging. The film material can comprise a thermoplastic polymer, for instance polyethylene (PE), polypropylene (PP), polyester like PET, polyamide (PA) polymer.

[0013] In an embodiment of the invention, said needle frame is biased away from said support surface. In this way, the working speed increases.

[0014] In an embodiment each needle has a weight near said end away from said tip, for urging said needle towards said support surface.

[0015] In an embodiment the device further comprises a transporter for advancing a band of said film material through said device over said support surface.

[0016] In an embodiment the device further comprising a controller for instructing said transporter to advance said film material a predefined length over said support surface, stopping said film material, and for after stopping said film material activating said actuator to move said needle frame in the direction of said support surface for said needles to puncture said film material.

[0017] In an embodiment said support surface comprises a layer of compressible material.

[0018] In an embodiment said layer of compressible material comprises a top layer rubber-like material, in an embodiment a layer of polyurethane, for instance a layer of material commercially known as habasiet®. It was found that better results could be obtained with a material which elastically deforms a little when the needles are pushed onto the material.

[0019] In an embodiment said tips of the needles are adapted to make perforations have a cross section for providing a liquid-tight film material, pref of about 50-300 micron. In this context, liquid-tight means that when water is applied on the film, the water will not drip through the microperforations. The microperforations are of such size, however, that water will pass through or evaporate in the form of moisture. When applied to a packaging, for instance as a sealing film on a deep-draw packaging,

water will not drip out of the packaging through the microperforations. Moisture in the atmosphere inside the packaging, however, can slowly evaporate through the microperforations.

[0020] In an embodiment said needles are positioned in said frame and the length of said tips are adapted to have the tips extend through the film material. In this embodiment, the length of the tip is larger than the thickness of the film material. The tip does not penetrate the film material completely, but the end of the tip extends out of the film material. In that way, a tapered perforation is made.

[0021] In an embodiment said needles are positioned in said needle frame to produce a matrix of perforations.

[0022] In an embodiment said film material is for sealing a product, and said film material has a product side directed towards the product to be sealed, and an outside directed away from said product, and said film material is provided in said device with its outside on said planar support surface and said device punctures said film from the product side. This provides microperforations which are tapered or conical towards the outside. I.e., the cross section at the product side is larger than the cross section at the outside of the film material. It was found that this resulted in an optimal moisture transmission. The microperforations were drip-proof. The invention also pertains to such film material, and to a packaging sealed with said film material.

[0023] In an embodiment of the method, said microperforations have cross section of 50-300 micron. It was found that such a cross section provides drip-proof perforations but which allow moisture to pass.

[0024] In an embodiment of the method, said polymer film, preferably thermoplastic polymer film, has a thickness of about 10-50 micron.

[0025] In an embodiment of the method, it results in about 1-1600 perforations per square meter. The number depends on the packaging.

[0026] In an embodiment of the method said polymer film is for sealing a product, and said polymer film has a product side directed towards the product to be sealed, and an outside directed away from said product, and said film material is advanced with its outside on said planar support surface and punctured from the product side. It was found that with this method, tapered microperforations could be obtained with the best performance.

[0027] The invention further pertains to an apparatus comprising one or more of the characterising features described in the description and/or shown in the attached drawings, and to a method comprising one or more of the characterising features described in the description and/or shown in the attached drawings.

[0028] The various aspects discussed in this patent can be combined in order to provide additional advantages.

Description of the Drawings

[0029] The invention will be further elucidated referring to an embodiment of a device shown in the attached drawings, showing in:

Figure 1 shows a longitudinal cross section of a device according to the invention;

Figure 2 shows a transverse cross section of a device according to the device of Figure 1;

Figure 3 shows a detail of the device of Figure 1;

Figure 4 shows a top view of the device of Figure 1.

Detailed Description of Embodiments

[0030] Figure 1 shows a device for puncturing a series of perforations in the length of film material 3. The device has a transport unit 2. In an embodiment, this may be a transport band which transports the film material through the device. This transport band runs over a support providing plate 4. In this embodiment, the film material 3 is transported using an external transport device. In this embodiment, the transport unit 2 has guiding rolls which transport the film material 3 over a support surface.

[0031] The puncturing device 1 further has a support frame 5 onto which the transport unit is mounted. In this embodiment mounted to frame 5 are actuators 8 which are mounted to move a needle frame 6 in a reciprocating manner up and down to the planar support surface 4. Frame 5 further comprises a plate 10 mounted between needle frame 6 and the support surface 4. The needle frame 6 is mounted biased away from plate 10 using springs 9 positioned between needle plate 6 and frame plate 10.

[0032] Needle plate 6 holds needles 7 which have a longitudinal axis 9. These needles are held in such a way that they can move freely in upwards direction along longitudinal axis L.

[0033] Figure 2 shows the device of Figure 1 in a transverse cross section. In this embodiment, there are two rows of needles 7 mounted in the device 1. In this view, the band of transport band 2 has been removed in order to view to transport rolls 11 and 12.

[0034] Figure 3 shows the detail already indicated in Figure 1. In this detailed cross section, the frame plate 10 is attached to frame 5 of the device which is the earth bounded reference frame. The needle frame 6 is spring-coupled to this frame plate 10 to be able to move to and away from this frame plate 10. Needle plate 6 is provided with microperforations which hold a holder 13 for a needle 12. Attached on top of holder 13 is a weight 14. Furthermore attached to holder 13 between weight 14 and needle plate 6, is a stop 15. The needle assembly 7 does move freely upwards with respect to needle plate 6. The position of needle assembly stop 15 together with the distance between the needle plate 6 and frame plate 10 define the depth with which the needle 12 can puncture a foil 3.

[0035] In this embodiment, actuators 8 are adapted to have a pushing member 17 which can move up and down in order to urge needle plate 6 towards frame plate 10. In this embodiment, the length of part 17 can be modified in order to adjust the penetration depth of needle 12. In this embodiment, support plate 6 has a support plate layer of compressible material 17. It was found that when using a compressible material, such as a rubbery polyurethane layer, it was possible to puncture for instance a polymer film using needle 12 in such a way that well defined, round microperforations can be made.

[0036] Figure 4 shows a top view of the device for puncturing a series of perforations 1. Again, the same reference numbers as before are used.

[0037] In operation, first the needle frame and weight on the needles and the vertical positions of the needles is set in such a way that a part of the tips remains out of the film material. In other words, the tip preferably does not fully puncture the film material. This provides a film material with tapered holes. It was found that such holes provide a valve action, thus allowing a proper moisture balance in a packaging for for instance food products. For instance for fresh fruit.

[0038] The transport unit transports the film material a working length into the device. The actuator then urges the needle frame down. The needles this puncture the film material. The actuator releases the film frame. The needles thus come free from the film material, because the needle frame is pushed up by the biasing force of the springs. Subsequently, the transporter advances the film material a working length in order to provide a fresh, unpunctured length of material. This process is repeated of a full length of film material. It is clear that the device can easily be incorporated in a packaging line. For instance, the device can be placed in a deep-draw packaging line, Vertical form fill and seal machines, Topseal machines, flowwrappers, L bar sealers.

[0039] It will also be clear that the above description and drawings are included to illustrate some embodiments of the invention, and not to limit the scope of protection. Starting from this disclosure, many more embodiments will be evident to a skilled person which are within the scope of protection and the essence of this invention and which are obvious combinations of prior art techniques and the disclosure of this patent.

Claims

1. A device for punching series of microperforations in a length of film material, like a polymer foil, comprising a planar support surface for supporting said film material, a needle frame mounted reciprocatingly movable above said support surface, said needle frame holding a series of needles with their needle tips towards said support surface and which are mounted in said needle frame to be substantially freely movable in their longitudinal direction, said de-

vice further comprising an actuator for reciprocate said needle frame towards said support surface for bringing the tips of said needles in contact with said support surface.

2. The device according to claim 1, wherein said needle frame is biased away from said support surface.
3. The device according to claims 1 or 2, wherein each needle has a weight near said end away from said tip, for urging said needle towards said support surface.
4. The device according to claims 1-3, further comprising a transporter for advancing a band of said film material through said device over said support surface.
5. The device according to any one of the preceding claims, further comprising a controller for instructing said transporter to advance said film material a pre-defined length over said support surface, stopping said film material, and for after stopping said film material activating said actuator to move said needle frame in the direction of said support surface for said needles to puncture said film material.
6. The device according to any one of the preceding claims, wherein said support surface comprises a layer of compressible material.
7. The device according to any one of the preceding claims, wherein said layer of compressible material comprises a top layer of polyurethane, for instance a layer of material commercially known as habasiet®.
8. The device according to any one of the preceding claims, wherein said tips of the needles are adapted to make perforations have a cross section for providing a liquid-tight film material, preferably of about 50-300 micron.
9. The device according to any one of the preceding claims, wherein said needles are positioned in said frame and the length of said tips are adapted to have the tips extend through the film material.
10. The device according to any one of the preceding claims, wherein said needles are positioned in said needle frame to produce a matrix of perforations.
11. The device according to any one of the preceding claims, wherein said film material is for sealing a product, and said film material has a product side directed towards the product to be sealed, and an outside directed away from said product, and said film material is provided in said device with its outside on said planar support surface and said device punc-

tures said film from the product side.

12. A method for punching series of microperforations in a length of polymer film, wherein a part of said polymer film is advanced over a planar support surface and is rested on said planar support surface, a frame provided with a series of needles which are free moveable in their longitudinal direction is moved downward with the tips of the needles piercing the part of polymer film until they rest on said planar support surface, said frame is moved upward away from said polymer film until said needles are free from said polymer film, and said punctured part of polymer film is advanced further until a new part of unpunctured polymer film rests on said planar support surface.
13. The method of claim 12, wherein said microperforations have cross section of 50-300 micron, wherein said polymer film, preferably thermoplastic polymer film, has a thickness of about 10-50 micron.
14. The method of claim 12 or 13, wherein said polymer film is for sealing a product, and said polymer film has a product side directed towards the product to be sealed, and an outside directed away from said product, and said film material is advanced with its outside on said planar support surface and punctured from the product side.
15. A polymer film material for use in food packaging, said film material having a food side directed towards the food to be packed, and an outside directed away from said food, said film material having a thickness of about 10-50 microns and comprising about 1-1600 microperforations per square metre, wherein said microperforations are about 50-300 microns in cross section and are tapered towards the outside.

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Fig 1

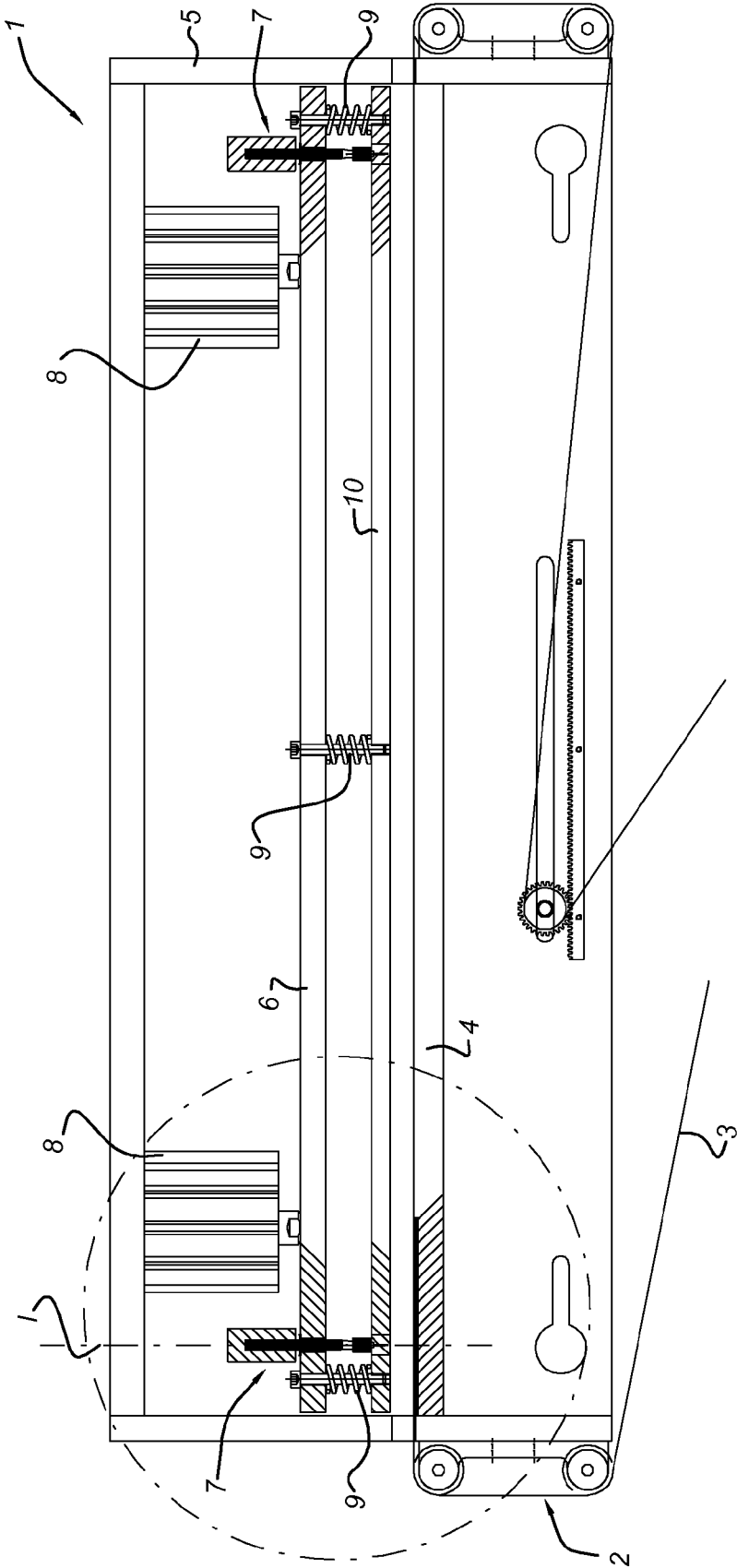


Fig 2

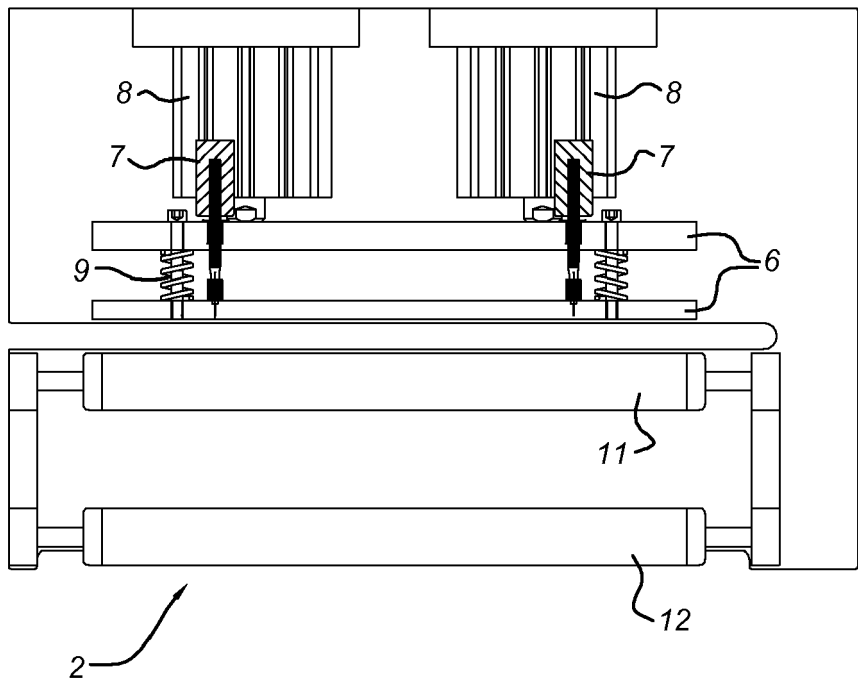


Fig 3

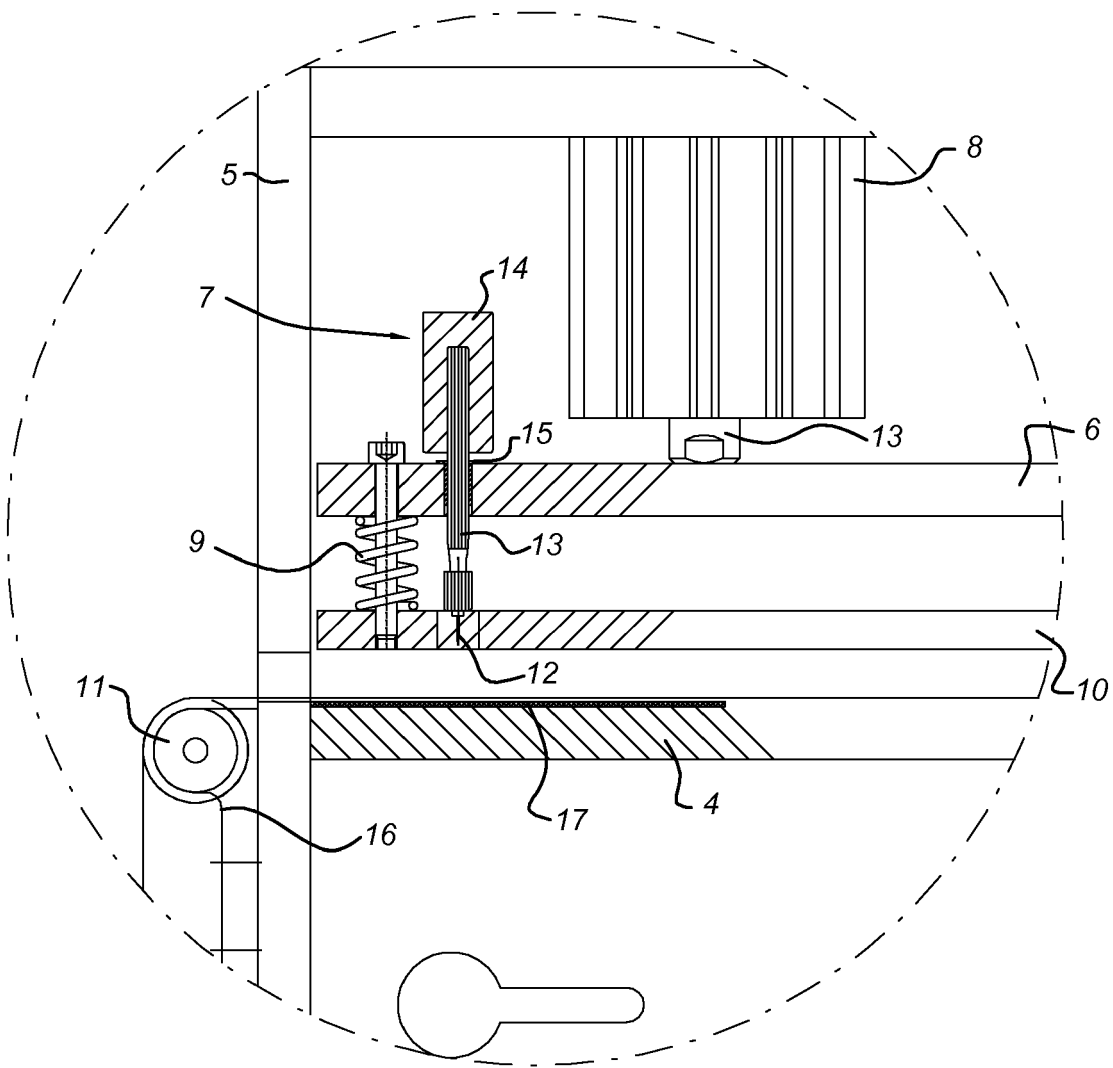
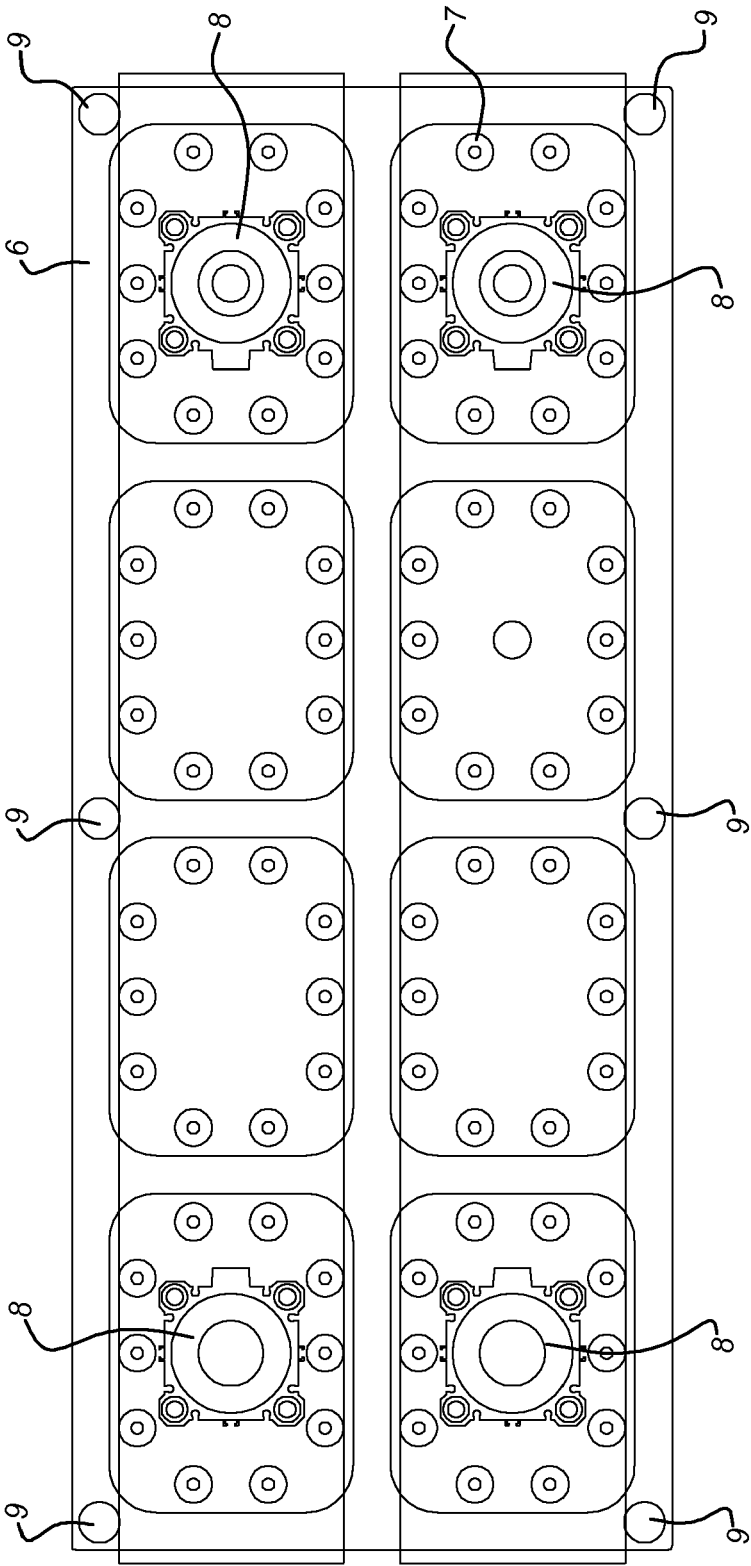


Fig 4





EUROPEAN SEARCH REPORT

Application Number
EP 08 16 7425

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 March 2009	Examiner Canelas, Rui
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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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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