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(54) **A COMB**

(57) The invention provides a comb comprising a base (2) and a plurality of pins (30),
- the pins (30) protruding, in a protrusion direction (x), from the base (2) to distal ends (302) of the pins,
- the pins forming a row (3) of pins in a row direction (y) which is transverse to the protrusion direction,
- wherein the pins comprise respective roots (301), the roots being confined to the base (2) without being fixed to the base,
- the comb comprising pushing means (4) arranged to push, at a distance from the roots (301), the pins (30) together so that adjacent pins are pressed towards each other,
- wherein the base (2) comprises first and second restriction devices (2011, 2031) on respective transverse sides of the row (3) of pins, the first and second restriction devices restricting, at a distance from the roots, movements of the pins (30) in a restriction direction (z) which is transverse to the protrusion direction and to the row direction,
- wherein the roots (301) of the pins are restrained so as to allow the pins (30) to undergo a limited rotation in relation to the base (2) around a respective axis at the respective root, which axis is parallel to the restriction direction.

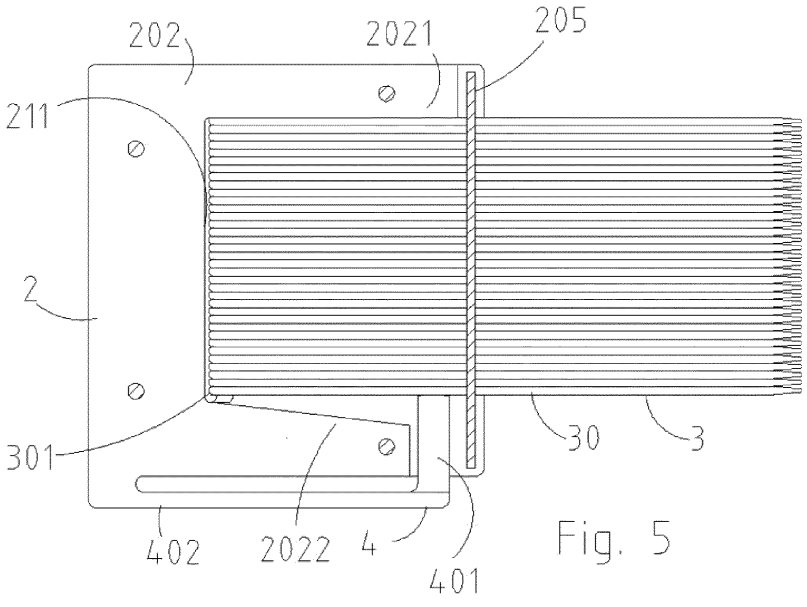

Fig. 5

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Description

TECHNICAL FIELD

[0001] The invention relates to a comb, in particular a lice comb, comprising a base and a plurality of pins.

BACKGROUND

[0002] A lice comb typically comprises a base, forming a handle for a user of the comb. The comb further typically comprises a row of a plurality of pins. Each pin may protrude from the base to a distal end of the respective pin. The pins may be provided as narrow teeth. The pins may be used for untangling or arranging hair. The comb may be used to remove head lice. More specifically, the pins may be used for trapping and removing lice and nits (eggs of lice) present in the hair. The hair may be human hair, or hair of an animal, such as a dog.

[0003] However, lice may not be effectively caught by the pins. Also, nits, attached to respective strands of hair, might not be removed by the comb.

[0004] US5873374 suggests providing a comb with pins that are rugged on their peripheral surface. It is suggested that this will more effectively remove foreign elements. The ruggedness is provided by cutting in the pins a helical groove or several parallel circumferential grooves. However, such grooves might damage the hair.

[0005] GB157572A discloses a comb in which pins of the comb are threaded on a steel wire, the ends of which are mounted in recesses of adjusting screws. However, the comb described in relatively complicated, and therefore complicated and expensive to manufacture. In addition, a translation of the pins provided by the suggested comb risks of causing a "drawer effect" whereby the pins get stuck.

SUMMARY

[0006] It is an object of the invention to provide a comb that effectively removes foreign elements, such as lice and nits, from hair. It is a further object of the invention to provide a comb that effectively removes foreign elements from hair, while avoiding or minimising damage to the hair. It is a further object of the invention to provide a comb that effectively removes foreign elements from hair, and that is easy to manufacture.

[0007] The objects are reached by a comb comprising a base and a plurality of pins. The pins protrude, in a protrusion direction, from the base to distal ends of the pins. The pins form a row of pins in a row direction which is transverse to the protrusion direction. The pins comprise respective roots, the roots being confined to the base without being fixed to the base. The comb comprises pushing means arranged to push, at a distance from the roots, the pins together so that adjacent pins are pressed towards each other. The base comprises first and second restriction devices on respective sides of the row of pins, the first and second restriction devices restricting, at a distance from the roots, movements of the pins in a restriction direction which is transverse to the protrusion direction and to the row direction. The roots of the pins are restrained so as to allow the pins to undergo a limited rotation in relation to the base around a respective axis at the respective root, which axis is parallel to the restriction direction.

[0008] The pushing means may be arranged to push in the row direction. The pushing means is arranged to push, at a distance from the roots, the pins together. The pushing means may in addition push the pins closer to the roots, or at the roots. Thus, the pushing means may be arranged to push, at least at a distance from the roots, the pins together. Preferably, each pin protrudes in the protrusion direction, at least when the pins are pushed together.

[0009] The restriction devices may form parts of a housing formed by the base, for parts of the pins. The restriction devices are preferably, in the restriction direction, located on opposite sides of the row of pins. Preferably, at least parts of the restriction devices are located at a region at a distance from the roots, from which region, the pins protrude from the base. Thereby, movements of the pins in the restriction direction, may be restricted at the region from which the pins protrude from the base. Thereby, the pins, or at least the protruding portions thereof, may be aligned where strands of hair pass between pins during use of the comb. In some embodiments, the restriction devices may extend from the pins roots, along the pins, to the region from which the pins protrude from the base. However, in some embodiments, the restriction devices extend from the region, from which the pins protrude from the base, towards the roots, but stop short of the roots.

[0010] As exemplified below, the pushing means may be pushed by a manual force of the comb user, towards the pins. Alternatively, the pins may be pushed by the pushing means by some other means, e.g. by spring force. Thereby, the restriction devices may prevent or restrict movements of the pins in the restriction direction. A tendency for such out of plane movements of the pins may be caused by the pushing means pushing the pins together along the row of pins.

[0011] The roots of the pins are confined in relation to the base without being fixed to the base. The pin roots may be restricted or restrained to the base. The roots of the pins may be confined, by the base and in relation to the base, in the pin row direction. Thereby, the pins may be arranged so that when pushed together by the pushing means, the roots of adjacent pins are pushed into contact with each other. The comb may be arranged so that the pin roots are allowed to make limited movements, in relation to the base, along the row of pins. The comb may be arranged so that the pin roots are allowed to make limited movements, in relation to each other, along the row of pins. The pin roots may be brought to be in contact with each other by the pushing means. Thereby, a parallel

arrangement of the pins, or at least protruding portions thereof, when the pins are pushed together may be allowed. Thereby, the comb may be relatively short in the protrusion direction. In a traditional comb, if the pins of a comb are pushed together, they will not be parallel, since the pin center axes will be further apart at the pin roots than at a distance from the roots.

[0012] The roots of the pins are restrained, e.g. by the base, so as to allow the pins to undergo a limited rotation in relation to the base around a respective axis at the respective root, which axis is in the restriction direction. Thereby, each pin may be confined by the base, or by the base and the pushing means. Thereby, separation of the pins, at a distance from the roots, may be allowed. This may advantageous during an initial phase of a hair lice comb treatment, to untangle hair. Thereby, one or more of the pins may extend in a small angle to the protrusion direction. Therefore, herein the protrusion direction may be understood as a direction in which the pins protrude when pushed together by the pushing means.

[0013] The invention allows for the pins to be pushed together, while the pins are moved through the hair of a person. The invention further allows this to be done while restricting pin movements in the restriction direction. Thereby, the pins, or at least the protruding portions of the pins, may be kept aligned while being pushed together. Thereby, tufts of hair may be squeezed between the pins. Thereby, the likelihood of lice being caught by the pins is increased. Also, the force, with which the pins are pushed together, may remove or crush nits attached to strands of hair pulled between the pins. Nevertheless, the pins may present a smooth surface, so that damage to the hair is avoided or minimised.

[0014] The arrangement of the roots of the pins to be restrained, e.g. by the base, so as to allow the pins to undergo a limited rotation in relation to the base around a respective axis in the restriction direction, allows for avoiding a "drawer effect", which could entail an arrangement where the pins are translated in the row direction.

[0015] Also, the rotation of the pins, allowed by embodiments of the invention, provides for embodiments of the comb which are easy to manufacture. The roots of the comb may be restricted to the base in a manner which makes the comb simple to manufacture.

[0016] Preferably the respective axes around which the respective pins are allowed to undergo a limited rotation, are located an engagement location in which the pins are restrained by the base in the protrusion direction. This further secures avoiding said "drawer effect".

[0017] In some embodiments, the roots of the pins extend in a non-zero angle to respective major portions of the pins. The major portion of each pin may be substantially straight. Thereby, the roots may be retrained by the base. The base may surround the roots transversally to the roots. The base may surround the roots in a radial direction of the roots. Each root may be surrounded by the base, or by the base and one or more adjacent pin roots. Thereby, each pin may also be restrained, without being fixed to the base, in a direction of the major portion.

[0018] The base may comprise a slot extending along the row of pins, wherein the roots extend into the slot. The slot may extend in the row direction. As stated, the base comprises restriction devices on respective sides of the row of pins, the restriction devices restricting, at a distance from the roots, movements of the pins in the restriction direction. Thereby, the base may house portions of the pins, without fixing them.

[0019] In some embodiments, where the roots of the pins extend in a non-zero angle to the major portions, the roots are arranged in a cascaded manner in the base.

[0020] Thereby, embodiments which are particularly easy to manufacture, e.g. according to embodiments of the method exemplified herein, are provided.

[0021] Preferably, a difference between a length of the slot and a combined extension of the pins in the row direction is less than the individual extension of the roots transverse to the protrusion direction. This may prevent the pins to be turned around axes in the protrusion direction, and moved out of base.

[0022] It is understood that the combined extension of the pins may be the extension of the row of pins in the row direction. Thereby, the pins may be abutting. The extension of the roots transverse to the protrusion direction may be the extension of the roots transverse to pin main portions.

[0023] As exemplified below, in some embodiments, the base comprises two slots. The slots may be distributed on opposite sides, in the restriction direction, of the major portions of the pins. Thereby, the root of each pin may extend in a non-zero angle, e.g. substantially perpendicularly, to the major portion of the pin. The root may extend into the slots. Thereby, the root forms two projections, extending into a respective of the slots.

[0024] In such embodiments, where two slots are provided, in which respective parts of the root are inserted, a difference between a length of the slots and a combined extension of the pins in the row direction is less than the individual extension of the roots transverse to the protrusion direction.

[0025] As exemplified below, in some embodiments, the base comprises a bar. The bar may extend in the row direction. The engagement between the pins and the base may be provided by the bar extending through holes in the pins. The holes may be larger than the transverse extension, e.g. the diameter, of the bar.

[0026] Preferably the pushing means is arranged to push the pins together at a distance from an engagement location in which the pins are restrained by the base in the protrusion direction. Thereby, a moment arm may be provided for the pushing means. The pushing means may be arranged to push the pins together only between the pin distal ends and the engagement location.

[0027] The pushing means may comprise a pushing device adapted to be in contact with an end of the row of pins. The pushing device may extend towards an end of the row of pins. The pushing device may extend in a

plane formed by the protrusion direction and the row direction. The pushing device may be arranged to push onto a pin at an end of the row of pins. The base may comprise a counteracting device on other side of row of pins, arranged to counteract a pushing force of the pushing means when the pins are pushed together by the pushing means.

[0028] The pins may be allowed to move apart at the pushing device, e.g. when the pins are not pushed together by the pushing device. This may facilitate initial untangling of the hair, before the comb is used with the pins pushed together.

[0029] Preferably, first and second guide devices are provided to restrict movements of the pushing device in the restriction direction. Thereby, the pushing device may be effectively directed towards the pins.

[0030] The first and second guide devices may be comprised by the base, wherein the first and second guide devices are located on respective sides of the pushing device. The pushing device may extend towards the end of the row of pins, between the guide devices. In some embodiments, the guide devices may be formed by the same parts, e.g. layers of the base, forming the restriction devices. In some embodiments however, the restriction devices and the guide devices may be formed by separate parts of the base. In further embodiments, the guide devices may be provided fixed to, or as part of, the pushing device. Nevertheless, in additional embodiments, the comb may be provided without any guide devices to restrict movements of the pushing device in the restriction direction.

[0031] The pushing device may be located at a distance from the pin roots. The pushing device may be located at a distance from the pin distal ends. The pushing device may be, in the protrusion direction, located between the pin roots and a region at which the pins protrude from the base. This may reduce a risk of hair getting tangled on the pushing device. The pushing device is preferably closer, in the protrusion direction, to the region at which the pins protrude from the base than to the pin roots. Thereby, the pins may be firmly pushed together in the region at which the pins protrude from the base. This is beneficial since during use a lot of hair strands will be present at or close to said region. The distance, in the protrusion direction, between the restriction devices and the roots, may be larger than the distance, in the protrusion direction, between the pushing device and the roots.

[0032] The comb may be arranged to allow limited movements of the pins, while confining them to the base. The pins may be restrained, in relation to the base, e.g. by the base, in the restriction direction.

[0033] The pins may be restrained, in relation to the base, e.g. by the base, in the protrusion direction. The restriction of the pins in the protrusion direction may be provided by an engagement between the pins and the base. For example, the engagement may be provided by the roots extending in a non-zero angle to respective major portions of the pins, and the roots extending into a slot in the base, as mentioned above. In other embodiments, the engagement between the pins and the base may be provided by a bar extending through holes in the pins. The bar may extend in the row direction, e.g. as exemplified below.

[0034] The engagement between the pins and the base may coincide with an engagement region. The pins may extend, in the protrusion direction, from the roots to the distal ends of the pins.

[0035] The roots and the engagement region may be at the same position along the protrusion direction, e.g. where the engagement is provided by the roots extending in a non-zero angle to respective major portions of the pins, and the roots extending into the slot in the base.

[0036] In some embodiments, the root is located on a side of the engagement region, or the engagement between the pins and the base, which is opposite to the distal ends. Thereby, preferably, the distance between the roots and the engagement region is less than two times, more preferably less than one time or less than 0.5 times, the extension of the pins in the restriction direction.

[0037] Thereby, the allowance of the pins to undergo a limited, or restricted, rotation in relation to the base around the respective axis in the restriction direction, is secured. More specifically, the axis of rotation of a pin may be the root of the pin, and since the root coincides with, or is close to, the engagement region, translational movements of the pins in the engagement region, along the row direction, will be none or small.

[0038] As exemplified below, movements of the pins along the row of pins, may be restricted. In particular, rotations of the pins around the axis in the restriction direction, may be restricted by on one hand a counteracting device, and on the other hand the pushing means or a limitation device. Thereby, the counteracting device, and the pushing means or limitation device, may be located on opposite sides of the pins in the row direction.

[0039] The pins may be, e.g. by the base, prevented from, or restricted in, a rotation, in relation to the base, around an axis which is parallel to the row of pins. The pins may be prevented from, or restricted in, a rotation, in relation to the base, around an axis which is parallel to the protrusion direction. The pins may be, e.g. by the base or by the base and the pushing device, prevented from, or restricted in, a rotation, in relation to the base, around an axis which is in the restriction direction.

[0040] Preferably, the comb is arranged to that the pins, or at least protruding portions thereof, are parallel when pushed together by the pushing means. Thereby, gaps between the pins, when pushed together, may be avoided. The protruding portions may extend between a region where the pins protrude from the base and the respective distal ends.

[0041] As suggested, in some embodiments, the pushing means comprises a pushing device arranged to be manually pushed so as for the pushing device to push

the pins together.

[0042] In some embodiments, the pushing device are arranged to be pushed by a spring force so as for the pushing device to push the pins together. The spring force may be adjustable. In some embodiments, an elastic element is arranged to introduce a spring force between the pushing device and the base. Thereby, the elastic element is arranged to introduce a spring force between the pins and the base. The elastic element, e.g. a spring, may be provided between the pushing device and the base. In some embodiments, an elastic element is provided between the pushing device and a manoeuvring device. Thereby, a spring force is provided between the pushing device and the base. The manoeuvring device may be used to adjust a force with which the pins are pushed together. In some embodiment, a spring force may counteract movements of the pins away from each other.

[0043] In some embodiments, the pushing device forms an elastic device. Thereby, the elastic device may be in direct contact with the pin at an end of the pin row. Thereby, the elastic element is arranged to introduce a spring force between the pins and the base.

[0044] In some embodiments, the pushing means comprises a pushing device adapted to be in contact with an end of the row of pins, wherein the pushing means further comprises a manoeuvring device, wherein the pushing device is connected to the manoeuvring device, wherein the manoeuvring device and pushing device are arranged so as for the manoeuvring device to be moved towards the pins in the restriction direction whereby the pushing device push the pins together.

[0045] The pushing device may be connected to the manoeuvring device outside of the pins as seen in the row direction. The pushing device may be arranged to extend towards the end of the row of pins, in a plane formed by the row direction and the restriction direction, in a non-zero angle to the row direction and to the restriction direction.

[0046] The manoeuvring device may be provided in the form of a cantilevered beam, which is fixed to the base closer to the pin roots than to the pushing device. Thereby, the manoeuvring device may be located outside one of the restriction devices. Thereby the manoeuvring device may be located at a distance from the restriction device. Thereby, the pushing device may be provided at a distal end of the manoeuvring device. Thereby, the manoeuvring device may be cantilevered so that it can be flexed at its distal end towards the pins.

[0047] Said restriction device may extend from the pins roots towards the pin distal ends, and terminate with a restriction device boundary. The manoeuvring device may extend past the restriction device boundary. The pushing device may be located between the restriction device boundary and the pin distal ends. Thereby, the pushing device may be located closer to the restriction device boundary than to the pin distal ends.

[0048] Thereby, when the manoeuvring device is pushed towards the pins by a user, an end of the pushing device, opposite to the manoeuvring device, push the pins together. Thereby, the pushing device is arranged to push the pins together. This is advantageous, since the user may hold the comb without any pushing action of the pushing means, and provide such a pushing action without changing the hand grip of the comb.

[0049] The pushing device may be connected to the manoeuvring device in any suitable manner. The pushing device may be mounted to the manoeuvring device. The pushing device and the manoeuvring device may be integrated with each other. The pushing device may be connected to the manoeuvring device by a flexible joint.

[0050] Preferably, the base comprises preventing means to prevent pins to move, at a distance from the roots, in the restriction direction. Thereby, gaps between the pins, e.g. when pushed together, may be securely avoided. Thereby, a plane may be formed by the pin row. The plane may be formed by the pins, or at least the protruding portions thereof, when the pins, or at least the protruding portions thereof, are aligned.

[0051] The preventing means may comprise first and second prevent devices each extending along the row of pins, at a distance from the roots, on a respective side of the pins. The prevent devices may extend along the row of pins at a distance from the distal ends. The pins may be arranged to move apart, along the row of pins, at the prevent devices.

[0052] The distance, in the protrusion direction, between the prevent devices and the roots, is preferably larger than the distance, in the protrusion direction, between the pushing device and the roots. Thereby, the risk of hair getting tangled on the pushing device is reduced.

[0053] The second prevent device may be arranged to as to be pushed towards the pins, so as to push the pins against the first prevent device. The second prevent device may be arranged to as to be pushed permanently, e.g. by spring force, or by actuation, e.g. manual, so as to push the pins against the first prevent device. The second prevent device may be pushed towards the pins, so as to push the pins against the first prevent device, while the pushing means pushes the pins together along the row of pins. Thereby, a strong squeezing force between the pins may be provided with a minimal risk of gaps between the pins.

[0054] The first prevent device may be formed by the first restriction device. The second prevent device may be provided in addition to the second restriction device. Alternatively, the second prevent device may be formed by the second restriction device. Thus, in some embodiments, the first and second prevent devices may be formed by the first and second restriction devices. Thereby, the first and second restriction devices may be squeezed together, to prevent pins to move in the restriction direction.

[0055] The objects are also reached with a comb comprising a base and a plurality of pins, the pins protruding,

in a protrusion direction, from the base to distal ends of the pins, the pins forming a row of pins in a row direction which is transverse to the protrusion direction, wherein the pins comprise respective roots, the roots being confined to the base, wherein the base comprises first and second restriction devices on respective transverse sides of the row of pins, the first and second restriction devices restricting, at a distance from the roots, movements of the pins in a restriction direction which is transverse to the protrusion direction and to the row direction, the comb comprising pushing means arranged to push, at a distance from the roots, the pins together so that adjacent pins are pressed towards each other, wherein the pushing means comprises a pushing device adapted to be in contact with an end of the row of pins, wherein the pushing means further comprises a manoeuvring device, wherein the pushing device is connected to the manoeuvring device, wherein the manoeuvring device and pushing device are arranged so as for the manoeuvring device to be moved towards the pins in the restriction direction whereby the pushing device push the pins together. The pushing means may be, in the protrusion direction, closer to a region, at which the pins protrude from the base, than to the roots.

[0056] The pushing device may be arranged to extend towards the end of the row of pins, in a plane formed by the row direction and the restriction direction, in a non-zero angle to the row direction and to the restriction direction. The manoeuvring device may be provided in the form of a cantilevered beam, which is fixed to the base closer to the pin roots than to the pushing device. The advantage of a comb with such pushing means has been explained above. In embodiments with such pushing means, the roots of the pins may be confined in relation to the base without being fixed to the base. Alternatively, the roots may be fixed to the base. Thereby, the roots may be in permanent contact with each other.

[0057] The objects are also reached with a method of manufacturing a comb according to embodiments of the invention, wherein the roots of the pins extend in a non-zero angle to respective major portions of the pins, wherein the base comprises a slot extending along the row of pins, wherein the roots extend into the slot, the method comprising positioning a plurality of pins in fixing positions in a pin positioning jig, with distal ends of the pins in positions in relation to each other, which the distal ends will have in the comb, locking the pins to the positioning jig with the pins in the fixing positions, bending, while the pins are locked to the positioning jig with the pins in the fixing positions, ends of the pins, which ends are opposite to the distal ends, and mounting at least a portion of the base to the pins, while the pins are locked to the positioning jig with the pins in the fixing positions, thereby introducing the bent ends of the pins into a slot in the base. Thereby, a time effective manner of bending the pins, and assembling them with the base, is provided.

[0058] Further advantages and advantageous features of the invention are disclosed in the following description and in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0059] Below, embodiments of the invention will be described in detail with reference to the drawings, in which

- fig. 1 - fig 3 show views, in three orthogonal directions, of a comb according to an embodiment of the invention,
- fig. 4 shows a cross-sectional view, with the section oriented as indicated with the arrows IV-IV in fig. 1,
- fig. 5 shows a cross-sectional view, with the section oriented as indicated with the arrows V-V in fig. 3,
- fig. 6 - fig. 11 depicts steps in an embodiment of a method of manufacturing a comb according to an embodiment of the invention,
- fig. 12, shows an alternative embodiment of the comb, in a view corresponding to the view in fig. 5,
- fig. 13a shows a view corresponding to the view in fig. 5, of a further alternative embodiment of the invention,
- fig. 13b shows a cross-sectional view, with the section oriented as indicated with the arrows XIIIb-XIIIb in fig. 13a,
- fig. 14 shows a cross-section of yet another embodiment of the invention, the section being located similarly to that of fig. 13b,
- fig. 15 shows a further alternative embodiment of the invention, in a view corresponding to the view in fig. 1,
- fig. 16 shows a perspective view of a portion of a comb according to another embodiment of the invention,
- fig. 17 shows a comb according to a further embodiment of the invention, in a view corresponding to the one in fig. 4,
- fig. 18 shows a cross-section of the comb in fig. 17, with the section oriented as indicated by the arrows p2-p2 in fig. 17,
- fig. 19 shows a comb according to yet another embodiment of the invention, in a view corresponding to the one in fig. 4, and
- fig. 20 shows the comb in fig. 19 in a view corresponding to the one in fig. 5
- fig. 21 is a plan view of a comb according to a further embodiment of the invention,
- fig. 22 shows the comb in fig. 21 as seen in a direction indicated by the arrow XXII in fig. 21,
- fig. 23 shows a cross-section of the comb in fig. 21 with the section oriented as indicated by the arrows XXIII-XXIII in fig. 21
- fig. 24 shows a comb according to another embodiment of the invention, in a view corresponding to the view in fig. 22,
- fig. 25 shows the comb in fig. 24 in a view corresponding to the view in fig. 23,
- fig. 26 shows a comb according to a further embodiment of the invention, in a view corresponding to the

view in fig. 22, and

- fig. 27 shows a plan view of a comb according to another embodiment of the invention.

DETAILED DESCRIPTION OF EMBODIMENTS OF THE INVENTION

[0060] Fig. 1 - fig 3 show views of a comb according to an embodiment of the invention. The comb comprises a base 2 and a row 3 of pins 30. The comb may comprise any suitable number of pins, e.g. 20-55 pins, in this example 35 pins. The pins may be made in any suitable material, e.g. stainless steel. The pins may be made from rods. The pins may have a circular cross-section. The diameter of the pins may be e.g. 0.7 - 1.5 mm, e.g. around 1 mm. The pins may have a smooth surface. In alternative embodiments, the pins may have a serrated or jagged surface.

[0061] Reference is made also to fig. 4 and fig. 5. Each pin 30 comprises a root 301. The root is confined to the base 2 as exemplified below. Each pin protrudes, in a protrusion direction, from the base to a distal end 302 of the pin.

[0062] The protrusion direction of the pins is indicated with the x-axis in fig. 1 and fig. 2. The direction of the row 3 of pins, herein also the row direction, is transverse to the protrusion direction of the pins 30. The row direction is indicated with the y-axis in fig. 1. A plane formed by the row of pins is parallel to a plane formed by the x-axis and y-axis in fig. 1. A direction transverse to the plane formed by the row of pins is indicated with the z-axis in fig. 2. This direction is herein also referred to as a restriction direction.

[0063] As exemplified below, the pins 30 are not fixed to the base 2. The roots 301 of the pins are restrained, by the base and in relation to the base, in the row direction y.

[0064] The base has a length in the protrusion direction x. The base has a width which is transverse to the length. The width is in the row direction y. The base has a thickness which is transverse to the length and width of the base. The length and width are larger than the thickness.

[0065] In this example, the base 2 comprises a first, a second, and a third layer 201, 202, 203. The second layer is interposed between the first and third layers. The layers are held together with bolted connections 204. Alternatively, rivets, or adhesive may be used to hold the layers together. In some embodiments, the first and second layers 201, 202 may be combined into a single layer. The base 2, or layers thereof, may be made in any suitable material, e.g. nylon plastic, aluminium, or stainless steel. The base, or layers thereof, may be made in any suitable manner, e.g. from sheet material, by injection moulding, or by additive manufacturing.

[0066] A major portion 303 of each pin is substantially straight. The base 2 comprises a slot 211. The slot 211 is formed in the first layer 201. As exemplified in fig. 5, the slot extends along the row 3 of pins. As exemplified in fig. 4, the root 301 of each pin extends in a non-zero angle, in this example perpendicularly, to the major portion 303 of the pin. The roots 301 extend into the slot 211. The width of the slot is larger, preferably slightly larger, than the width of the pins 30. Thereby, the pins are, without being fastened to the base, restrained, in relation to the base, in the protrusion direction. I.e., each pin 30 is restrained, in relation to the base, in a direction of the major portion 303 of the pin.

[0067] Thereby, the roots 301 of the pins are restrained so as to allow the pins 30 to undergo a limited rotation in relation to the base 2 around a respective axis RA at the respective root, which axis is parallel to the restriction direction z, (fig. 4). The respective axes RA around which the respective pins 30 are allowed to undergo a limited rotation, are located at an engagement location EL in which the pins are restrained by the base in the protrusion direction x.

[0068] The base comprises first and second restriction devices 2011, 2031 on respective sides of the row 3 of pins. In this example, the restriction devices extend from the pin roots 301, along the pins 30, and to a region 222 at a distance from the roots, from which region, the pins protrude from the base. Alternatively, the restriction devices may extend from a distance from the roots to the region 222 from which the pins protrude from the base. Thereby, there may be openings in the base, between the roots and the restriction devices.

[0069] In this example, the first and second restriction devices 2011, 2031 are formed by respective parts of the first and third layers 201, 203. The first and second restriction devices 2011, 2031 restrict movements of the pins 30 in the restriction direction z. In fig. 5, the plane formed by the row of pins is parallel with the plane of the drawing. As suggested below, there might be some limited movement of pins in the restriction direction z, which is transverse to the row direction y and to the protrusion direction x. Nevertheless, herein the plane formed by the row of pins is defined as a plane formed by the pins when they are in the same position in the restriction direction.

[0070] The distance between the first and second restriction devices 2011, 2031 is larger, preferably slightly larger, than the width of the pins 30. For example, the distance between the first and second restriction devices 2011, 2031 may be 0.1-1.0 mm, or 0.1-0.5 mm, e.g. approximately 0.2 mm, larger than the width of the pins 30. Thereby the pins are prevented from being squeezed between the first and second restriction devices 2011, 2031.

[0071] As can be seen in fig. 5, the comb comprises pushing means 4 arranged to push the pins 30 together so that adjacent pins are pressed towards each other. The pushing means 4 is arranged to push the pins together in the row direction y. The pushing means 4 is arranged to push the pins at a distance from the roots 301. More specifically, the pushing means 4 is arranged to exert, at a distance from the roots 301, a pushing force onto one of the pins 30, located at one of the ends of the

row 3 of pins.

[0072] The base comprises a counteracting device 2021 on other side of row of pins, arranged to counteract the pushing force of the pushing means 4, when the pins are pushed together by the pushing means. In this example, the counteracting device is formed by a part of the intermediate, second layer 202 of the base. In alternative embodiments, the counteracting device 2021 may be formed as a separate device, or as a part of the first layer 201, or the third layer 203 (fig. 4).

[0073] In this example, the base comprises a limitation device 2022 located on the same side of the row 3 of pins as the pushing means 4. In this example, the limitation device 2022 is formed by a part of the intermediate, second layer 202 of the base. In alternative embodiments, the limitation device 2022 may be formed as a separate device, or as a part of the first layer 201, or the third layer 203 (fig. 4).

[0074] When the pins are not pushed, movements of the pins along the row of pins, are restricted by, on one hand the counteracting device 2021, and on the other hand the pushing means or limitation device 2022. Movements of the pins along the row of pins, may also be restricted by ends of the slot 211. Preferably, the slot 211 is longer, preferably slightly longer, than the row of pins when the pins are pushed together. Thereby, the pin roots 301 are allowed to make, at least when the pins are not pushed together, limited movements, in relation to the base, along the row of pins. Thereby, the pin roots are allowed to make limited movements, in relation to each other, along the row of pins. Also, the pins are thereby arranged so that when pushed together by the pushing means 4, the roots 301 of adjacent pins are pushed into contact with each other. This may ensure that the pins are parallel when pushed together.

[0075] The pushing means 4 comprises a pushing device 401 adapted to be in contact with an end of the row of pins. The pushing device extends, in the plane formed by the row 3 of pins, towards an end of the row of pins, between guide devices 2013, 2033, as can also be seen in fig. 3. The guide devices 2013, 2033 restrict movements of the pushing device out of the plane formed by the row of pins. In this embodiments, the restriction devices 2011, 2031, and the guide devices 2013, 2033 are all formed by the first and thirds layers 201, 203 of the base. However, in some embodiments, the restriction devices and the guide devices may be formed by separate parts of the base.

[0076] The pushing device 401 is located, in the protrusion direction, at a distance from the pin roots 301, and at a distance from the pin distal ends 302. The pushing device is arranged to push onto the pin at an end of the row of pins.

[0077] As illustrated in fig. 5, an elastic element 402 is provided between the pushing device 401 and the base 2. In this example, the elastic element 402 is formed by a beam. The beam 402 extends from the base, on a side thereof. The beam extends substantially in parallel with the pins 30.

[0078] The pushing device 401 is formed as a tongue. The pushing device 401 extends from the elastic element 402, towards the pins 30. The pushing device 401 extends between the guide devices 2013, 2033. The extension of the pushing device, in the restriction direction, is slightly smaller than the distance between the guide devices 2013, 2033. Thereby, the pushing device is not squeezed between the guide devices 2013, 2033.

[0079] The pushing device 401 is arranged to be manually pushed so as for the pushing device to push the pins together. The base 2 may be of a suitable size for a user to hold it. The pushing means 4 may be attached to the base, so that a user may push, while moving the pins 30 through the hair of another person, the pushing means 4, e.g. with a finger on the hand used for holding the comb. Thereby the pins are pushed together, to squeeze tufts of hair between the pins. Thereby, lice are effectively removed, and nits may be crushed between pins.

[0080] The pushing means 4 may be arranged so that the elastic device 402 is substantially unloaded when the pushing device 401 is close to, or in contact with, the pin 30 at the end of the row. Alternatively, the elastic device 402 may be arranged to bias the pushing device 401 onto the pin 30 at the end of the row, when the pins are pushed together.

[0081] By the slot 211 and the pin roots 301 extending into the slot, the pin roots may be arranged in a row along the slot 211. Thereby, each root 301 may form with the slot and two adjacent roots, or with the slot and one adjacent root (in the case of a root at an end of the pin row), an articulation of the respective pin. As exemplified in fig. 5, the limitation device 2022 is at a distance from the pins when the latter are pushed together. Thereby, the pins are restrained so as to allow the pins to undergo a limited rotation around a respective axis at the respective root, which axis is in the restriction direction.

[0082] Thereby, the pins 30 may be moved apart at a distance from the roots 301. This is advantageous is case the hair being treated is tangled. Thereby, the user may avoid pushing the pushing means. The elastic element 402 can provide a spring force counteracting the movement of the pins apart from each other. Once the hair is untangled, the user can start using the pushing device.

[0083] The first and second restriction devices 2011, 2031, the counteracting device 2021, and the limitation device 2022, may form together a housing for portions of the pins not protruding from the base. Thereby, a rotation of the pins, in relation to the base, around an axis which is parallel to the row 3 of pins the pins 30, is restricted or prevented.

[0084] Further, a rotation of the pins, in relation to the base, around an axis which is parallel to the protrusion direction, is restricted or prevented. In other words, a rotation of any of the pins, in relation to the base, around a longitudinal axis of the major portion 303 of the respective pin, is restricted or prevented. This may be accom-

plished by a suitable length of the pin roots 301 is relation to the length of the slot 211. For example, the length of each pin root 301 may be larger than the difference between the length of the slot 211 and the combined width of the roots 301.

[0085] Also, a rotation of the pins, in relation to the base, around an axis which is in the restriction direction, is restricted or prevented.

[0086] As suggested, preferably the distance between the first and second restriction devices 2011, 2031 is larger, preferably slightly larger, than the width of the pins 30, so that the pins are prevented from being squeezed between the first and second restriction devices 2011, 2031. Thereby, said advantageous limited movement of the pins within the plane formed by the row of pins, is allowed.

[0087] However, when the pushing means 4 is used, it is advantageous to prevent any movement of the pins in the restriction direction z. For this, the base comprises preventing means 2012, 2051 to prevent pins to move out of a plane formed by the row of pins. The preventing means comprises first and second prevent devices 2012, 2051 each extending along the row 3 of pins, at a distance from the roots 301 and at a distance from the pin distal ends 302, on a respective side of the pins. The first and second prevent devices 2012, 2051 are located where the pins protrude from the base.

[0088] In the protrusion direction, the pushing device 401 is located closer to the first and second prevent devices 2012, 2051 than to the pin roots 301, preferably in the vicinity of the first and second prevent devices 2012, 2051.

[0089] The first and second prevent devices 2012, 2051 are formed by the first restriction device 2011, and by a prevent bracket 205, respectively. The prevent bracket may be made in any suitable material, e.g. nylon plastic, or stainless steel. The prevent bracket 205 extends, in the protrusion direction x, from the second prevent device 2051 at the region 222 where the pins protrude from the base, to a region on the other side of the pin roots 301, where the prevent bracket is fastened to the remainder of the base 2. Thereby, the prevent bracket may present a flexibility at the second prevent device 2051. The second prevent device 2051 present a straight edge extending along the row of pins.

[0090] When the pins are pushed together by the pushing means 4, the prevent bracket 205 may be pushed so that the second prevent device 2051 is pushed towards the pins 30, so as to push the pins against the first prevent device 2012. Thereby, the first and second prevent devices 2012, 2051 may prevent pins from moving out of the plane of the pins, while the pins are pushed together by the pushing means 4.

[0091] Preferably, the first and/or the second prevent device 2012, 2051 is made of metal. Thereby, an advantageous low friction between the device(s) and the pins may be provided. Thereby the pins may be allowed to move apart from each other while squeezed between the first and second prevent devices 2012, 2051.

[0092] The prevent bracket 205 may be arranged so that the prevent bracket 205 is unloaded when the second prevent device 2051 is close to, or in contact with, the pins 30. Thereby, the second prevent device 2051 may be pushed manually towards the pins. Alternatively, the prevent bracket 205 may be arranged to bias the second prevent device 2051 onto the pins 30. Thereby, the second prevent device 2051 may be pushed by a spring force towards the pins.

[0093] In some embodiments, the comb may be provided without the preventing means 205. Thereby, the restriction devices 2011, 2031 may be arranged to prevent pins to move out of a plane formed by the row of pins.

[0094] Reference is made to fig. 6 - fig. 11, depicting steps in an embodiment of a method of manufacturing a comb. The comb is similar to the one described with reference to fig. 1 - fig. 5, with a difference that it does not have any preventing means 205. Of course, the method may be used for manufacturing a variety of embodiments of the comb, including such with preventing means.

[0095] As depicted in fig. 6, the method comprises positioning a plurality of pins 30 in fixing positions in a pin positioning jig 501. The positioning jig may be joined with a supporting jig 502, e.g. by means of guiding pins 5011, shown in fig. 8. The distal ends 302 of the pins are thereby positioned in relation to each other, in substantially the same relative positions that the distal ends will have in the comb. The distal ends may be positioned in a straight line.

[0096] As depicted in fig. 7, the pins are locked to the positioning jig with the pins in the fixing positions. This may be done with a fixing device 5012. The fixing device may be hinged to the remaining portion of the positioning jig 501. The fixing device may have an elastic sheet 5013 arranged to bias the pins to the remaining portion of the positioning jig 501. The fixing device may be fixed to the remaining portion of the positioning jig 501, e.g. by a screw 5014.

[0097] Thereafter, as depicted in fig. 8, the positioning jig 501 is removed from the supporting jig 502. Thereafter, as depicted in fig. 9, the pins 30, locked to the positioning jig 501 with the pins in the fixing positions, are positioned in a bending machine 503.

[0098] Thereafter, using the being machine, and while the pins are locked to the positioning jig with the pins in the fixing positions, ends 301 of the pins, which ends are opposite to the distal ends, are bent, as depicted in fig. 10. The ends may form the roots 301 of the pins. The ends may be bent approximately ninety degrees to the major portions of the pins. The bending machine 503 may be a metal sheet bending machine.

[0099] The pins are thereafter removed from the bending machine. Thereafter, as depicted in fig. 10, the base is mounted to the pins, while the pins are locked to the positioning jig with the pins in the fixing positions. Thereby, the bent ends are inserted into the slot 211 in the first layer 201 of the base. The second and third layers 202,

203 of the base may be mounted to the first layer, e.g. by bolts 204, or rivets.

[0100] Thereafter, the positioning jig may be removed from the pins, as depicted in fig. 11.

[0101] Embodiments of the method may be used for manufacturing a variety of embodiments of the comb, e.g. the embodiment described below with reference to fig. 17 and fig. 18.

[0102] Reference is made to fig. 12, showing an alternative embodiment of the comb, in a view corresponding to the view in fig. 5. The embodiment is similar to the one described above with reference to fig. 1 - fig. 5, with the following exceptions.

[0103] The roots 301 of the pins 30 extend within the plane formed by the pin protrusion direction and the pin row direction. The roots 301 are located in a cavity 212 of the base 2. The major portions 303 of the pins are of different length. Thereby, the distal ends of the pins are at the same position in the protrusion direction. The roots 301 of the pins are cascaded. Thereby, each pin 30 is restrained, in relation to the base, in a direction of the major portion 303 of the pin.

[0104] Reference is made to fig. 13a - fig. 13b, showing a further alternative embodiment of the comb. Fig. 13a shows a view corresponding to the view in fig. 5, and fig. 13b is a cross-sectional view as indicated in fig. 13a. The embodiment is similar to the one described above with reference to fig. 1 - fig. 5. For example, the base 2 comprises a first, a second, and a third layer 201, 202, 203. Further, as indicated in fig. 13b, the base comprises first and second restriction devices 2011, 2031 on respective sides of the row 3 of pins. The first and second restriction devices 2011, 2031 are formed by respective parts of the first and third layers 201, 203.

[0105] Similarly to the embodiment in fig. 1 - fig. 5, as can be seen in fig. 13a, the comb comprises pushing means 4 arranged to push the pins 30 together. The pushing means 4 is arranged to exert, at a distance from the roots 301, a pushing force onto one of the pins 30, located at one of the ends of the row 3 of pins. The base 2 comprises a counteracting device 2021 on other side of row of pins, arranged to counteract the pushing force of the pushing means 4, when the pins are pushed together by the pushing means. The counteracting device is formed by a part of the intermediate, second layer 202 of the base. The base comprises a limitation device 2022 located on the same side of the row 3 of pins as the pushing means 4. The limitation device 2022 is formed by a part of the intermediate, second layer 202 of the base. The limitation device may limit movements of pins apart from each other at the region 222 where the pins protrude from the base.

[0106] Differing from the embodiment in fig. 1 - fig. 5, the pushing device 401 of the pushing means 4 is provided in the form of an elastic device. The elastic device 401 is in the form of a leaf spring. The elastic device 401 is biased between the pins 30 and a manoeuvring device 403. Thereby, the elastic device 401 extends towards an end of the row of pins. Thereby, guide devices 2013, 2033 form guides for the elastic device.

[0107] The manoeuvring device 403 extends through slots 404 in the first and third layers 201, 203. By the elastic device 401, the manoeuvring device 403 is biased against the limitation device 2022. The manoeuvring device 403 may be moved along the slots 404. For this a user may grab the manoeuvring device 403 on opposite sides of the base 2. Thereby the position of the pushing device 401 along the pins 30 may be changed. The limitation device 2022 is provided with cuts 405 along the slots 404. The manoeuvring device 403 may be pushed into any of the cuts 405 by the pushing device 401. Thereby the position of the pushing device 401 along the pins 30 may be fixed.

[0108] By the movable pushing device 401, the force pushing the pins together in the region 222 where the pins protrude from the base, may be varied. More specifically, where the pushing device 401 is relatively close to the pin protrusion region 222, a relatively high force will be required to bend the pins away from each other in said region 22. Where the pushing device 401 is relatively far away from the pin protrusion region 222, a relatively low force will be required to bend the pins 30 away from each other in said region 222.

[0109] Reference is made to fig. 14, showing a cross-section of yet another embodiment of the comb. Similarly to fig. 13b The cross-section is located at pushing means 4 of the comb.

[0110] Similarly to the embodiment in fig. 1 - fig. 5, a pushing device 401 of the pushing means is formed as a tongue. The pushing device is adapted to be in contact with an end of the row of pins. The pushing device 401 extends from an elastic element 402, towards the pins 30, between guide devices 2013, 2033. Thereby, the elastic device 401 extends towards an end of the row of pins. Thereby, guide devices 2013, 2033 form guides for the pushing device.

[0111] The elastic device 402 is in the form of a helical spring. The elastic device 402 is biased between the pushing device 401 and a manoeuvring device 403. Thereby, the elastic element is arranged to introduce a spring force between the pushing device and the base. The manoeuvring device 403 is provided in the form of a bolt which is threaded in the base. By turning the bolt, a user may compress or relax the elastic device 402. Thereby the spring force, so as for the pushing device 401 to push the pins 30 together, is adjustable.

[0112] Reference is made to fig. 15, showing a further alternative embodiment of the comb. Fig. 15 shows a view corresponding to the view in fig. 1. The embodiment in fig. 15 is similar to the one in fig. 1 - fig. 5, except for the following:

An elastic element 402, in the form of a beam, is provided between the pushing device 401 and a joint 406. The joint it fixed to the base 2. The elastic element 402 and a manoeuvring arm 407 are articulated at the joint 406. A manoeuvring device 408 is arranged to be moved along

an edge of the base 2, between the base and the manoeuvring arm 407. Thereby, the manoeuvring device 408 may be wedged between the base and the manoeuvring arm 407.

[0113] By moving the manoeuvring device 408 towards the joint 406, the manoeuvring arm 407 is rotated so as to push a protrusion 4021 on the beam 402, so as for the beam to rotate at the joint. Thereby the pushing device 401 is pushed towards the pins 30 by the elastic force of the beam. By changing the position of the manoeuvring device 408 along the edge of the base 2, the elastic force acting on the pushing device 401 may be adjusted. The manoeuvring device 408 and the edge of the base 2 may be provided with complementary serrations, to fix the manoeuvring device 408 along the edge.

[0114] The manoeuvring arm 407 pushes the protrusion 4021 on the beam 402 by a rod 4071. By bending the rod 4071, a user may release the rod from the protrusion, so that the elastic force on the pushing device is removed. Thereby, the manoeuvring device 408 may be moved away from the joint.

[0115] Fig. 16 shows a perspective view of a portion of a comb according to another embodiment of the invention. The embodiment has features in common with embodiments described above. Differing from the embodiments described above, portions of some of the pins 30 are exposed in a recess 231 in the base 2. The recess 231 is provided between the roots of the pins, and a region 222 where the pins protrude from the base 2.

[0116] Pushing means 4 is arranged to push, in the recess 231, the pin at the end of the row of pins. The pushing means comprises a pushing device 401. The pushing device comprises jaws 4011 which open towards the pins 30. An elastic element 402 is provided between the pushing device 401 and the base 2, similarly to what has been described with reference to fig. 1 - fig. 5. In this example, the elastic element 402 is formed by a beam.

[0117] When a user pushes the pushing device 401 towards the pins 30, the pin closest to the pushing device is positioned between the jaws. The jaws form guide devices restricting movements of the pushing device in the restriction direction.

[0118] Reference is made to fig. 17 and fig. 18, showing an embodiment which is similar to the embodiment described with reference to fig. 1 - fig. 5. Differences will be described here.

[0119] As can be seen in fig. 18, the pins 30 extend further in the restriction direction than in the row direction. The pins have an elongated cross-section. The pins may be formed as elongated plates. Surfaces of the pins facing in opposite directions in the row direction may be flat. When the pins are pushed together, the pins may contact each other along a non-zero length in the restriction direction. Thereby, hair will be subjected to pressure between the pins along this length. Thereby, lice and nits may be effectively caught when the comb is moved through the hair.

[0120] The pins may be formed from plates, e.g. metal plates, e.g. stainless steel plates, by cutting, e.g. laser or water cutting. Edges of the pins may be rounded off by sand blasting. Alternatively, the pins may be made by some other manufacturing technique, e.g. injection moulding.

[0121] A major portion 303 of each pin is substantially straight. The base 2 comprises two slots 211. The slots are distributed of opposite sides, in the restriction direction, of the major portions of the pins. The slots 211 are formed in the first layer 201 and in the third layer, respectively. The slots extend along the row 3 of pins.

[0122] The root 301 of each pin extends in a non-zero angle, in this example perpendicularly, to the major portion 303 of the pin. The root 301 extend into the slots 211. Thereby, the root 301 forms two projections 3012, extending into a respective of the slots.

[0123] The widths of the slots are larger, preferably slightly larger, than the extensions of the projections 3012 in the protrusion direction (in this embodiment the longitudinal direction of the major portions 303 of the pins). Thereby, each pin 30 is restrained, in relation to the base, in a direction of the major portion 303 of the pin.

[0124] Thereby, the roots 301 of the pins are restrained so as to allow the pins 30 to undergo a limited rotation in relation to the base 2 around a respective axis RA at the respective root, which axis is parallel to the restriction direction z, (fig. 17). The respective axes RA around which the respective pins 30 are allowed to undergo a limited rotation, are located at an engagement location EL in which the pins are restrained by the base in the protrusion direction x.

[0125] As in the embodiment in fig. 1 - fig. 5, when the pins are not pushed, rotations of the pins, are restricted by, on one hand a counteracting device 2021 (fig. 5), and on the other hand the pushing means or limitation device 2022 (fig. 5). Movements of the pins along the row of pins, may also be restricted by ends of the slot 211. Preferably, the slot 211 is longer, preferably slightly longer, than the row of pins when the pins are pushed together.

[0126] Reference is made to fig. 19 and fig. 20. This embodiment is similar to the one described with reference to fig. 17 and fig. 18, with some differences described in the following.

[0127] The base 2 comprises a bar 222. The bar extends in the row direction from a counteracting device 2021, to a limitation device 2022. The engagement between the pins 30 and the base 2 is provided by the bar 222 extending through holes 305 in the pins. The holes 305 are larger than the transverse extension, e.g. the diameter, of the bar 222.

[0128] Similar to other embodiments, e.g. the one described with reference to fig. 1 - fig. 5, the limitation device 2022 has a surface facing the pins which is at a non-zero angle to the protrusion direction. Thereby, the counteracting device 2021 and the limitation device 2022 are closer to each other at the region of engagement between the pins and the base, in this embodiment the bar, than at the pushing device 4. Thereby, a limited rotation of the

pins around axes at the respective roots, in the restriction direction, is allowed. In this example, the rotation is also allowed by the holes 305 being larger than the transverse extension, e.g. the diameter, of the bar 222.

[0129] Reference is made to fig. 21 - fig. 23, showing a comb according to a further embodiment of the invention. Similar to other embodiments disclosed herein, the comb comprises a base 2 and a plurality of pins 30.

[0130] The base 2 may be layered as described above. The base 2 comprises first and second restriction devices 2011, 2031 on respective transverse sides of the row of pins. The first and second restriction devices restrict, at a distance from the roots, movements of the pins 30 in a restriction direction z which is transverse to the protrusion direction x and to the row direction y.

[0131] Similarly to the embodiment described with reference to fig. 17 and fig. 18, the pins 30 have an elongated cross-section. In this example, the pins cross-section is substantially rectangular. At the distal ends thereof, the pins are chamfered.

[0132] As can be seen in fig. 23, the base 2 comprises two slots 211. The slots are distributed of opposite sides, in the restriction direction, of the major portions of the pins. The root 301 of each pin forms two projections 3012, extending into a respective of the slots. Thereby, each pin 30 is restrained, in relation to the base, in a direction of the major portion 303 of the pin.

[0133] Thereby, the roots 301 of the pins are restrained so as to allow the pins 30 to undergo a limited rotation in relation to the base 2 around a respective axis RA at the respective root, which axis is parallel to the restriction direction z. The respective axes RA around which the respective pins 30 are allowed to undergo a limited rotation, are located at an engagement location EL in which the pins are restrained by the base in the protrusion direction x.

[0134] The comb comprises pushing means arranged to push, at a distance from the roots 301, the pins 30 together. As depicted in fig. 22, the pushing means comprises two pushing devices 401 adapted to be in contact with opposite ends of the row of pins 30. The pushing devices 401 are, in the protrusion direction x, closer to a region 222, at which the pins protrude from the base, than to the roots 301.

[0135] The pushing means further comprises two manoeuvring devices 403. The manoeuvring devices 403 are provided in the form of cantilevered beams, in this example a plate shaped beams, which are fixed to the base closer to the pin roots 301 than to the pushing device 401. The manoeuvring devices 403 are located outside the restriction devices 2011, 2031, on opposite sides of the pins. The manoeuvring devices 403 are located at a distance from the restriction devices 2011, 2031. Thereby, along portions of the pins 30 there are gaps between the manoeuvring devices 403 and the restriction devices 2011, 2031.

[0136] In this embodiment, the manoeuvring devices 403 extends from an area of the pin roots 301, along the pins 30, and to a region 222 at a distance from the roots, from which region, the pins 30 protrude from the base. Thereby, the manoeuvring devices 403 are cantilevered so that they can be flexed at their distal ends towards the pins.

[0137] As can be seen in fig. 23. the pushing devices 401 are, compared to the region 222 where the pins 30 protrude from the restriction devices 2011, 2031, located closer to the distal ends of the pins. Thereby, the pushing devices 401 are connected to, more specifically mounted to the manoeuvring devices 403. As can be seen in fig. 22, the pushing devices 401 are mounted to the manoeuvring devices 403 on opposite sides of the pins in the row direction y. The pushing devices 401 may be fixed to the manoeuvring devices 403, or in any other manner joined to the manoeuvring devices 403. In some embodiments, the pushing devices 401 may be joined with the manoeuvring devices 403 by means of flexible joints. In this example, the pushing devices 401 are connected to the manoeuvring devices 403 by protrusions 4011 of the pushing devices 401 extending into cut-outs 4031 in the manoeuvring devices 403.

[0138] The pushing devices 401 extend, in a plane formed by the row direction y and the restriction direction z, i.e. a plane extending transversally to the pins 30, in non-zero angles to the row direction and the restriction direction. The pushing devices 401 may extend towards the respective end of the row of pins, in an angle to the row direction y which is 30-60 degrees, e.g. about 45 degrees. In this embodiment, each pushing device 401 has two legs, each extending from a respective of the manoeuvring devices 403 towards the respective end of the row of pins, in an angle of 30-60 degrees to the row direction y. The pushing devices 403 are flexible. The pushing devices may be made in any suitable material, e.g. steel, aluminium, or a plastic material.

[0139] Thereby, when the manoeuvring devices 403 are pushed towards the pins 30 by a user, e.g. by being squeezed towards each other, ends of the pushing devices, opposite to the manoeuvring devices push the pins together. Thereby, the pushing device 401 is arranged to be manually pushed, via the manoeuvring devices 403, so as for the pushing device to push the pins 30 together.

[0140] In some embodiments, the pushing devices 401 are, when not being pushed, at a distance from each other that is larger than the combined extension of the pins 30 in the row direction y. Thereby, the pins may be allowed to move freely between the pushing devices, when the pushing devices are not being pushed.

[0141] In other embodiments, the pushing devices are, when not being pushed, in contact with the pins. Thereby, the pins may still be allowed undergo a limited rotation in relation to the base 2 around a respective axis at the respective root, which axis is parallel to the restriction direction z, by pushing the pushing devices apart, and thereby pushing the manoeuvring devices 403 apart.

[0142] Fig. 24 - fig. 25 show views of a comb according to another embodiment of the invention. The comb is

similar to the one shown in fig. 21 - fig. 23, with exceptions as follows:

The comb comprises a single manoeuvring device 403. On the opposite side of the pins 30, in the restriction direction z, at an end of one of the restriction devices 2011, an aligning device 409 is formed. In this embodiment, the alignment device is fixed to the restriction device 2011. The alignment device 409 is integrated with the restriction device 2011. The alignment device 409 has a flat side facing the pins 30. The alignment device 409 is arranged to be in contact with the pins 30.

[0143] Thereby, the pushing devices 401 are mounted to the manoeuvring device 403. Each pushing device 401 comprises a single leg. The pushing devices 401 extend towards the alignment device 409 and the respective end of the row of pins, in an angle to the row direction y which is 30-60 degrees, e.g. about 45 degrees. The pushing devices 401 are arranged to be in contact with the alignment device 409. The pushing devices 401 may slide along the alignment device 409.

[0144] Thereby, when the manoeuvring device 403 is pushed towards the pins 30 by a user, ends of the pushing devices, opposite to the manoeuvring devices, push the pins together directed by the alignment device 409.

[0145] Fig. 26 shows a view of a comb according to a further embodiment of the invention. The comb is similar to the one shown in fig. 24 - fig. 25, with exceptions as follows:

The comb comprises a single pushing device 401 on one side of the row of pins 30, in the row direction y. On the other side of the row of pins, a counteracting device 2021 is provided. The counteracting device 2021 is arranged to counteract the pushing force of the pushing devices 401, when the pins are pushed together by the pushing devices 401.

[0146] Fig. 27 shows a plan view of a comb according to another embodiment of the invention. The comb is similar to the one described with reference to fig. 1 - fig. 5, but differs as follows: A manoeuvring device 403 is located outside of one of the restriction devices 2031. The manoeuvring device 403 is fixed to the pushing device 401. Thereby, a user may, while holding the comb, bias the manoeuvring device 403 away from the distal ends of the pins. Thereby, a bending moment will be introduced to the elastic element 402, provided between the pushing device 401 and the base of the comb. Thereby, the pushing device 401 will push the pins together.

[0147] It is to be understood that the present invention is not limited to the embodiments described above and illustrated in the drawings; rather, the skilled person will recognize that many changes and modifications may be made within the scope of the appended claims.

[0148] It is understood that in embodiments of the invention, the row direction may be transverse to protruding portions of the pins. The protruding portions may extend between a region where the pins protrude from the base and the respective distal ends. The protruding portions may be straight. The protrusion direction may be the longitudinal direction of the protruding portions when the pins are parallel. The protrusion direction may be the longitudinal direction of the protruding portions when the pins are pushed together. The pins may be allowed to assume positions in which the protruding portions are aligned. The protruding portions may be aligned when the protruding portions are parallel and all extend in an imaginary plane. The imaginary plane may be flat. The row direction may be perpendicular to the longitudinal extension of the protruding portion of at least one of the pins, and the row direction may intersect the protruding portions of at least two of the pins. Where the protruding portions of the pins are aligned, the row direction may be perpendicular to the protruding portions of the pins, and the row direction may intersect the protruding portions of all of the pins. A plane formed by the pins may be a plane formed by the protruding portions when the protruding portions of all pins are in the same position in the restriction direction. The plane formed by the pins may be a plane formed by the protruding portions when all protruding portions are aligned. The restriction devices may restrict movements, in relation to the base, of any of the pins in relation to at least two other pins, remaining in the same position in relation to the base. Thereby, the row direction may be perpendicular to the protruding portions of the remaining pins, and the row direction may intersect the protruding portions of the remaining pins.

Claims

1. A comb comprising a base (2) and a plurality of pins (30),

- the pins (30) protruding, in a protrusion direction (x), from the base (2) to distal ends (302) of the pins,
- the pins forming a row (3) of pins in a row direction (y) which is transverse to the protrusion direction,
- **characterised in that** the pins comprise respective roots (301), the roots being confined to the base (2) without being fixed to the base,
- the comb comprising pushing means (4) arranged to push, at a distance from the roots (301), the pins (30) together so that adjacent pins are pressed towards each other,
- wherein the base (2) comprises first and second restriction devices (2011, 2031) on respective transverse sides of the row (3) of pins, the first and second restriction devices restricting, at a distance from the roots, movements of the pins (30) in a restriction direction (z) which is transverse to the protrusion direction and to the row direction,
- wherein the roots (301) of the pins are restrained so as to allow the pins (30) to undergo a limited rotation in relation to the base (2)

around a respective axis (RA) at the respective root, which axis is parallel to the restriction direction (z).

2. A comb according to claim 1, wherein the respective axes (RA) around which the respective pins (30) are allowed to undergo a limited rotation, are located at an engagement location (EL) in which the pins are restrained by the base in the protrusion direction (x).

3. A comb according to any one of the preceding claims, wherein the pushing means (4) is arranged to push the pins (30) together at a distance from an engagement location (EL) in which the pins are restrained by the base in the protrusion direction (x).

4. A comb according to any one of the preceding claims, wherein the roots (301) of the pins extend in a non-zero angle to respective major portions of the pins.

5. A comb according to claim 4, wherein the base comprises a slot (211) extending along the row of pins, wherein the roots (301) extend into the slot.

6. A comb according to claim 5, wherein a difference between a length of the slot (211) and a combined extension of the pins in the row direction is less than the individual extension of the roots transverse to the protrusion direction.

7. A comb according to any one of the preceding claims, wherein the pushing means (4) comprises a pushing device (401) adapted to be in contact with an end of the row (3) of pins, wherein the pushing device (401) is, in the protrusion direction (x), closer to a region (222), at which the pins protrude from the base, than to the roots (301).

8. A comb according to any one of the preceding claims, wherein the pushing means (4) comprises a pushing device (401) arranged to be manually pushed so as for the pushing device to push the pins (30) together.

9. A comb according to any one of the preceding claims, wherein the pushing means (4) comprises a pushing device (401) adapted to be in contact with an end of the row (3) of pins, wherein the pushing means further comprises a manoeuvring device (403), wherein the pushing device is connected to the manoeuvring device (403), wherein the manoeuvring device (403) and pushing device (401) are arranged so as for the manoeuvring device (403) to be moved towards the pins in the restriction direction (z) whereby the pushing device (401) push the pins together.

10. A comb according to claim 9, wherein the pushing device (401) is arranged to extend towards the end of the row (3) of pins, in a plane formed by the row direction y and the restriction direction z, in a non-zero angle to the row direction and to the restriction direction.

11. A comb according to any one of claims 9-10, wherein the manoeuvring device (403) is provided in the form of a cantilevered beam, which is fixed to the base closer to the pin roots (301) than to the pushing device (401).

12. A comb comprising a base (2) and a plurality of pins (30),

- the pins (30) protruding, in a protrusion direction (x), from the base (2) to distal ends (302) of the pins,
- the pins forming a row (3) of pins in a row direction (y) which is transverse to the protrusion direction,
- **characterised in that** the pins comprise respective roots (301), the roots being confined to the base (2),
- wherein the base (2) comprises first and second restriction devices (2011, 2031) on respective transverse sides of the row (3) of pins, the first and second restriction devices restricting, at a distance from the roots, movements of the pins (30) in a restriction direction (z) which is transverse to the protrusion direction and to the row direction,
- the comb comprising pushing means (4) arranged to push, at a distance from the roots (301), the pins (30) together so that adjacent pins are pressed towards each other,
- wherein the pushing means (4) comprises a pushing device (401) adapted to be in contact with an end of the row (3) of pins, wherein the pushing means further comprises a manoeuvring device (403), wherein the pushing device is connected to the manoeuvring device (403), wherein the manoeuvring device (403) and pushing device (401) are arranged so as for the manoeuvring device (403) to be moved towards the pins in the restriction direction (z) whereby the pushing device (401) push the pins together.

13. A comb according to claim 12, wherein the pushing device (401) is arranged to extend towards the end of the row (3) of pins, in a plane formed by the row direction y and the restriction direction z, in a non-zero angle to the row direction and to the restriction direction.

14. A comb according to any one of claims 12-13, wherein the manoeuvring device (403) is provided in the form of a cantilevered beam, which is fixed to the base closer to the pin roots (301) than to the pushing device (401).

15. A method of manufacturing a comb according to claim 5, comprising positioning a plurality of pins in fixing positions in a pin positioning jig, with distal ends of the pins in positions in relation to each other, which the distal ends will have in the comb, locking the pins to the positioning jig with the pins in the fixing positions, bending, while the pins are locked to the positioning jig with the pins in the fixing positions, ends of the pins, which ends are opposite to the distal ends, and mounting at least a portion of the base to the pins, while the pins are locked to the positioning jig with the pins in the fixing positions, thereby introducing the bent ends of the pins into a slot in the base.

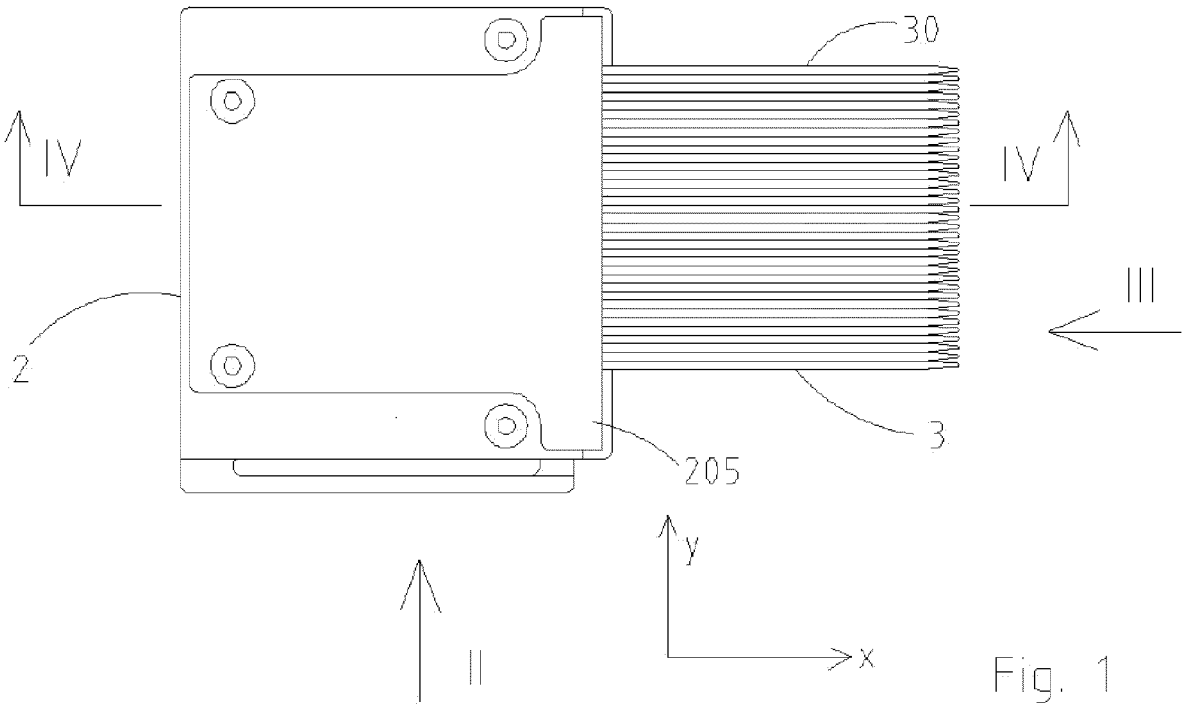

Fig. 1

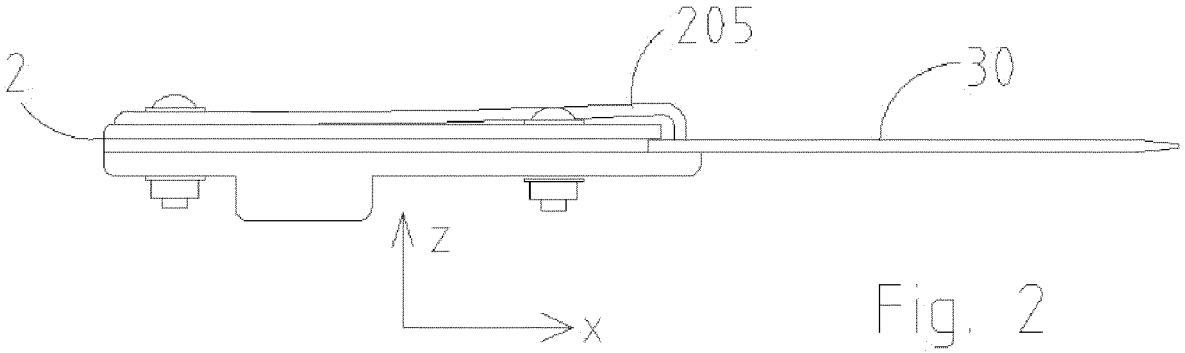

Fig. 2

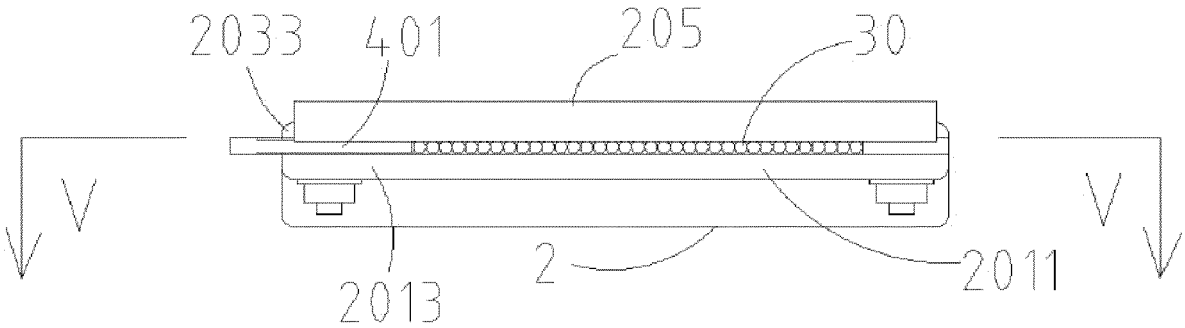

Fig. 3

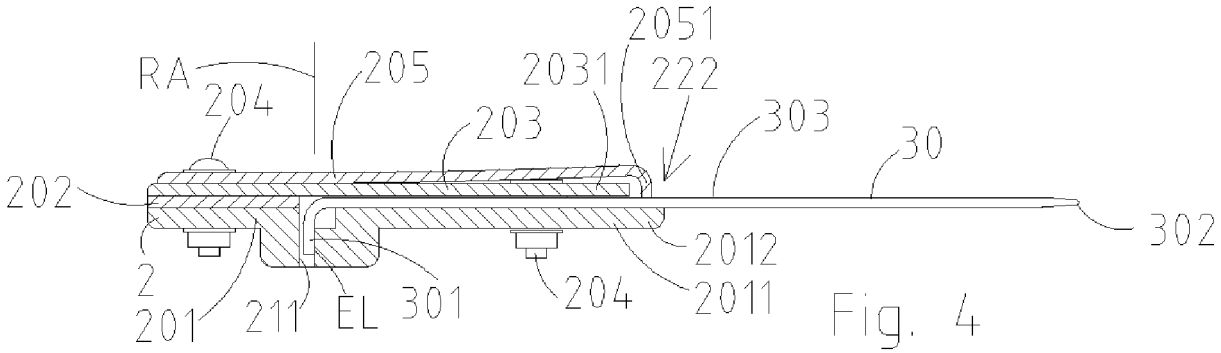
RA
204
205
2031
2051
222
203
303
30
202
302
2012
2
201
211
EL
301
204
2011

Fig. 4

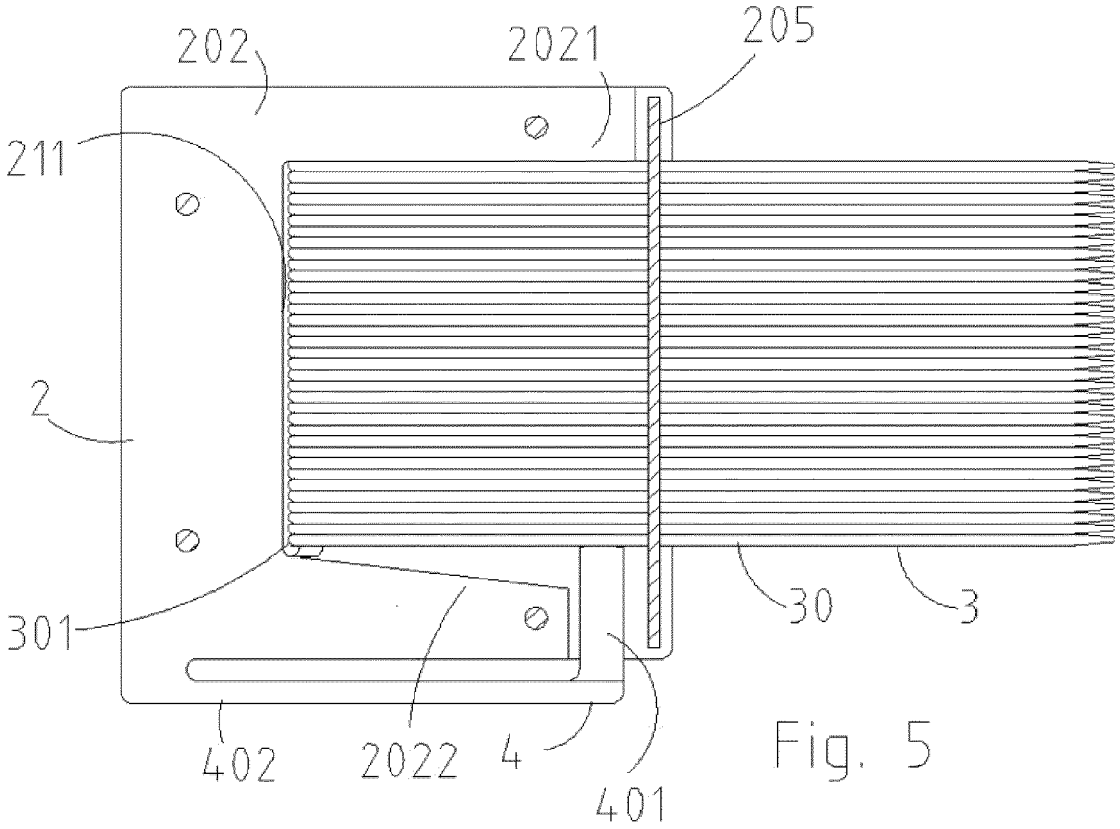
202
2021
205
211
2
301
30
3
402
2022
4
401

Fig. 5

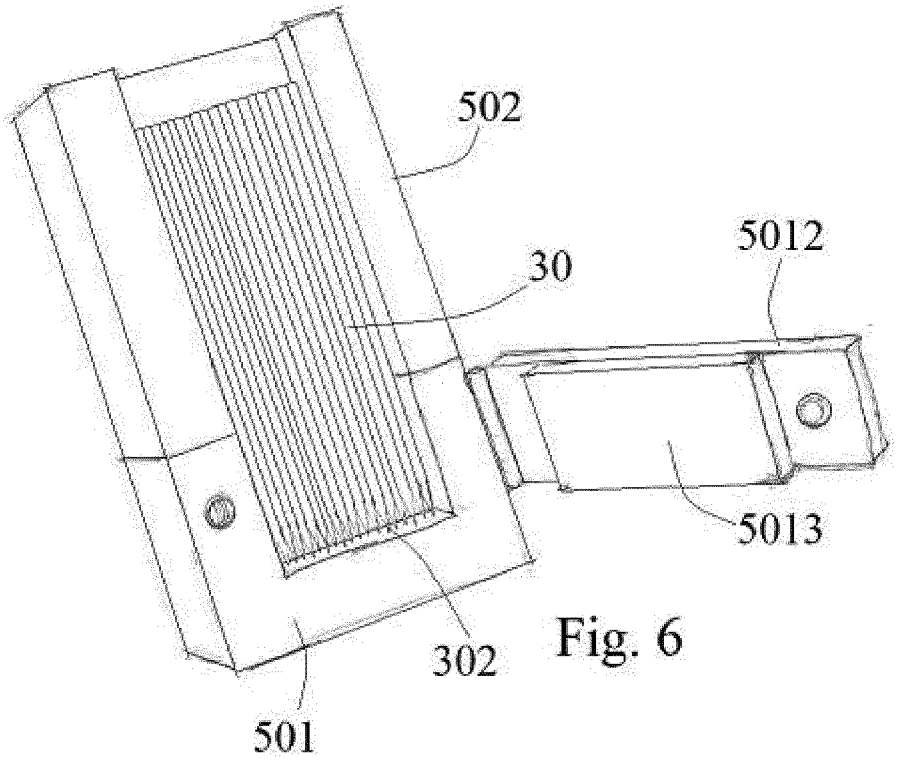

Fig. 6

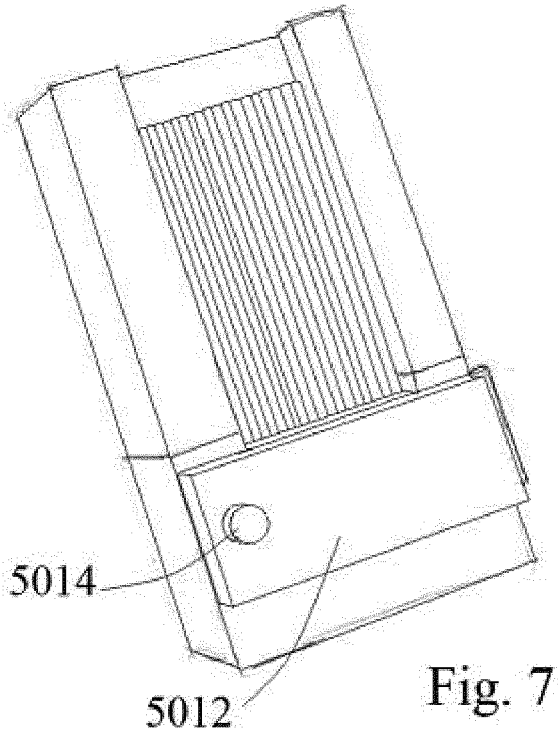

Fig. 7

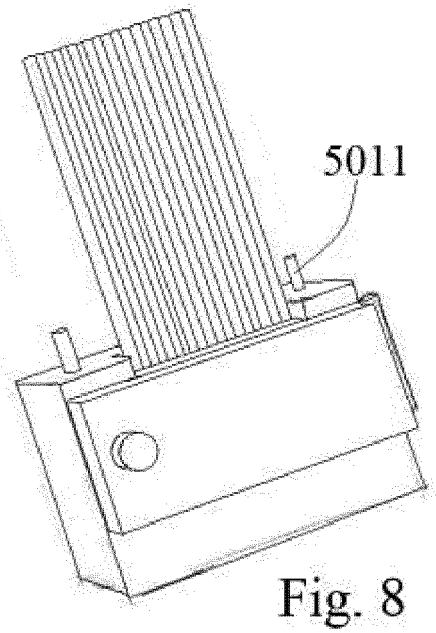

Fig. 8

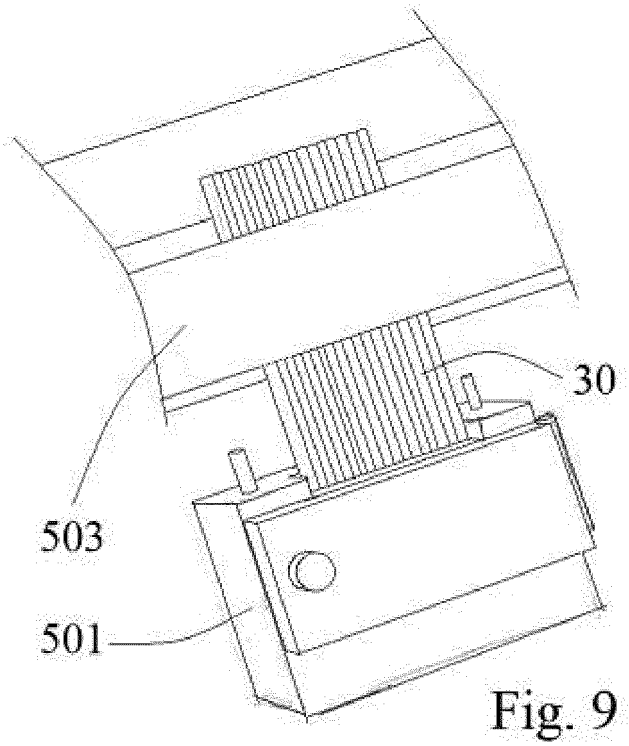

Fig. 9

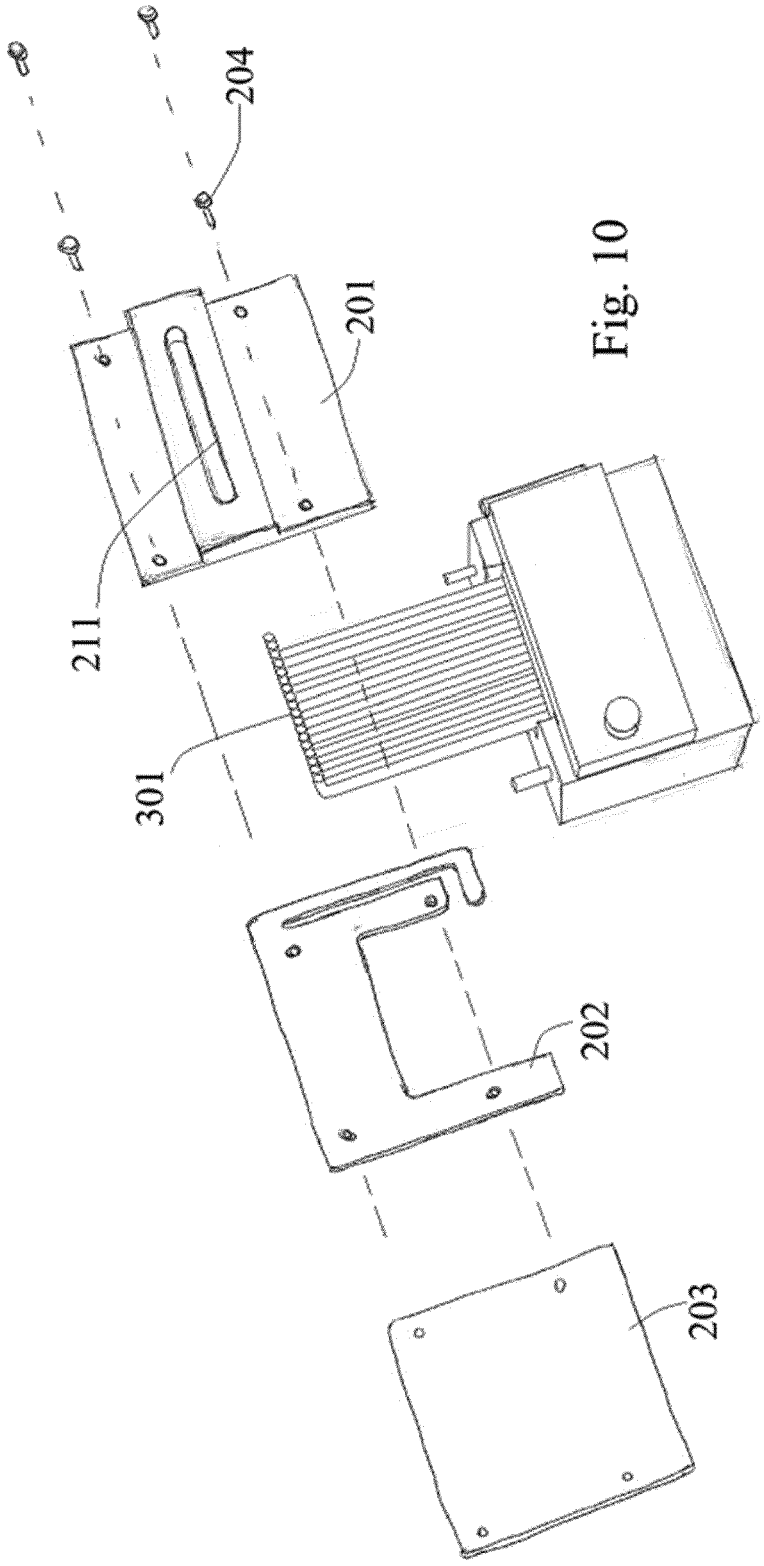

Fig. 10

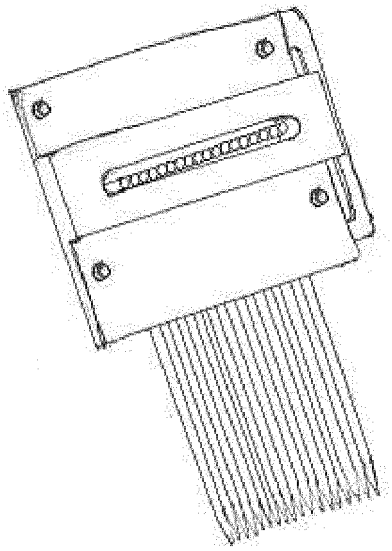

Fig. 11

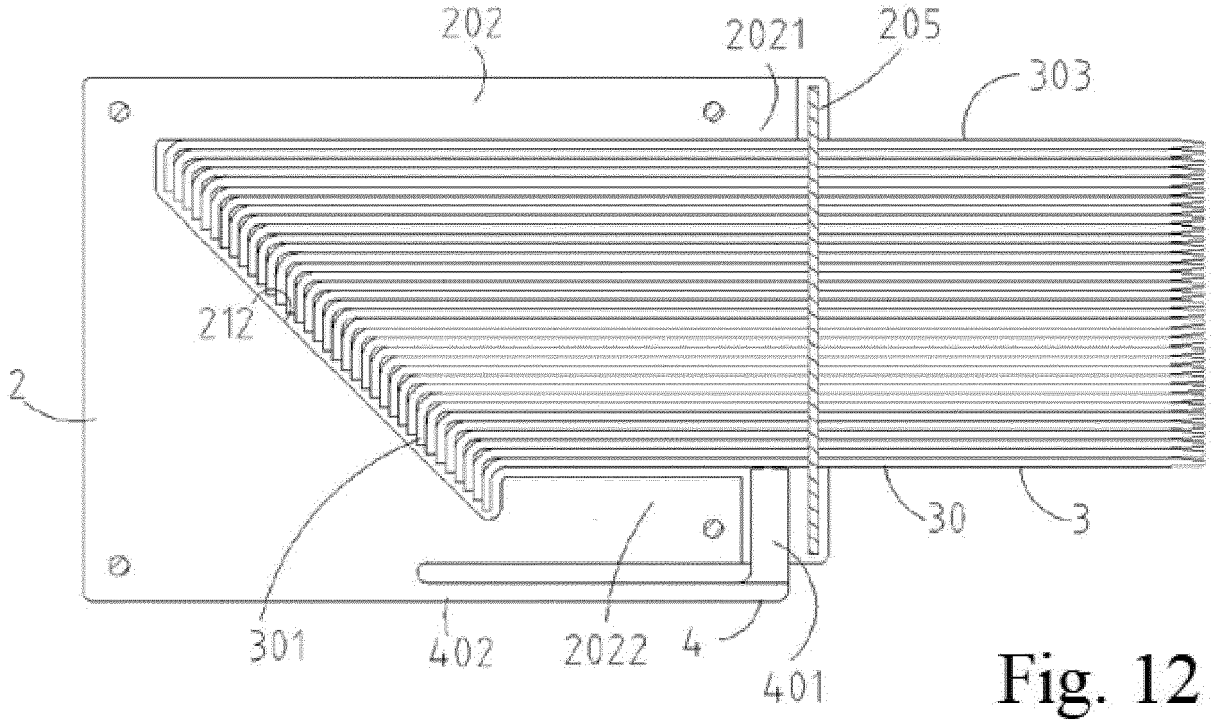

Fig. 12

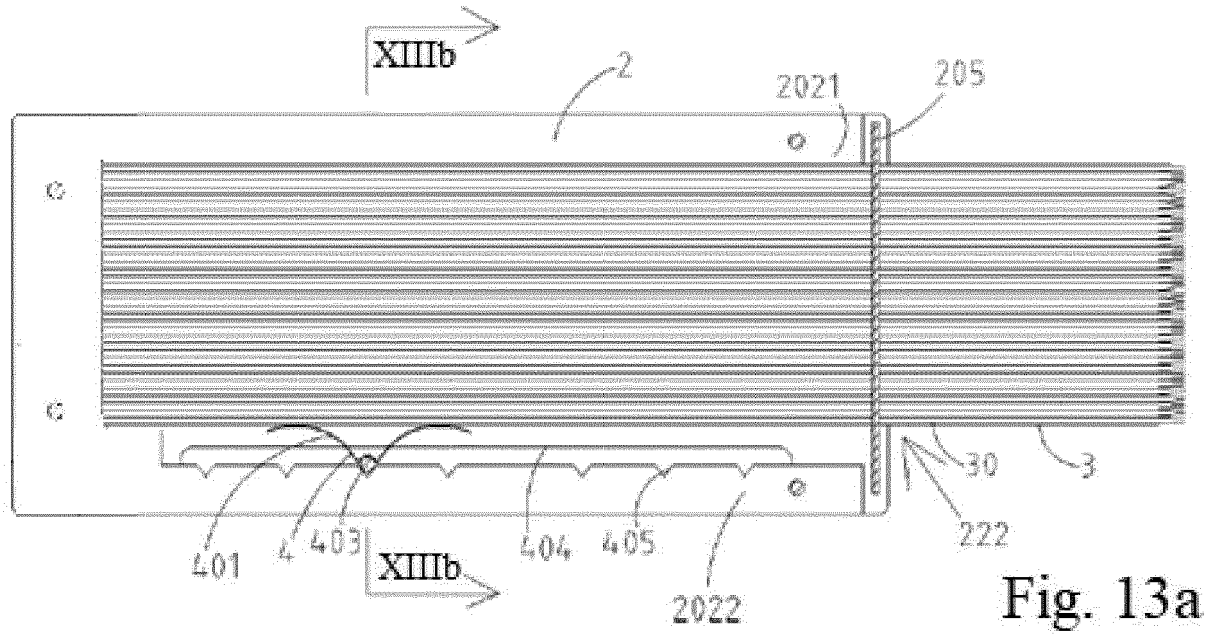

Fig. 13a

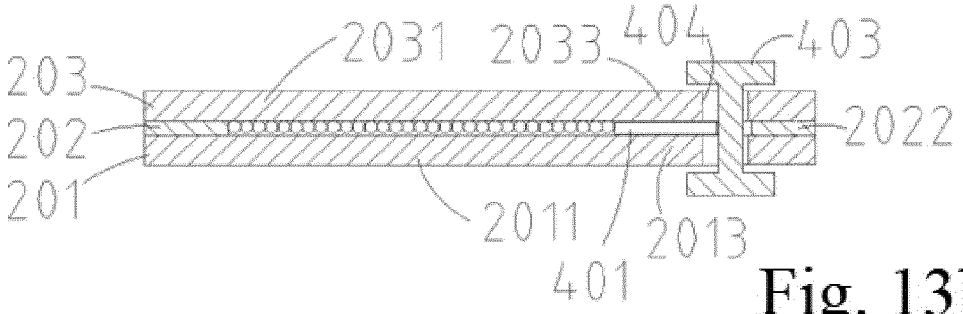

Fig. 13b

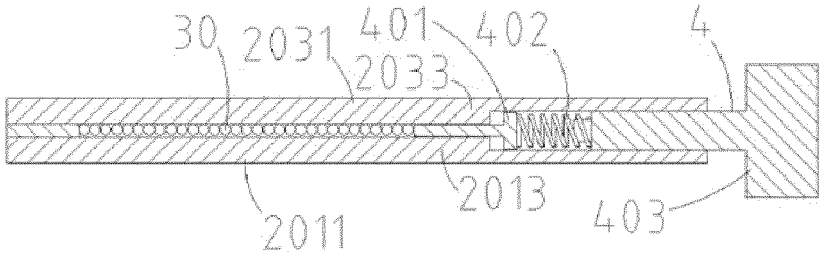

Fig. 14

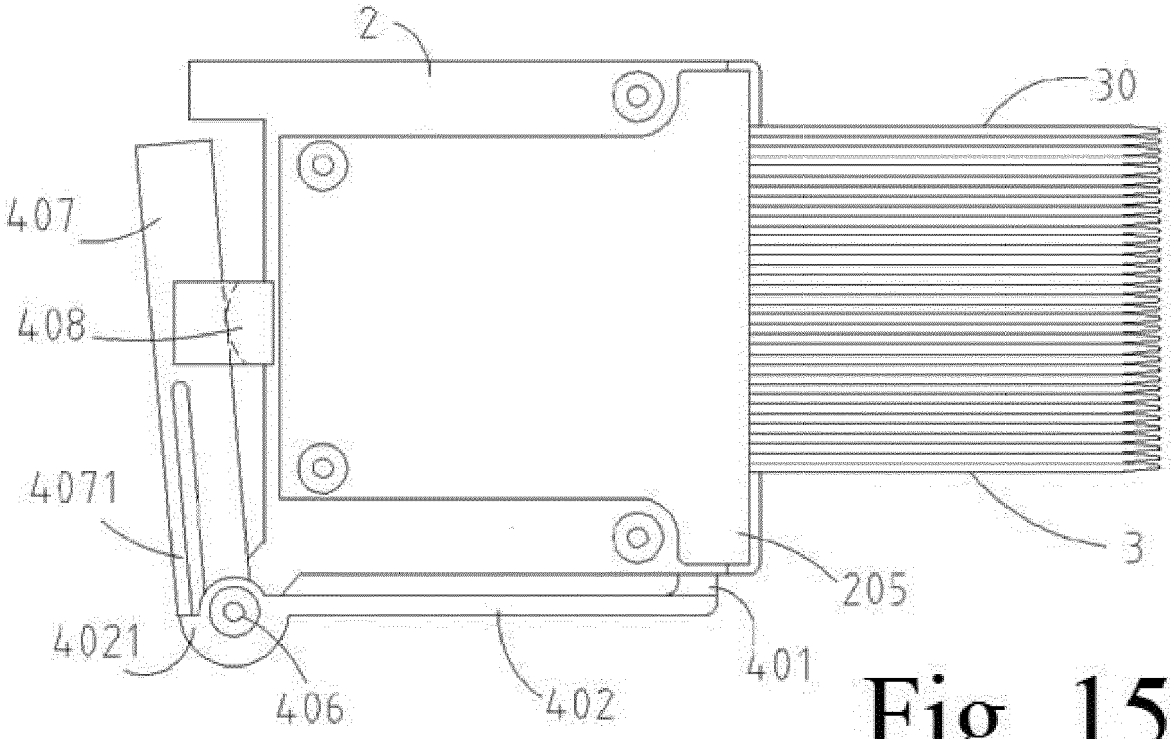
2
30
407
408
4071
3
205
4021
401
406
402

Fig. 15

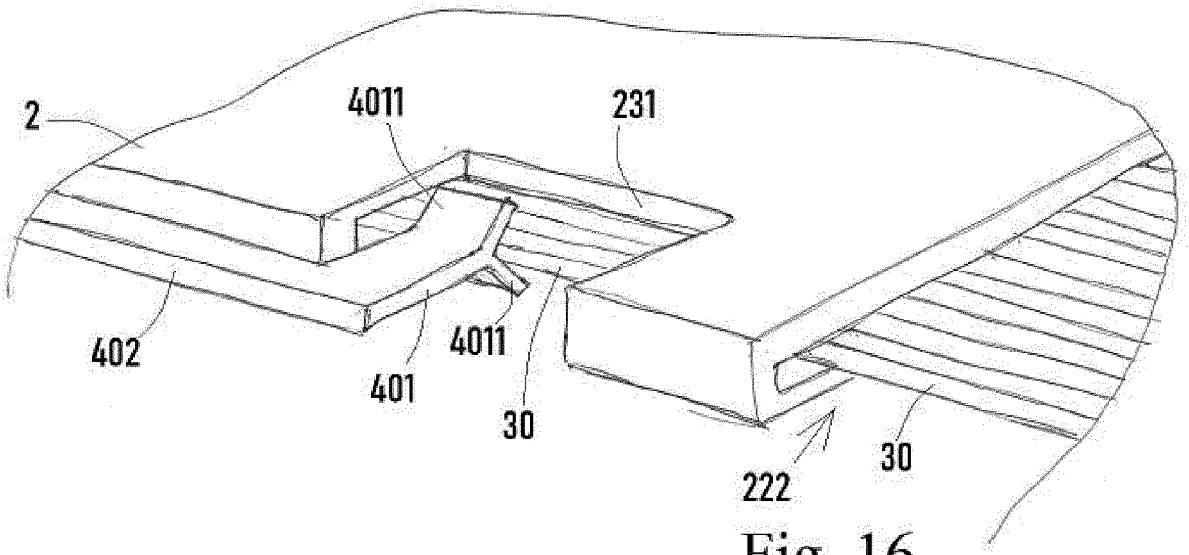
2
4011
231
402
401
4011
30
222
30

Fig. 16

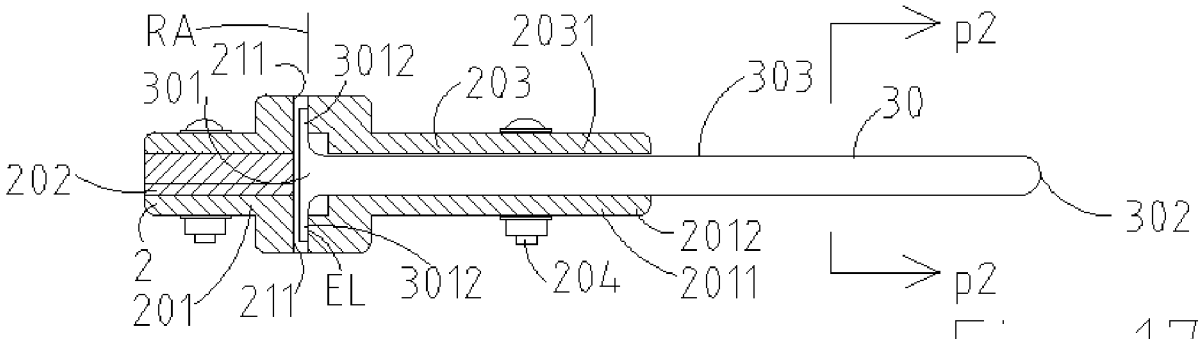

Fig. 17

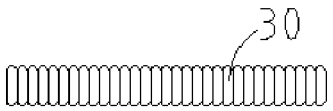

Fig. 18

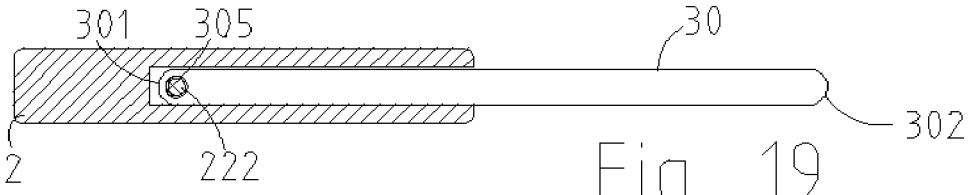

Fig. 19

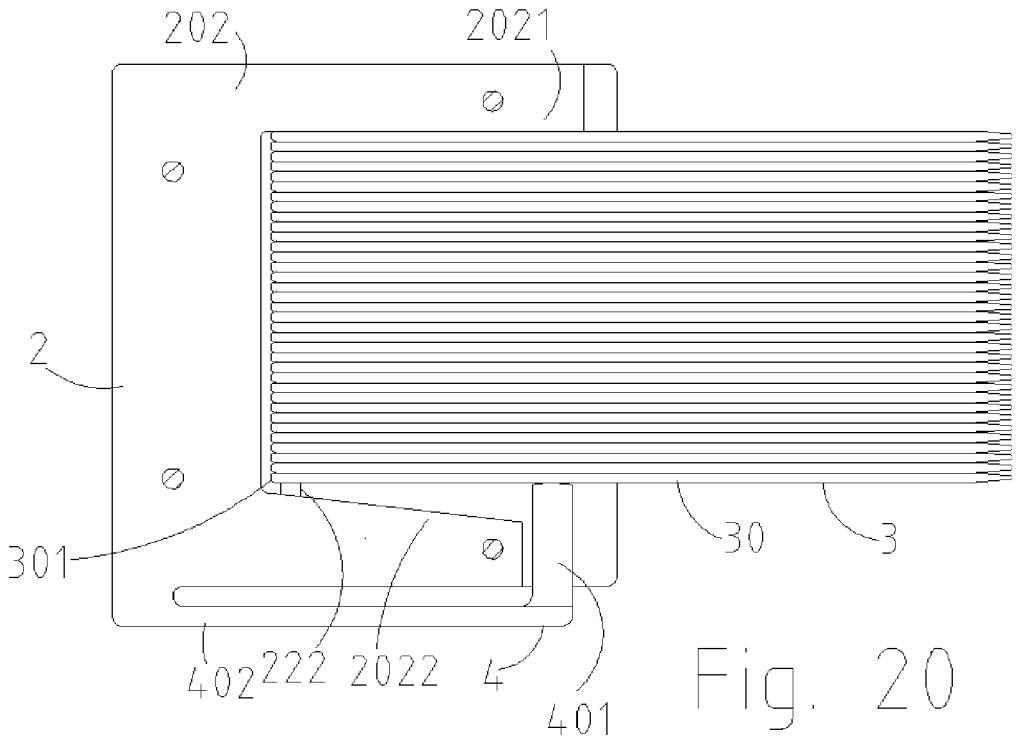

Fig. 20

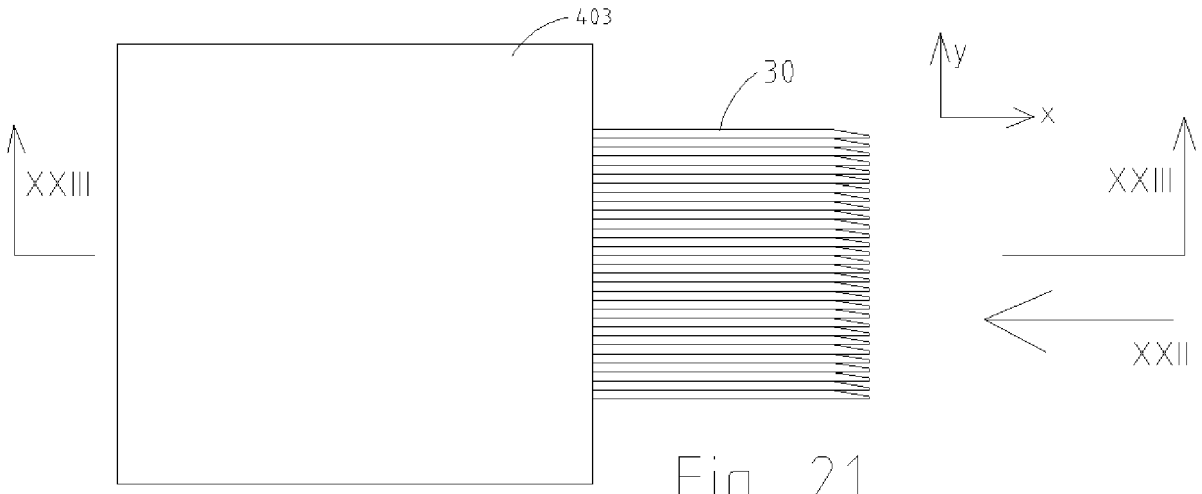

Fig. 21

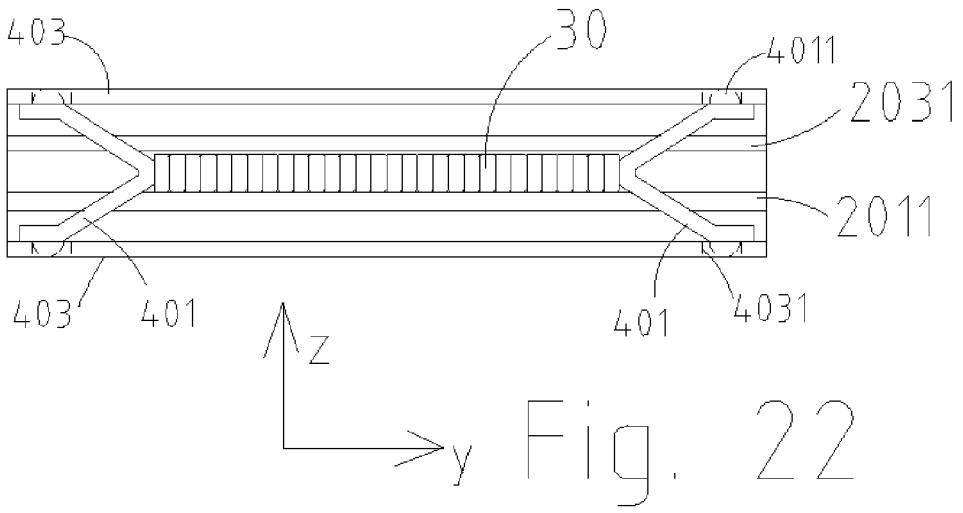

Fig. 22

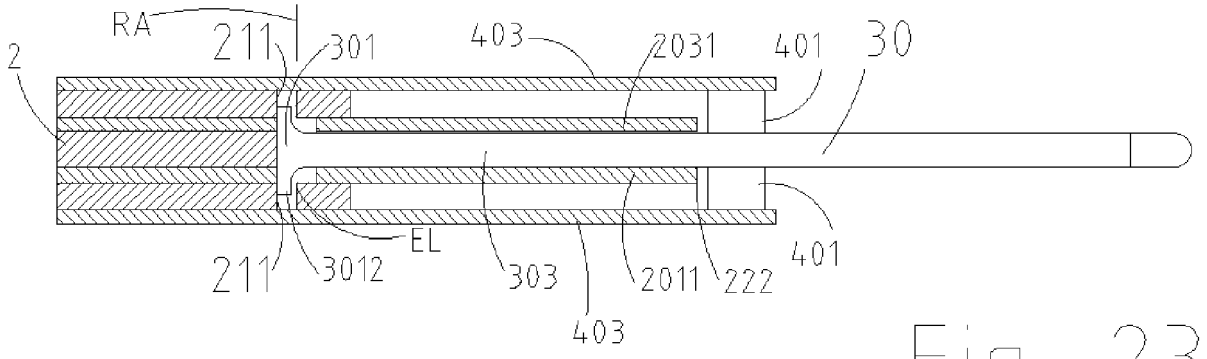

Fig. 23

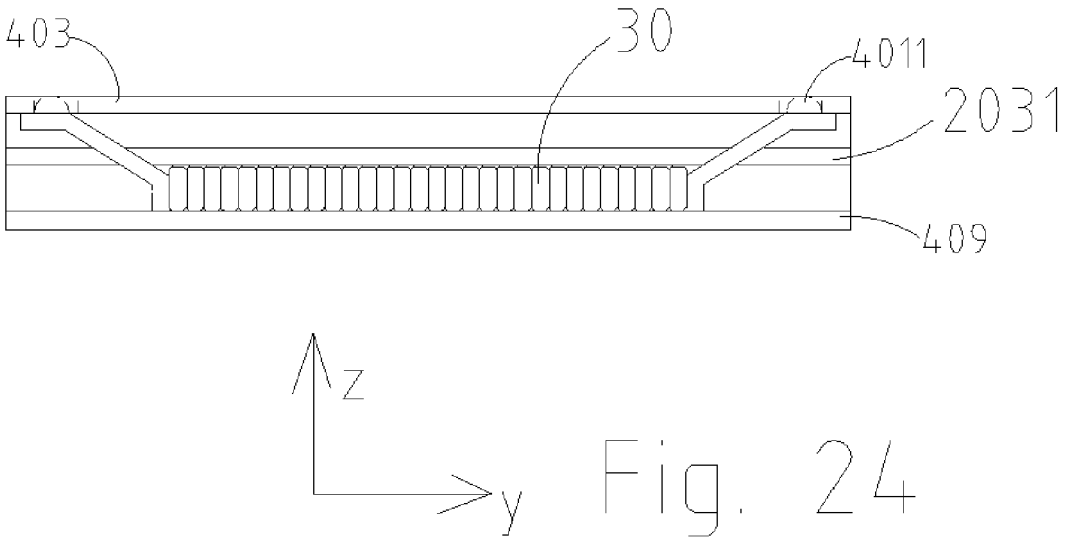

Fig. 24

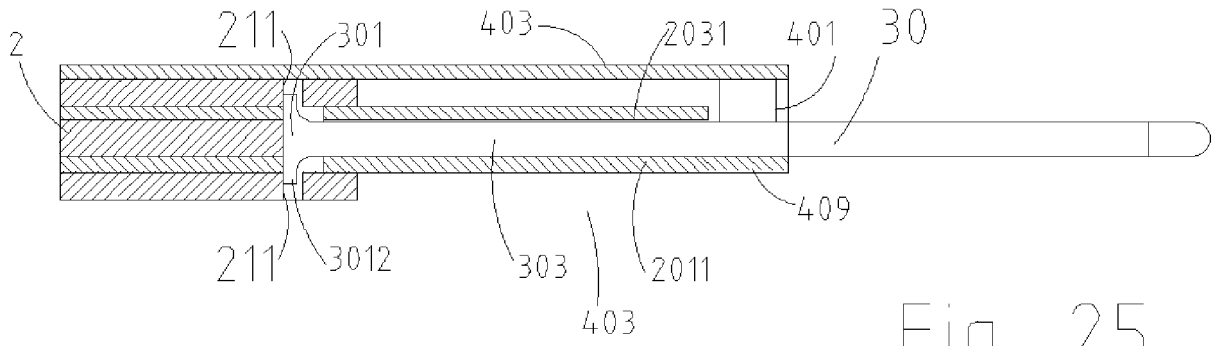

Fig. 25

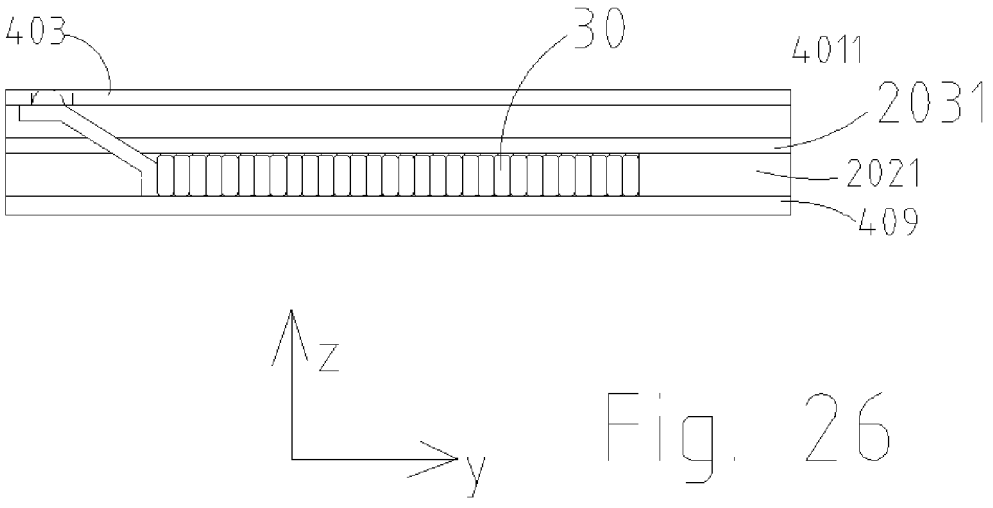

Fig. 26

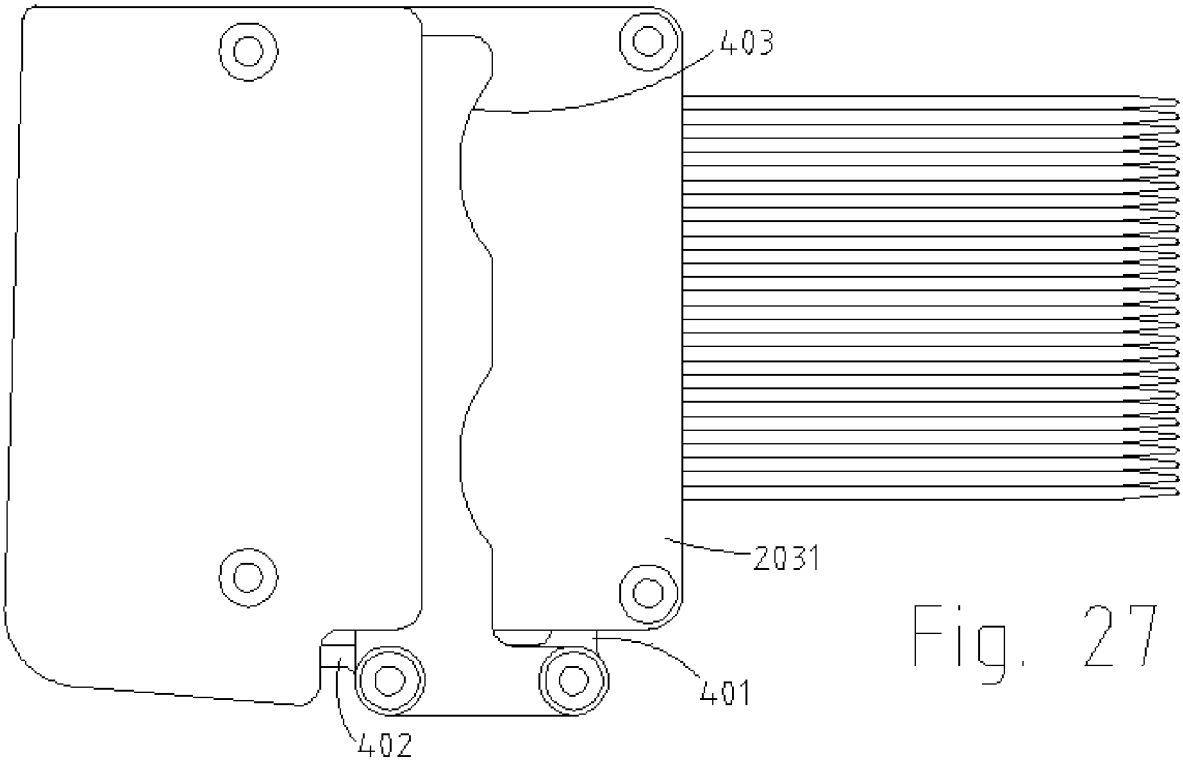

Fig. 27

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EUROPEAN SEARCH REPORT

Application Number
EP 21 02 0275

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	CN 202 603 938 U (UNIV SHANGHAI DIANJI) 19 December 2012 (2012-12-19) * abstract; figures *	1-15	INV. A45D24/04 A45D24/10 A45D24/30
A	US 1 425 937 A (JULIUS BIDERMAN) 15 August 1922 (1922-08-15) * page 1, lines 101-111; figures *	1-15	
A	US 1 426 111 A (JOHN SACKER) 15 August 1922 (1922-08-15) * page 1, lines 75-95; figures *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

A45D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 October 2021	Zattoni, Federico

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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15-10-2021

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CN 202603938 U	19-12-2012	NONE	
US 1425937 A	15-08-1922	NONE	
US 1426111 A	15-08-1922	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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- GB 157572 A **[0005]**