

(19) **DANMARK**

(10) **DK/EP 3397821 T3**



(12) **Oversættelse af
europæisk patentskrift**

Patent- og
Varemærkestyrelsen

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- (51) Int.Cl.: **E 04 B 1/76 (2006.01)** **E 04 D 3/36 (2006.01)**
- (45) Oversættelsen bekendtgjort den: **2020-04-20**
- (80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2020-02-05**
- (86) Europæisk ansøgning nr.: **16867426.5**
- (86) Europæisk indleveringsdag: **2016-12-28**
- (87) Den europæiske ansøgnings publiceringsdag: **2018-11-07**
- (86) International ansøgning nr.: **NO2016050270**
- (87) Internationalt publikationsnr.: **WO2017116237**
- (30) Prioritet: **2015-12-29 NO 20151803** **2016-09-16 NO 20161476**
- (84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**
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- (54) Benævnelse: **Fastgørelsesindretning og fremgangsmåde til fastgørelse af isoleringsmateriale til et fladt tag og værktøj til montering af fastgørelsesindretningen**
- (56) Fremdragne publikationer:
EP-A1- 2 660 403
US-A- 3 798 710
US-A- 4 244 269
US-B1- 9 010 064

DESCRIPTION

[0001] The invention is related to a fastening device and method for fastening isolation material to a flat roof. Traditional fastening devices for flat roof isolation and covering/foil material of different thickness is solved by using different fixed size retaining strips being fastened to and extending from a base material to the top face of the isolation and covering/foil material, where a receiving device secures the isolation material, the receiving device being either part of the retaining strip, or is a type of attachable receiving device being mountable to the retaining strip on site and being able to achieve an adjustable length by applying the receiving device at a certain pressure pressing the covering material lightly to achieve a tight fit.

[0002] Several types of these fastening devices are in use, and for all it is a challenge for the carpenters and workers to keep a stock of correct size fastening devices for all the different roof cover thicknesses and material.

[0003] When a fastening device of wrong format is used, it may lead to a serious problem, potentially creating leakage through the roof isolation and covering material.

[0004] Another problem with the available solutions in the building industry is that they are vulnerable to external load. For example if a person walks on the roof after mounting of isolation and cover, and happens to step on a location close to or upon the hidden fastening device, the locking mechanism may be tightened further, with the result that the retaining strip will extend further above the stopping device, and potentially create a puncture of the cover arranged over the fastening device, or the isolation layer being permanently depressed offering a much poorer isolation and draining capacity. Same problem may be experienced if there are other strain on the roof cover, such as strong wind, snow and ice, and other.

[0005] US 9 010 064 B1 discloses a fastening device according to the preamble of claim 1.

[0006] The technical problem to be solved is to provide a locking/fastening means able to be adjustable to different isolation/cover thickness, and at the same time not represent a hazard for penetration of the water tight seal that is arranged on top covering the fastening means when isolation layer is depressed by weather or man.

[0007] The present invention comprises a fastening device according to one of the claims 1 to 15 for isolation material for flat roofs, wherein the isolation and foil material may differ in thickness dependent on purpose and location, the angle of the flat roof surface, the need for isolation, and other.

[0008] The invention further comprises a method according to claim 16 for using the fastening device of the invention and the use of the fastening device tool of the invention.

[0009] The various features which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this disclosure. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference is made to the drawings showing non exhaustive examples of embodiments of the invention.

Fig: 1A - Section of isolation on an inclined flat roof

Fig: 1B - Section of isolation on an inclined flat roof fastening means covered by watertight seal

Fig. 2A - 2B- Flexible strip front and side view

Fig. 2C - Flexible strip bottom view

Fig. 3A -3C - Details of receiving device

Fig. 3D - 3F - Details of receiving device with spikes

Fig. 4A - 4D Stop nut

Fig. 5A - 5B- Flexible strip front and side view with receiving device mounted

Fig. 5C - Flexible strip with receiving device mounted bottom view

Fig. 6 - Flexible strip with receiving device mounted

Fig. 7A - 7D - Details of stop nut operation

Fig. 8A - 8C - Views of flexible strip with receiving device mounted

Fig. 9A - 9G - Details of receiving device and stop nut

Fig. 10A - 10C - Flexible strip front, side and bottom view with receiving device

Fig. 11A - 11G - Details of receiving device and stop nut

Fig. 12A - 12D - Flexible strip with receiving device in different mounting phases

Fig. 13A - 13D - Details of receiving device with multiple threads and corresponding stop nut

Fig. 14A - 14D - Flexible strip with upper part able to tilt Fig. 15 - Comparison of flexible strip with extended base and non-extended base on corrugated base material surface.

[0010] When the phrase base material is used in this document it should be understood to also cover any type of roof construction of any type of building where it is required to be covered with a layer of isolation material and/or cover.

[0011] When the phrases screw, plug, screwing tool, plugging tool is used it shall comprise the meaning of any type of pin, screw, plug, spike or other used to screw, drive, drill and drive, drill

and screw or other to ensure a tight and lasting fixation of the fastening device to the base material. If base material is of concrete, a well used technique us to predrill a hole and then drive the plug into the predrilled hole, or even using some sort of casing and then screw or plug adapted for use with casings.

[0012] The fastening device of the present invention provides a flexible device wherein the fastening device may be fluently mounted in a single operation, and where the fastening device may be able to support a variety of different thicknesses of isolation material. The fastening device comprises a flexible strip and a receiving device. The receiving device comprises a stop nut providing a locking action, of the receiving device and the flexible strip, once the stop nut is moved to the locking position, a locking action that will permanently fix the receiving device at the decided length from the base material of which the fastening device is fixed to.

[0013] The invention further comprises a method enabling a tool to be used to fix the fastening device to the base material, also fix the receiving device and optionally cut the excess strip material in a single operation.

[0014] The flexible strip 2 of the present invention, is shown in figure 2A - 2C, comprising a base 20 which is formed as a spherical hollow tube with a bottom part 25 closing off the base in the bottom end. The bottom end provides a centered guiding hole or dent 26 on the inside of the bottom end for guiding a screw or plug 62. The hollow tube part 20 merges into a middle section 21 having a half pipe form. Along most of the middle section 21 is a ridge form 24 pattern, for example a saw teeth form with the tapering side towards the upper end 22 of the flexible strip, formed where each ridge extends peripherally on the outside surface, protruding outwards to offer a stop guide function when a receiving device is guided over and downwards the flexible strip 2. The inside surface of the middle half pipe formed section 21 may have a smooth surface.

[0015] The top part 22 of the flexible strip 2 offer a tapered form for providing an easy threading of the receiving device when mounting the fastening device.

[0016] A hole 23 may be provided in the top part 2 of the flexible strip 2.

[0017] Embodiments of the receiving device are shown in figure 3A - 3F and figure 7A - 7D. The receiving device is comprised of a disc shaped part and a tube formed part 35. The tube formed part 35 is hollow. The hollow space in the tube formed part 35 extends through the disc shaped part, and thus provides a channel 37 through the whole receiving device. The channel 37 is formed to receive both the flexible strip 2 and a stop nut 40. Embodiments of te stop nut is illustrated in figure 4A - 4D and figure 7A - 7D. The inside wall of the channel 37 is formed on a first side 34 to an arc diameter similar to the outside arc diameter of the mid form section 21 of the flexible strip, and the second side 33 of the channel inside surface is formed with a diameter similar to the outside arc diameter of the stop nut 40. The first side 34 of the channel 37 of the receiving device 30 comprises a protruding flange like thread 74 for engaging with the ridge form pattern 24 of the flexible strip 2. The second side 33 of the inside channel

comprises a second thread 71 for engaging with a circular groove 44 formed along a part 43 of the outside of the stop nut 40. The diameter of the first side 34 of the channel 37 is preferably larger than the diameter of the second side 33 of the channel 37. When the flexible strip 2 and the stop nut 40 is inserted in the receiving device 30, 35, and the stop nut is in an unlocked position, it is possible to move the stop nut 40 and the receiving device 30, 35 up and down the length of the flexible strip 2.

[0018] The stop nut 40 is formed such that, when mounted in the channel 37 of the receiving device, it shall provide access, via a passageway 46 through the mid-section of the stop nut 40, for part of a mounting tool for screwing or plugging a screw or plug 62 through the bottom part 25 of the base 20 of the flexible strip 2 and into the base material (roof). The stop nut 40 has integrated engaging features 41, 47 for engaging with a tool that are able to turn 75 the stop nut 40, for example at least 90 degrees in a clockwise direction from a starting position. The engaging features 41, 47 may be formed as protruding stubs 41 that can engage with corresponding groves formed in a tool pipe, alternatively the inside form of the passageway 46 may be formed to integrate with a corresponding outer surface of a tool/pipe such as a hexagon pattern 47 as provided in an umbraco key type tool. Other engaging features 41, 47 may be provided to provide gripping engagement between the stop nut 40 and a tool for rotating the stop nut 40.

[0019] The stop nut 40 further has on the outside an axial protruding ridge 43 comprising a groove/dent 44 for engaging with the thread 71 in the second part 33 of the channel 37 in the receiving device 30, 35, when the stop nut 40 is rotated, for example clockwise. The axial protruding ridge 43 is in a starting position aligned with a first shoulder area 76 of first side 34 of the channel 37 of the stopper device when the stop nut is mounted in the stopper device. The stopper device 40 has further on the outside, approximately on the opposite side of the protruding axial ridge 43, another protrusion 42, 48. This second protrusion 42, 48 is for engaging the inside arc of the flexible strip 2 when the flexible strip is threaded into the receiving device 30, and the stop nut is mounted in a starting position in the receiving device 30, and the stop nut 40 is rotated clockwise. In a starting position the second protrusion 42, 48 is aligned with a second shoulder area 77 of first side 34 of the channel 37 of the receiving device 30 when the stop nut is mounted in the stopper device. When the flexible strip and the stop nut is mounted inside the channel 37, and stop nut 40 is turned clockwise, the second protrusion 42, 48 will push the flexible strip 2 towards the inside wall of the first side 34 of the channel 37, and thus two of the peripherally ridges 24 on the outer surface of the flexible strip will engage with the protruding flange like thread 74 inside the first side 34 of the channel 37 of the receiving device 30, 35, and thus lock the receiving device 30, 35 and the flexible strip 2 in a fixed position.

[0020] Figure 7A - 7D shows embodiments of the stages before and after the stop nut 40 is turned one quarter of a full circle, 90 degrees. In a starting position, as shown in figure 7A, the second thread 71 of the receiving device 30 has not engaged with the protruding ridge 43 with the dent 44, and the stop nut 40 outside wall facing the inside arc of the flexible strip is not in tight engagement 72. In figure 7B it is shown that when the stop nut 40 is rotated clockwise,

the protruding ridge 43 with the dent 44 of the stop nut 40 engage with the second thread 71 of the receiving device 30, and the second protrusion 42, 48 of the stop nut 40 engage with the inside arc of the flexible strip pushing the flexible strip 2 and its outside formed peripheral ridges 24 towards the inside of the receiving device 30 first wall 34 which comprise the protruding flange like thread 74.

[0021] On the protruding ridge 43 side of the stop nut, there may be provided a rotate stopping feature in the form of an integrally formed biased spring 78 protruding radially, for example in an anticlockwise direction of the rotating motion direction 75 as shown in one embodiment in figure 7D. In the far end of the biased spring is formed an outward pointing, from the center of the stop nut 40, tap 79 for engagement with a corresponding groove 79' in the receiving device 30, such that when the stop nut 40 is rotated a quarter of one full circle from the starting point, the tap 79 and groove 79' will engage, and lock the stop nut in a fixed position relative the receiving device 30, 35.

[0022] The second protrusion 42, 48 of the stop nut 40 may be provided in various forms, such as a protruding tap 42, 48, or an increasing outer diameter 48 of the stop nut, or other.

[0023] The channel 37 in the receiving device 30, 35 is arranged with a displacement related to the center 36 of the receiving device, such that the center 36 of the receiving device 30 coincides approximately with the midpoint inside the arc of the halfpipe of the mid-section 21 if the flexible strip 2 when mounted in the receiving device 30.

[0024] In one embodiment of the receiving device 30, 35, the stop nut 40 is maintained inside the receiving device, optionally from the production of the two parts from the same piece of material, by small connecting strings providing breakable holding means (not shown). In another embodiment the stop nut 40 is inserted into the receiving device 30, 25 when assembled on site before use.

[0025] A fastening tool is provided featuring 3 separate tools in one device for screwing or plugging the screw or plug 62 into the roof 61, for turning the stop nut 40, and for cutting excess parts of the flexible strip protruding above the retaining device 30, 35 after mounting and fastening.

[0026] The fastening device and its various parts may be produced in any type of material, or a combination of materials. Advantageous results have been experienced using nylon and/or nylon composites. Nylon may also be reinforced by using glass fiber and/or carbon fiber to increase the mechanical properties of the various parts of the fastening device. In traditional solutions there has been a norm to use poly propylene, or variations of this, which is also a material that can be used in present invention. Using said nylon or nylon composites enable the present invention to be produced with less material use, and hence providing a lighter assembly.

[0027] A typically method for using an embodiment of the invention, as illustrated in figure 1A

and 1B, will be for the worker to use fastening devices of a length at least longer than the thickness of the isolation that is going to be secured on the roof. An isolation mat 1 layer is arranged on the base material/roof 3. Then as the cover/foil 5 is arranged over the isolation mats 1, the fastening devices are mounted in the outer strip area 6 of the foil 5. This area will be covered by subsequent cover/foil 5. The receiving device 30, 25 may be threaded over and down a flexible strip 2 if not ready assembled from vendor, and a stop nut 40 is arranged in the channel 37 of the receiving device 30, 25 in a starting position, if not ready assembled from vendor. A screw or plug 62 may be arranged in the bottom part 20 of the flexible strip 2. A screwing tool or plugging tool part of the mounting tool is lead through the opening in the stop nut 40 from above and down to the head of the screw or plug 62. Using the mounting tool to drive the bottom part of the flexible strip 2 through the cover/foil 5 and the isolation mat 1, and when it hit the roof to which it is to be mounted, the worker use the screwing tool or plugging tool to screw or plug the screw or plug 62 into the roof 61, and thereby fastening the flexible strip to the base material/ roof. If the isolation material and/or the cover material is of a material where it is hard to push the fastening device through merely by manual force, it may be predrilled a hole through the isolation material and or the cover using an appropriate tool before the bottom part of the flexible strip is driven through the cover and isolation. The receiving device 30, 35 is then pushed down to the top of the isolation 62, and hence pressing the isolation material to the base material. Then, optional spikes 34, arranged on the underside of the receiving device disk 30, will protrude into the isolation mat 1 and further fix the arrangement. The mounting tool part for rotating the stop nut 40 is brought in contact with the engaging features 41, 47 of the stop nut 40, and then rotated 90 degrees, and thus the flexible strip 2 is held in a locked arrangement to the retaining device 30, 35, 40. The mounting tool cutting feature is then activated to cut the protruding rest of the flexible strip 2 above the top side of the receiving device 30, 35. When the neighbor cover/foil 5 is arranged on the isolation, it will overlap 6 the mounted receiving device holding the previous mounted cover/foil, and thus create a tight roof cover, where none of the fastening devices are visible or creates a leaking point.

[0028] In a further embodiment, as shown in fig. 9A - 9G and fig. 10A - 10C, of the invention the receiving device 91, different from the thread 71 for engaging with a circular groove 44 formed along an outside part 43 of the stop nut 40 when mounted inside the receiving device as described in the previous embodiments, comprise holding tongues 92 and receiving snap latch 93 protrusions for retaining a stop nut 94 once it is received by the receiving device 91.

[0029] The inside wall of the channel 37 in the receiving device 91 is formed on a first side 34 to a form, for example an arc, similar to the outside form, for example an arc, of the mid form section 21 of the flexible strip 2, 101, and the second side 96 of the channel 37 inside surface is formed with a form, for example a diameter, similar to the outside form, for example arc diameter, of the stop nut 94. The first side 34 of the channel 37 of the receiving device 91 comprises a protruding flange like thread 74 for engaging with the ridge form pattern 24 of the flexible strip 2, 101.

[0030] The holding tongues 92 and receiving snap latch 93 protrusions are arranged on the

second side 96 form of the channel 37, in the lower end and upper end respectively, for example in the form of a circle, of the opening in the receiving device 91 opposite the half form, for example in the form of a circle, adapted for receiving the flexible strip 101. The number of holding tongues 92 and receiving snap latch 93 protrusions may vary, typically between 1 and 5. The second side 96 form, for example in the form of a circle, may have a smooth surface since the retaining means for the stop nut 94 are fully provided by the holding tongues 92 and receiving snap latch 93 protrusions.

[0031] In this embodiment the middle section 21 of the flexible strip 101 is a ridge form 24 pattern, for example a saw teeth form with the upper end 102 of the flexible strip 101 defining an area without a ridge form pattern, but preferably a smooth surface for easy insert in the receiving device.

[0032] The stop nut in the latter embodiment may be formed as a custom fit washer in a predetermined thickness to fit inside the space 37 in the receiving device 91 defined by the holding tongues 92 and receiving snap latch 93 protrusions.

[0033] The stop nut 93 will typically be provided in multitudes fixed to a strip or matrix (not shown) mountable in a fixation tool (not shown) by offering engaging features 98, for example in the form of a groove or channel through the stop nut, provided for the purpose of mounting the stop nut to the receiving device 91 once the flexible strip 2, 101 is inserted in to the receiving device 91.

[0034] Even if the figures all show typical embodiments where the stopper bit, the channel and the flexible strip has circular or semicircular forms, the invention may in the latter embodiment be formed differently, for example a rectangular stopper bit, fitted into an adapted rectangular space in the receiving device, where also the flexible strip shows a mid-section with straight sides.

[0035] The figures 9 and 10 show in detail:

Fig. 9A show an embodiment of the flexible strip 101 from obliquely below, inserted into the receiving device 91 where the stopper bit 94 is seen resting on the holding tongues 92.

Fig. 9B and 9C show an embodiment of the receiving device 91 from obliquely below and above respectively, comprising also the stopper bit 94 installed in the receiving device 91.

Fig. 9D and 9E shows the stopper bit from obliquely above and the side respectively.

Figure 9F shows one embodiment of the receiving device 91 from below, and fig. 9G shows the same from above.

Fig. 10A show an embodiment of the complete assembly of the flexible strip 101, receiving device 91 and the stop bit 94 from the side.

Fig. 10B show an embodiment of the complete assembly of the flexible strip 101, receiving

device 91 and the stop bit 94 from the front.

Fig. 10C show an embodiment of the complete assembly of the flexible strip 101, receiving device 91 and the stop bit 94 from below.

[0036] The flexible strip 101, 131 comprising a base 20 which is formed as a spherical hollow tube with a bottom part closing the base 20 in the bottom end, and an upper part 103 which opens up the tube portion and transforms the tube form into the half-pipe form of the mid 21 and upper section 102, 122 of the flexible strip 101, 131. The upper part 103 of the base 20 can advantageously be formed as a concave transition form as seen from the side in figure 10A. Other forms may be used, for example a convex form. The upper part comprise an arched form that will distribute any bending forces evenly over the length of the transformation part, and thereby prohibiting unintentional breakage of the flexible strip 101, 131 in this area. The bottom end provides, similar as identified in figure 2A - 2C, a centered guiding hole or dent 26 on the inside of the bottom end for guiding a screw or plug 62. The hollow tube part 20 merges into a middle section 21 having a half pipe form. Along most of the middle section 21 is a ridge form 24 pattern, for example a saw teeth form with the tapering side towards the upper end 22 of the flexible strip, formed where each ridge extends peripherally on the outside surface, protruding outwards to offer a stop guide function when a receiving device is guided over and downwards the flexible strip 101. The inside surface of the middle half pipe formed section 21 may have a smooth surface. The centered guiding hole 26 may comprise a thin breakable membrane or film, typically in a material equal to the flexible strip 101, arranged either in the inlet or outlet orifice 104 of the guiding hole 26. The membrane is strong enough for creating a holding force for a pre-mounted screw or plug 62, in order for it not to fall out under transport, but not so strong that it represent any hindrance for further screwing or moving the plug when the flexible strip 101 is mounted on a roof.

[0037] A typical user case of the invention according to the latter embodiment will thus be:

- arrange the isolation and cover on the roof
- insert the top end of the flexible strip into the receiving device 91
- fasten the flexible strip 101 to the roof 61
- slide the receiving device down the flexible strip as far as required for fixing the isolation and cover close to the roof
- manually, or by using a customized tool, insert a stop nut 93 into the space 97 and press until the edge of the bottom surface of the stop nut 94 comes to rest on the holding tongues 92, and the receiving snap latch 93 protrusions grips and holds the stop nut 94 fixed
- the stop nut presses ridge pattern of the flexible strip into the flange like thread 74 of the receiving device 91 for engaging with the ridge form pattern 24 of the flexible strip 2, 101, and thus fix the position of the receiving device permanently on the flexible strip 2, 101.

[0038] In a further embodiment, as shown in fig. 11A - 11G and fig. 12A - 12D, of the invention the receiving device 191 comprise holding tongues 192 and receiving snap latch 193 protrusions for retaining a stop nut 180 once it is received by the receiving device 191.

[0039] The inside wall of the channel 137 in the receiving device 191 is formed on a first side 134 to a form, for example an arc, similar to the outside form, for example an arc, of the mid form section 21 of the flexible strip 2, 101, and the second side 196 of the channel inside surface is formed with a form, for example a diameter, similar to the outside form, for example arc diameter, of the head part 181 of the stop nut 180. The first side 134 of the channel 137 of the receiving device 191 comprises a protruding flange like thread 174 (only partly visible in figure 11D), similar to the thread in figure 7B and 9F, for engaging with the ridge form pattern 24 of the flexible strip 2, 101.

[0040] The holding tongues 192 and receiving snap latch 193 protrusions are arranged on the second side 196 form of the channel 37, in the lower end and upper end respectively, for example in the form of a circle, of the opening 137 in the receiving device 191 opposite the half form, for example in the form of a circle, adapted for receiving the flexible strip 131. The number of holding tongues 192 and receiving snap latch 193 protrusions may vary, typically between 1 and 5. The second side 196 form, for example in the form of a circle, may have a smooth surface since the retaining means for the stop nut 180 are fully provided by the holding tongues 192 and receiving snap latch 193 protrusions.

[0041] This embodiment of the receiving devices 191 further comprise an elongated channel/conduit 197 extending out from the underside of the receiving device 191. The channel 197 is designed with a bottom part 198 with a tapered form towards a pointed bottom end 199. This is provided to ease the mounting phase when the receiving device 191 is pushed down to the upper surface of the isolation mat 1. The pointed bottom end 199 is arranged on the side of the receiving device 191 receiving the flexible strip 131.

[0042] In this embodiment the middle section 21 of the flexible strip 131 is a ridge form 124 pattern, for example a saw teeth form with the upper end 122 of the flexible strip 131 defining an area without a ridge form pattern, but preferably a smooth surface for easy insert in the receiving device.

[0043] It is further provided a flexible strip 131 comprising flexible/bendable upper end 122, which when a receiving device 191 is arrange to receive the flexible strip 131 and a stop nut 180 is mounted in the receiving device 191, the stop nut 180 being mounted in a non-locking position, as shown in figure 12B, the upper end 122 can be bent to the side (not shown) giving way for a mounting tool, such as a screw driver, to be pointed pass the outside of the receiving device and to the screw or plug 62 head for screwing or driving the screw or plug 62 into the base material/roof 3.

[0044] The stop nut 180 in the latter embodiment is formed to offer the ability to be mounted in

the receiving device in two positions, partly inserted, and fully inserted, as shown respectively in figure 12B and 12D. The stop nut 180 comprises a main portion 181 being a cylindrical form having an upper surface perpendicular to the cylindrical side form. The length of the main portion 181 is equal or less than the length of the channel 137 of the receiving device 191 between the underside of the receiving snap latch 193 and the upper side of the holding tongues 192 that are arranged on the second side 196 form of the receiving device 191. There is a recess or hole 186 arranged in the middle of the main portion 181, offering at least a recess for receiving a mounting aiding tool or similar. The recess or hole may be formed right through the main portion 181 of the stop nut 180. The stop nut 180 further has on the lower part of the main portion 181 a tapering or perpendicular surface 182 relative the side wall of the main portion 181. The stop nut 180 has a number of holding tongues 183, 184, 185 protruding from the underside of the main portion 181. The holding tongues 183, 184, 185 is arranged to offer a center portion 183 of the stop nut 180 with a circumference of a size fitting to the inside conduit 137 of the receiving device 191. The holding tongues 183, 184, 185 further having a tapering outer end 185, and a saw tooth form 184 with a largest circumference of a size larger than the inside conduit 137 of the receiving device 191, such that when the receiving device 191 is mounted on the top part of the flexible strip 131 and the stop nut 180 is pushed into the conduit 137 from the top side of the receiving device 191 the holding tongues 183, 184, 185 first entering the conduit 137, the holding tongues 183, 184, 185, the holding tongues 183, 184, 185 will bend backwards and let the holding tongues 183, 184, 185 part of the stop nut pass over receiving snap latch 193 or both the receiving snap latch 193 and the holding tongues 192 that are arranged on the second side 196 form of the receiving device 191. If the stop nut 180 is attempted to be pulled out it will not be able to be pulled further back then the saw tooth form 184 will abut to the underside of either the receiving snap latch 193 and the holding tongues 192, depending on how far down it was pushed. The stop nut 180 may rest in the conduit 137 together with the flexible strip 131 without the risk of falling out, and the receiving device 191 can freely be moved up and down the flexible strip 131 as shown in figure 12B.

[0045] When the stop nut 180 is pushed further down into the receiving device 191, the main portion 181 of the stop nut is moved pass the snap latch tongues 193, and the perpendicular surface 182 on the lower part of the main portion 181 of the stop nut 180 will abut against the holding tongues 192 of the receiving device. The circumference of the main portion 181 of the stop nut 180 will push the flexible strip 131 towards the first side 134 of the channel 137 of the receiving device 191, and the flange like thread 174 will engage with the ridge form pattern 24 of the flexible strip 131, and when the main portion 181 is moved to be positioned between the receiving snap latch 193 and the holding tongues 192 that are arranged on the second side 196 form of the receiving device 191, the receiving device 191 is locked in a fixed position along the flexible strip 191.

[0046] Even if the figures all show typical embodiments where the stopper bit, the channel and the flexible strip has circular or semicircular forms, the invention may in the latter embodiment be formed differently and still offer the above discussed features.

[0047] The figures 11 -14 show in detail:

Figure 11A show the receiving device seen from the side where the side formed to receive the stop nut is closest to the viewer, and the side receiving the flexible strip is furthest away from the viewer.

Figure 11B show the receiving device seen from a side perpendicular to the image in figure 11A.

Figure 11C show the receiving device from an oblique angel from below looking into the channel side that receives the stop bit.

Figure 11D show the receiving device from an oblique angel from above looking into the channel side that receives the stop bit. A small portion of the flange like thread can be identified in the upper portion of the channel.

Figure 11E show a side view of the stop nut.

Figure 11F show an oblique angel view from above of the stop nut, identifying the recess/hole through the main portion of the stop nut.

Figure 11G shows the receiving device from a side view with the stop nut inserted, and the stop nut is in a lock position. The flexible strip is not drawn to highlight the position of the stop nut inside the receiving device.

Figure 12A shows a flexible strip and the receiving device arranged on the flexible strip.

Figure 12B shows the flexible strip, the receiving device and the stop nut in a non-locking state.

Figure 12C shows an oblique view from below of the flexible strip, the receiving device and the stop nut in a locking state.

Figure 12D shows an oblique view from above of the flexible strip, the receiving device and the stop nut in a locking state.

Figure 13A illustrates a further embodiment of the receiving device wherein the tube formed part 35, 197 providing a channel 37, 137 through the receiving device 30, 91, 191 comprises multiple threads 130 for interacting with more than one thread on the flexible strip when the stop nut is in a locking state.

[0048] Having multiple threads 130, two or more, makes it necessary to make the channel 37, 137 part longer, and hence the length 132 of the main portion 181 of the stop nut 180 and the length 133 of the center portion 183 of the stop nut 180 must be adapted to the longer channel to be able to rest inside the channel 37, 137 in a non-locking state, and also be able to lock the length spanning all the threads 130 when in a locking state.

[0049] Figure 13D illustrates an alternative design of the receiving device holding tongues 135. This merely shows that different designs may be used for the holding tongues and receiving snap latch protrusions depending on the need for holding strength. In one embodiment these may be made intentional weak for allowing easier demounting of the stop nut and receiving device.

[0050] Figure 14A show an alternative embodiment of the flexible strip wherein there is formed a recess 140 from both sides towards the middle of the half pipe form between the upper end 22 of the flexible strip and the mid-section 21 of the flexible strip in order to make the flexible strip additional flexible and bendable in this part. The added flexibility in the part of the flexible trip with the recesses 140 is illustrated in figure 14D. The recesses 140 are provided to ease the access for a mounting tool to be lead down to the screw or plug 62 arranged in the base 20 of the flexible strip when being mounted on a roof.

[0051] The ridge form pattern along the middle section 21 of the flexible strip is shown in an alternative design in figure 14B where the ridge form is mainly square, but with a sloping upward facing surface, to allow easy sliding of the receiving device down to the top surface of the isolation when the flexible strip is being mounted to the base material. Along most of the middle section 21 is a ridge form 24 pattern, for example a saw teeth form with the tapering side towards the upper end 22 of the flexible strip, formed where each ridge extends peripherally on the outside surface, protruding outwards to offer a stop guide function when a receiving device is guided over and downwards the flexible strip 2. The inside surface of the middle half pipe formed section 21 may have a smooth surface.

[0052] The spherical hollow tube of the base 20 is also shown with an extended tube form 141 in figure 15. The extension 141 is necessary when the flexible strip is used to fasten an isolation mat to a base material (roof) having an irregular/uneven or corrugated form 153. Normally the base material is covered with a vapor barrier or vapor retarder 154 such as a polyethylene sheet. If the flexible strip is fastened at a section where there is a gap 151 between the vapor barrier or vapor retarder 154 and the base material 153, the flexible strip will perforate the vapor barrier or vapor retarder 152, 153, and it is in these cases important that the base part of the flexible strip 155 provides a complete spherical tube form at the penetration hole 152 in the vapor barrier or vapor retarder 154 to maintain the permeability characteristics of the vapor barrier or vapor retarder 154. As the figure also illustrates when a non-extended base 20 of a flexible strip 156 is used, the penetration hole 153 in the vapor barrier or vapor retarder 154 will present a hole in the barrier after mounting of the flexible strip 156. Therefor the extended tube form must be of a length 141 longer than the possible gap 151 between the base material surface 153 and the vapor barrier or vapor retarder 154.

[0053] The different components of the invention device, flexible strip, receiving device, plug, screw may be pre-mounted in a non-locking state in one unit, such that when the mounting process to the base material does not need to involve handling more than one unit. The plug will rest in the non-locking state inside the receiving device, but may additionally be bound by a thread, or strip (not shown). Such thread or strip may be easily broken when the plug is to be

moved to the locking state. Thread or strip may be a molded/soldered connection of any suitable material, a point glue connection, or any form of strip connection.

[0054] A typical user case of the invention according to the latter embodiment will thus be:

- mount receiving devices to the top part of the flexible strip and insert stop nut into the receiving device in the non-locking position
- arrange the isolation and cover on the roof
- fasten the flexible strip 131 to the roof 61
- slide the receiving device down the flexible strip as far as required for fixing the isolation and cover close to the roof
- push the stop nut 180 further down in to the channel 137 until the perpendicular surface 182 on the lower part of the main portion 181 of the stop nut 180 will abut against the holding tongues 192 of the receiving device
- the stop nut presses the ridge pattern of the flexible strip into the flange like thread 174 of the receiving device 191 for engaging with the ridge form pattern 24 of the flexible strip 131, and thus fix the position of the receiving device permanently on the flexible strip 131

The embodiments and variations described herein is examples of the invention and its use, and shall not be limiting the usage and technical features of the invention. It is the attached claims that define the protection scope.

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US9010064B1 [0005]

Patentkrav

1. Fastgørelsesindretning til isoleringsmateriale (1), omfattende:

5 en fleksibel strimmel (2, 101, 131), hvor den fleksible strimmel (2, 101, 131) omfatter mindst én basisdel (20) til fastgørelse til et basismateriale (3), og et midterafsnit (21) til at gå i indgreb med en modtagelsesindretning;

10 en modtagelsesindretning (30, 91, 191), omfattende en rørformet del (35, 197), der tilvejebringer en kanal (37, 137) gennem modtagelsesindretningen (30, 91, 191); hvor fastgørelsesindretningen er **kendetegnet ved, at** den yderligere omfatter:

en stopmøtrik (40, 94, 180) til montering i kanalen (37, 137); hvor kanalen (37, 137) er udformet til at modtage både stopmøtrikken (40, 94, 180) og midterafsnittet (21) af den fleksible strimmel (2, 101, 131).

15 **2.** Fastgørelsesindretning ifølge krav 1, hvor stopmøtrikken (94, 180) omfatter en hoveddel (94, 181), der er formet med en glat, udvendig flade til let indføring i modtagelsesindretningen (91, 191).

20 **3.** Fastgørelsesindretning ifølge krav 1, hvor stopmøtrikken (40, 94, 180) omfatter indgrebsmidler (41, 46, 47, 98, 186) til indgreb med et værktøj.

25 **4.** Fastgørelsesindretning ifølge krav 2, hvor stopmøtrikken (180) på den nedre del af hoveddelen (181) omfatter en tilspidsende eller vinkelret flade (182) i forhold til sidevæggen af hoveddelen (181), og et antal af holdetunger (183, 184, 185), der rager frem fra undersiden af hoveddelen (181), hvor holdetungerne (183, 184, 185) er indrettet til at tilvejebringe en midterdel (183) af stopmøtrikken (180) med en omkreds, der er mindre end omkredsen af hoveddelen (181), og holdetungerne (183, 184, 185) har yderligere en endedel (184, 185),
30 omfattende en savtakket form (184) med en tilspidsende udvendig ende (185), hvor omkredsen af den savtakkede form (184) er større end omkredsen af midterdelen (183), og holdetungerne (183, 184, 185) er indrettet til at tilvejebringe en eftergivelig adfærd ved, at omkredsen af den savtakkede form (184) kan formindskes ved at udøve en udvendig kraft (F), når den savtakkede form

(184) skubbes mod midterlinjen (C) af stopmøtrikken (180).

5 **5.** Fastgørelsesindretning ifølge et hvilket som helst af de foregående krav, hvor basisdelen (20) af den fleksible strimmel (2, 101, 131) har en hul cylinderform, og omfatter en bunddel (25), hvor et føringshul eller en føringsfordybning (26, 106) til føring af en skrue eller prop (62) er dannet i det mindste på indersiden af bunddelen (25).

10 **6.** Fastgørelsesindretning ifølge krav 5, hvor føringshullet (26, 106) yderligere omfatter en tynd, brydelig membran eller film, der er indrettet til at lukke føringshullet (26, 106) for at fastholde en tidligere anbragt skrue i føringshullet (26, 106) under transport.

15 **7.** Fastgørelsesindretning ifølge et hvilket som helst af de foregående krav, hvor midterafsnittet (21) af den fleksible strimmel (2, 101, 131) har en halv-rørsform, hvor den udvendige, bueformede flade omfatter et ribbeformet mønster (24), hvor ribberne (24) strækker sig periferisk på den udvendige flade.

20 **8.** Fastgørelsesindretning ifølge krav 7, hvor det ribbeformede mønster (24) har en savtakket form med den tilspidsende side af savtænderne mod en øvre ende (22, 102, 122) af den fleksible strimmel (2, 101, 131).

25 **9.** Fastgørelsesindretning ifølge et hvilket som helst af de foregående krav, hvor den indvendige væg af kanalen (37, 137) af modtagelsesindretningen (30) omfatter:
en første side (34) med en form svarende til den udvendige, bueformede halv-rørsform af midterafsnittet (21) af den fleksible strimmel (2, 101, 131), og
en anden side (33, 96, 196) med en form svarende til den udvendige, bueformede diameter af stopmøtrikken (40, 94, 180).

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10. Fastgørelsesindretning ifølge krav 9, hvor den første side (34) af den indvendige væg af kanalen (37, 137) af modtagelsesindretningen (30, 91, 191) omfatter:

en eller flere fremstående, flange-lignende tråde (74, 130), til indgreb med den udvendige bue af en fleksibel strimmel (2, 101, 131) ved montering indvendigt i modtagelsesindretningen.

- 5 **11.** Fastgørelsesindretning ifølge krav 9 eller 10, hvor den anden side (96, 196) af den indvendige væg af kanalen (37, 137) af modtagelsesindretningen (91, 191) omfatter:
- en eller flere holdetunger (92, 192), der er indrettet på bunddelen af formen af den anden side (96, 196), og en eller flere modtagende tryklåsefremspring (93, 10
193), der er indrettet på den øvre del af form af den anden side (96, 196) for at fastholde et stopmøtrik (94, 180), når den optages af modtagelsesindretningen (91, 191),
- 12.** Fastgørelsesindretning ifølge et hvilket som helst af de foregående krav, 15
hvor den rørformede del yderligere omfatter en aflang kanal eller ledning (197), der strækker sig ud fra undersiden af modtagelsesindretningen (30, 91, 191), hvor kanalen eller ledningen (197) omfatter en bunddel (198) med en tilspidset form mod en spids, nedre ende (199), og hvor den spidse, nedre ende (199) er indrettet på siden af modtagelsesindretningen (30, 91, 191) til modtagelse 20
af den fleksible strimmel (2, 101, 131).
- 13.** Fastgørelsesindretning ifølge et hvilket som helst af de foregående krav, hvor basisdelen (20) af den fleksible strimmel (101, 131) er formet som et sfærisk, hult rør med en bunddel, der lukker basen (20) i den nedre ende, og en 25
øvre transformationsdel (103), der åbner rørdelen og transformerer rørformen til en halvørersform af midterafsnittet (21) af den fleksible strimmel (101, 131), hvor den øvre del (103) har en konkav eller konveks form til fordeling af enhver bøjningskraft jævnt over længden af transformationsdelens øvre del (103).
- 30 **14.** Fastgørelsesindretning ifølge et hvilket som helst af de foregående krav, hvor den fleksible strimmelform (155) omfatter en eller flere udsparinger (140) i en del mellem den øvre del og midterafsnittet af den fleksible strimmel (155), hvor udsparingerne (140) er taget med for øget fleksibilitet af den fleksible

strimmel (155), når det øvre afsnit bøjes ved montering.

5 **15.** Fastgørelsesindretning ifølge et hvilket som helst af de foregående krav, hvor materialet i hvilken som helst af den fleksible strimmel (2, 101, 131), modtagelsesindretningen (30, 91, 191) og stopmøtrikken (40, 94, 180) er af nylon eller nylonkomposit.

10 **16.** Fremgangsmåde til fastgørelse af isoleringsmateriale til et basismateriale ved at anvende en fastgørelsesindretning ifølge et af de foregående krav, omfattende de følgende trin:

- anbringelse af isolering og afdækning på taget

- indføring af den øvre ende (102, 122) af den fleksible strimmel af fastgørelsesindretningen i modtagelsesindretningen (91, 191) af fastgørelsesindretningen,

15 - indføring af stopmøtrikken (94, 180) af modtagelsesindretningen i en ikke-låst position i modtagelsesindretningen (91, 191),

- fastgørelse af den fleksible strimmel (101, 131) til taget (61),

20 - glidning af modtagelsesindretningen (91, 191) ned ad den fleksible strimmel så langt som nødvendigt for at fastgøre isoleringen (1) og afdækningen (5) tæt ved taget (3),

- skub af stopmøtrikken (94, 180) videre ned i kanalen (37, 137), indtil undersiden af, eller den vinkelrette flade (182) på den nedre del af hoveddelen (181), af stopmøtrikken (94, 180) vil ligge an mod holdetungerne (92, 192), der er anbragt på den nedre del af formen af den anden side (96, 196) i kanalen (37, 137) af modtagelsesindretningen (91, 191),

25 - stopmøtrikken presser ribbemønsteret (24) af den fleksible strimmel ind i de flange-lignende tråde (74, 130, 174) af modtagelsesindretningen (91, 191) for at gå i indgreb med det ribbeformede mønster (24) af den fleksible strimmel (101, 131), og således fastgøre positionen af modtagelsesindretningen permanent på den fleksible strimmel (101, 131).

30

DRAWINGS

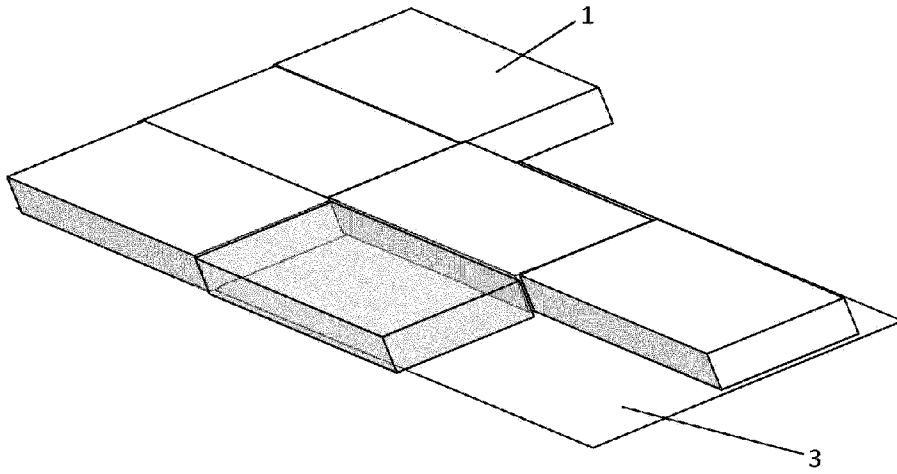


Fig. 1A

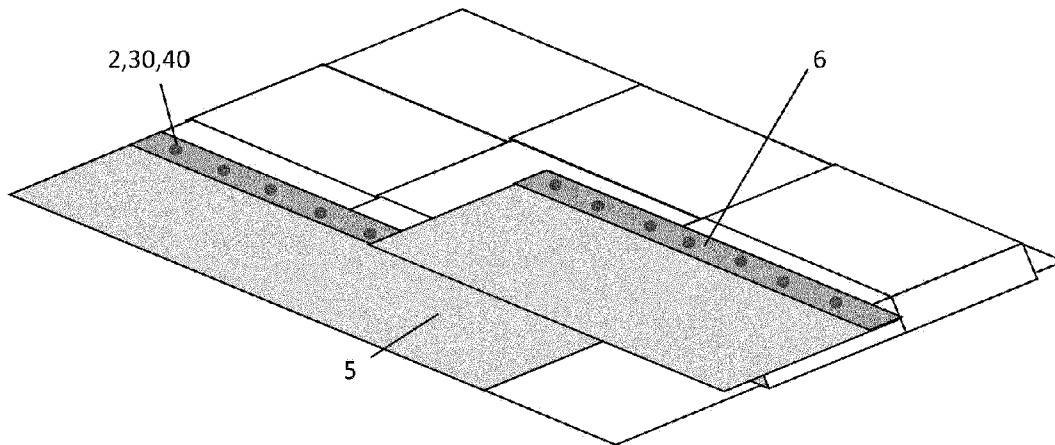


Fig. 1B

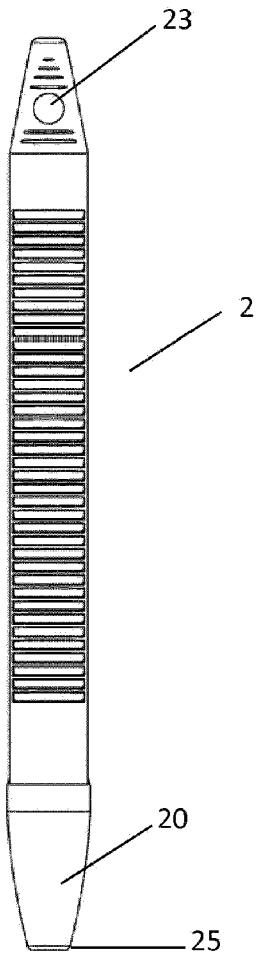


Fig. 2A

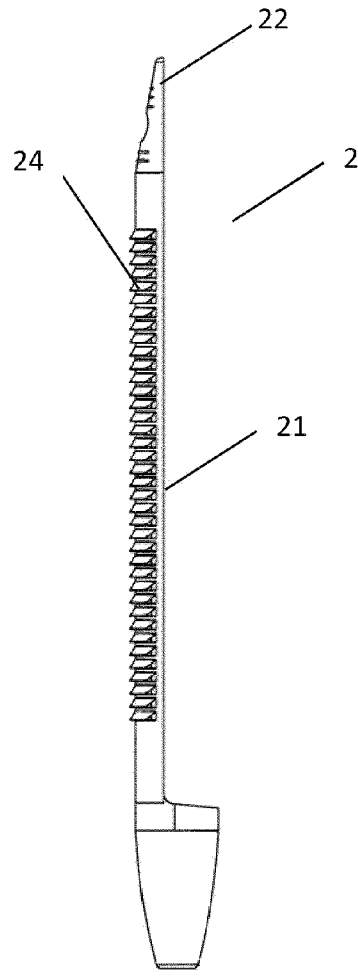


Fig. 2B

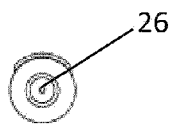


Fig. 2c

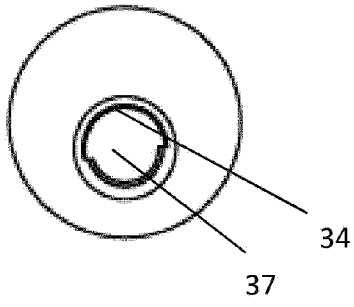


Fig. 3A

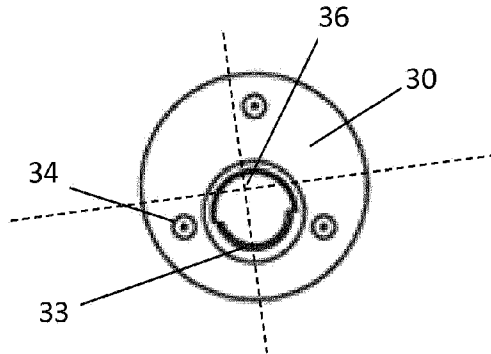


Fig. 3D

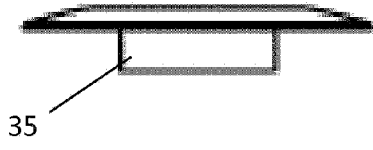


Fig. 3B

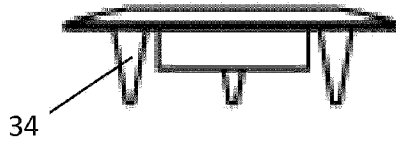


Fig. 3E



Fig. 3C

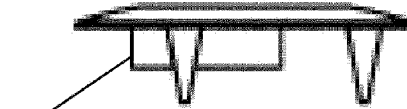
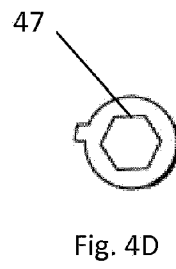
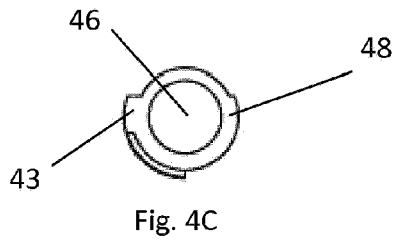
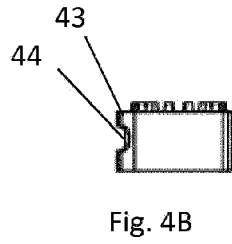
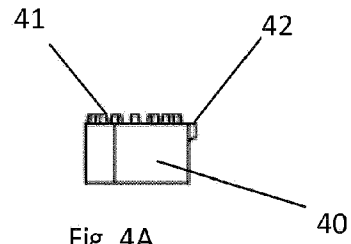


Fig. 3F



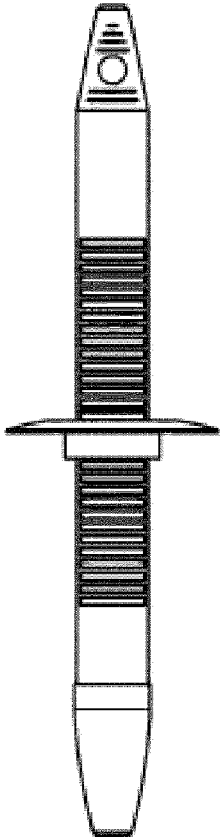


Fig. 5A

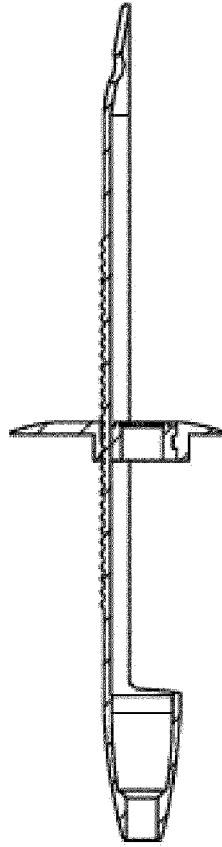


Fig. 5B

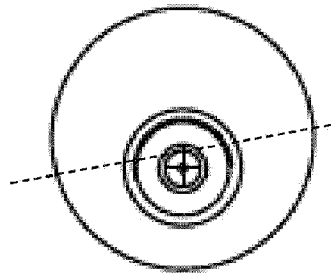


Fig. 5C

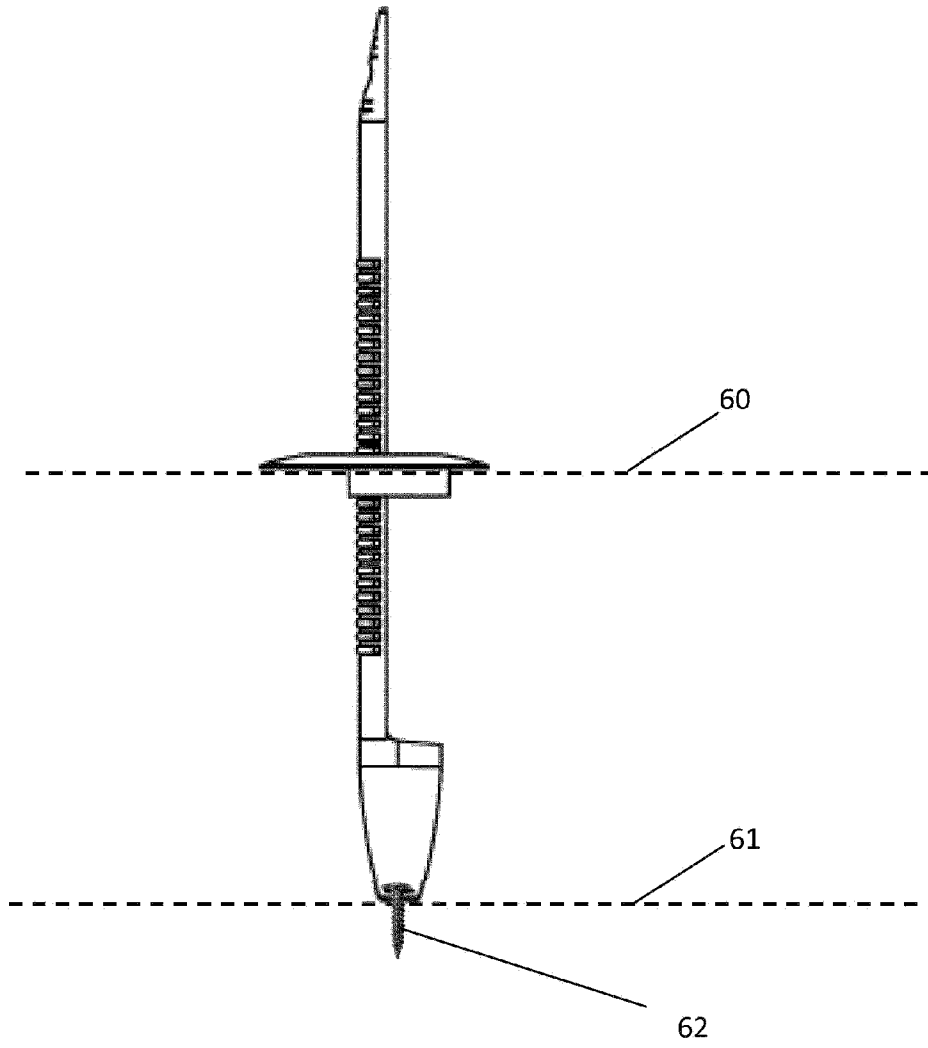


Fig. 6

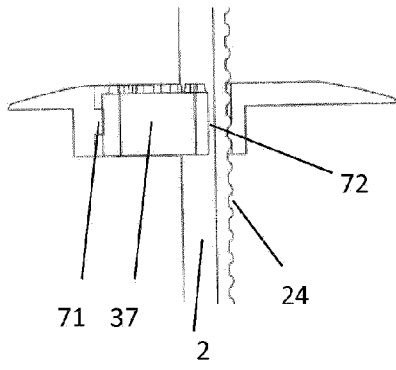


Fig. 7A

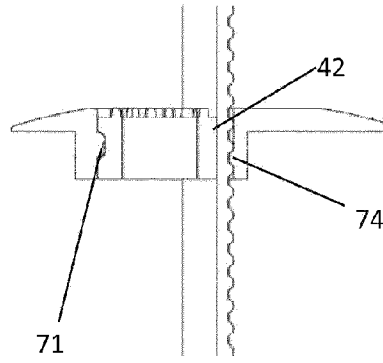


Fig. 7B

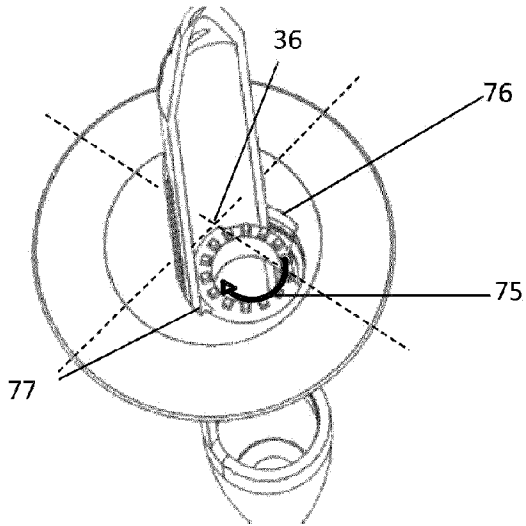


Fig. 7C

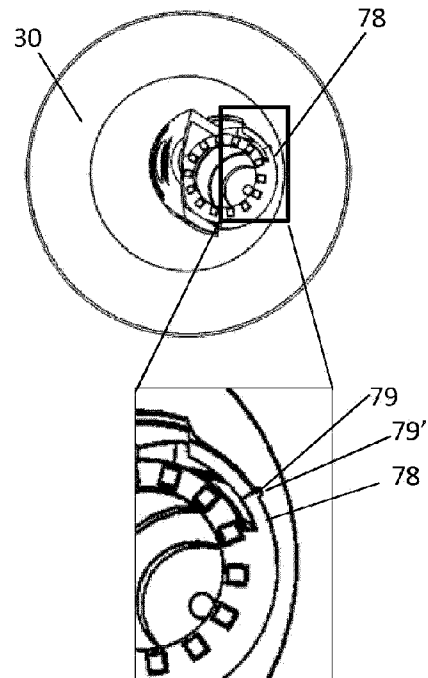


Fig. 7D

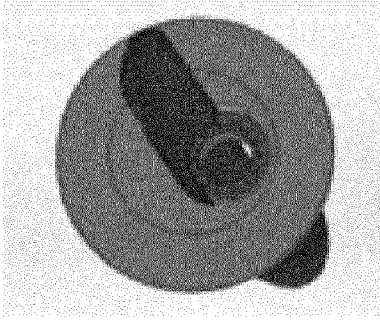


Fig. 8A

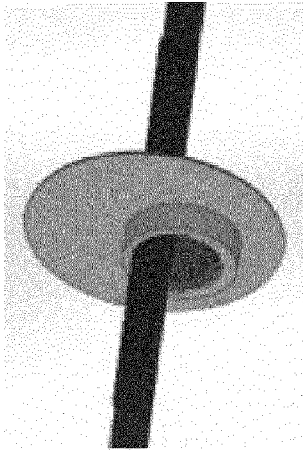


Fig. 8B

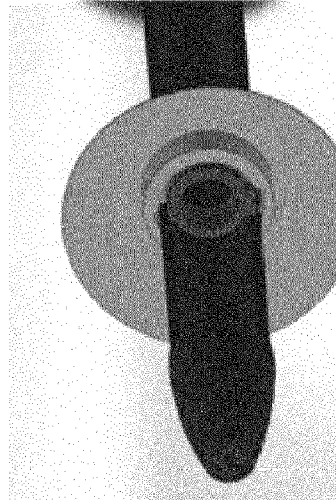


Fig. 8C

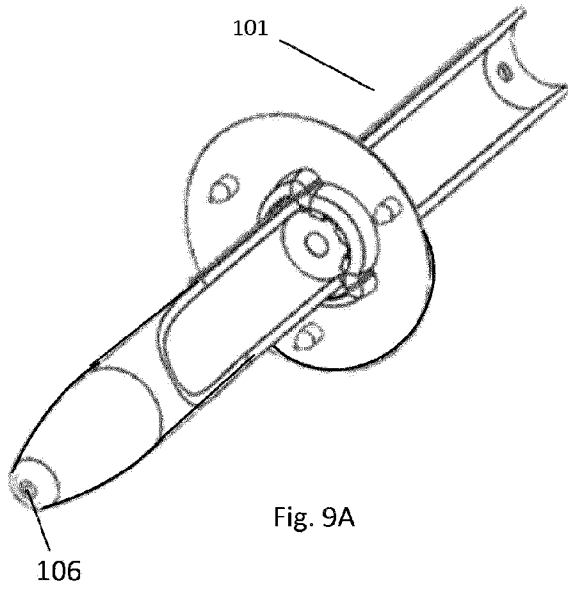


Fig. 9A

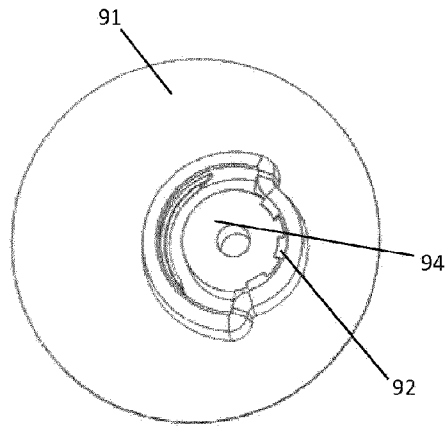


Fig. 9B

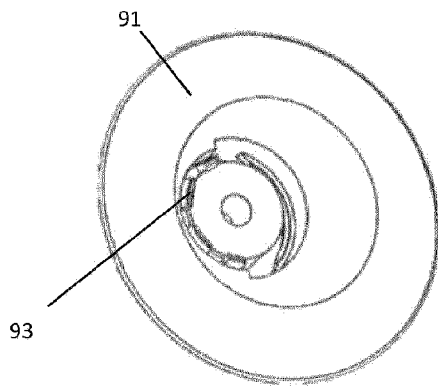


Fig. 9C

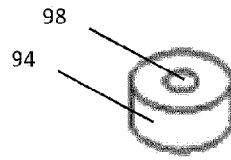


Fig. 9D



Fig. 9E

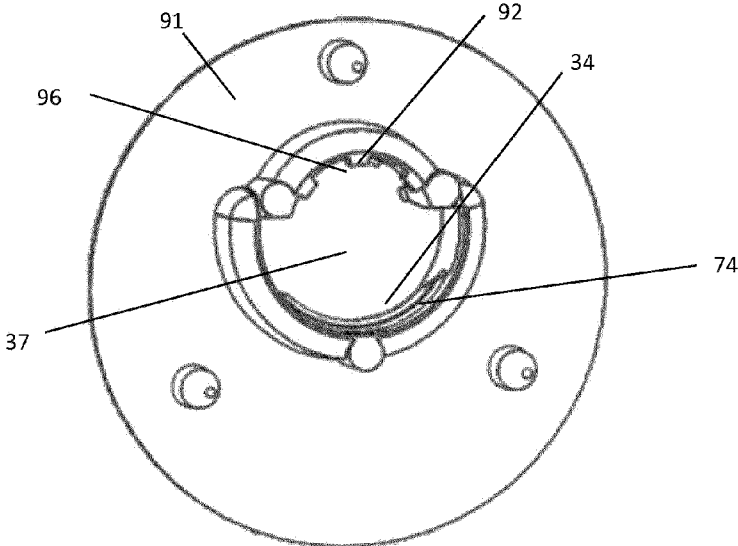


Fig. 9F

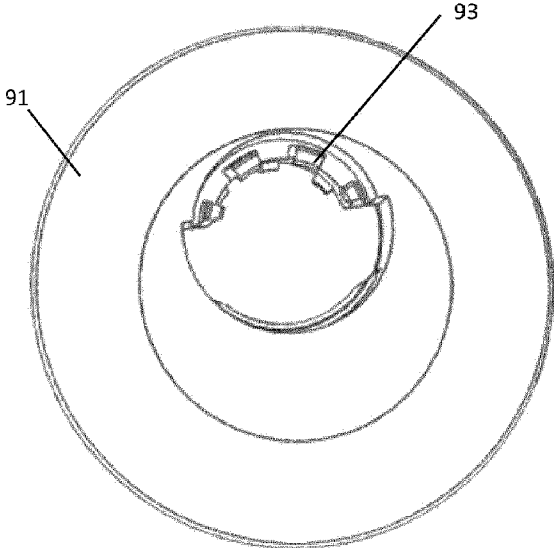
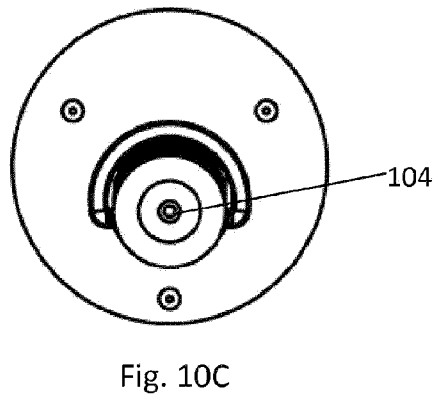
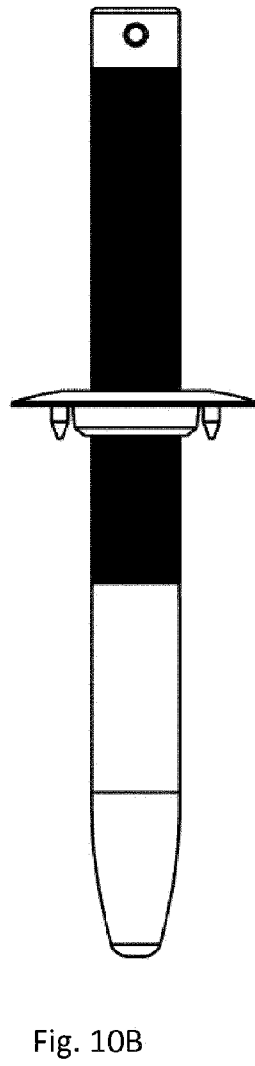
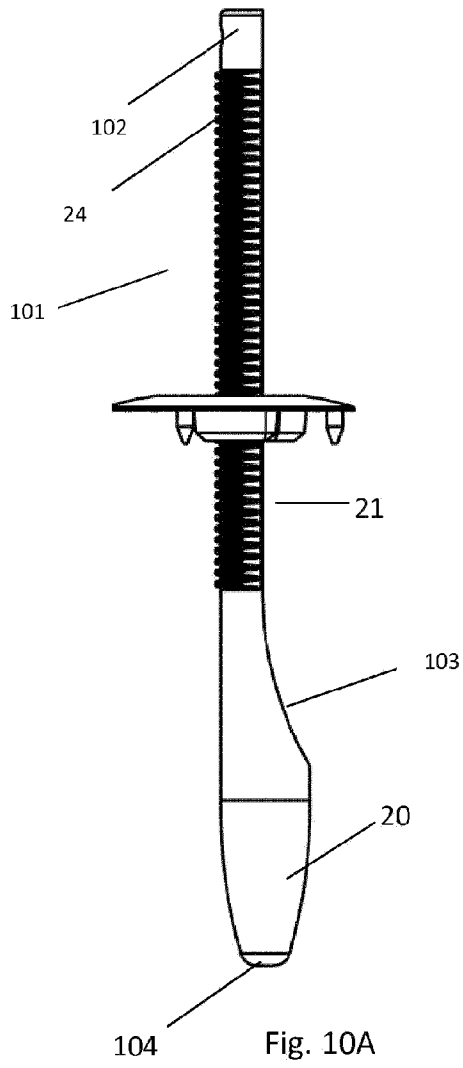


Fig. 9G



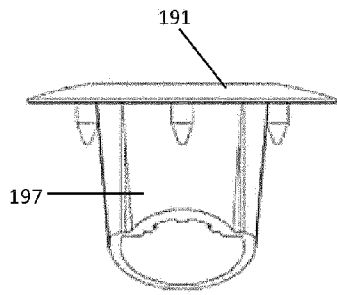


Fig. 11 A

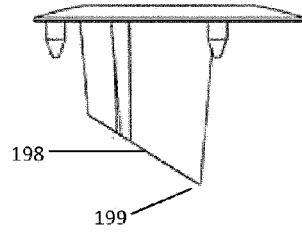


Fig. 11 B

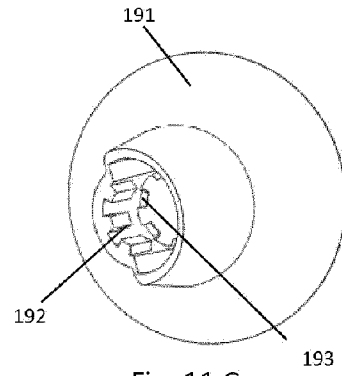


Fig. 11 C

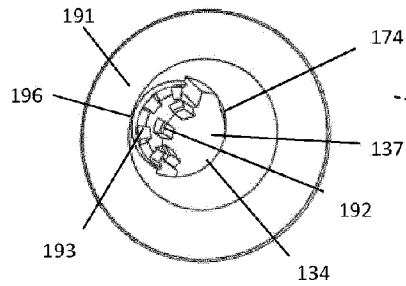


Fig. 11 D

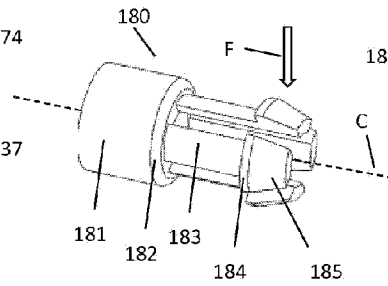


Fig. 11 E

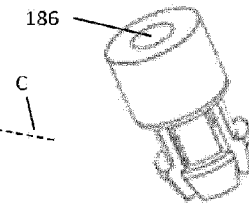


Fig. 11 F

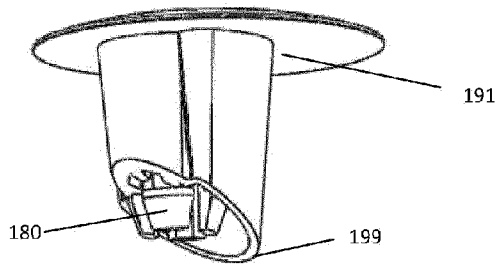
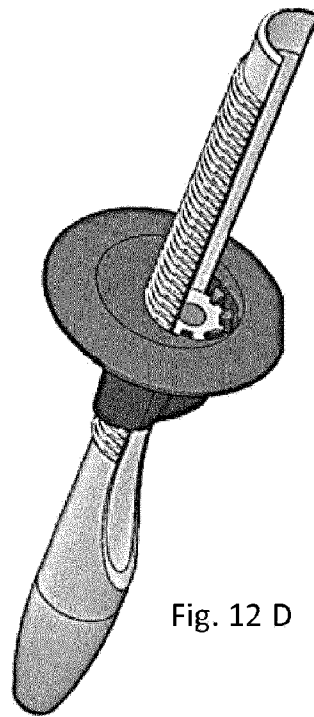
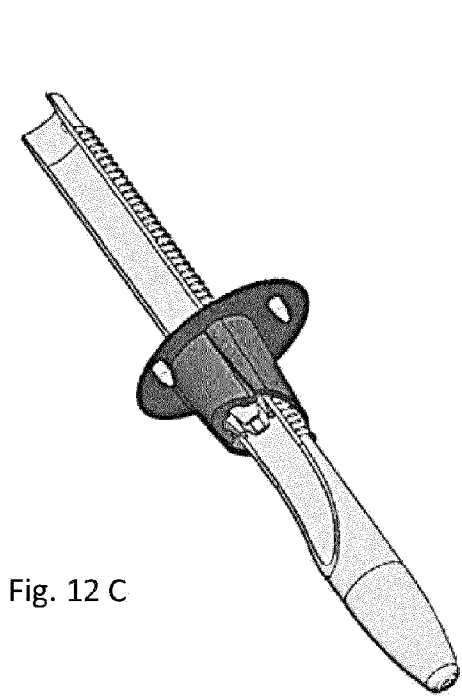
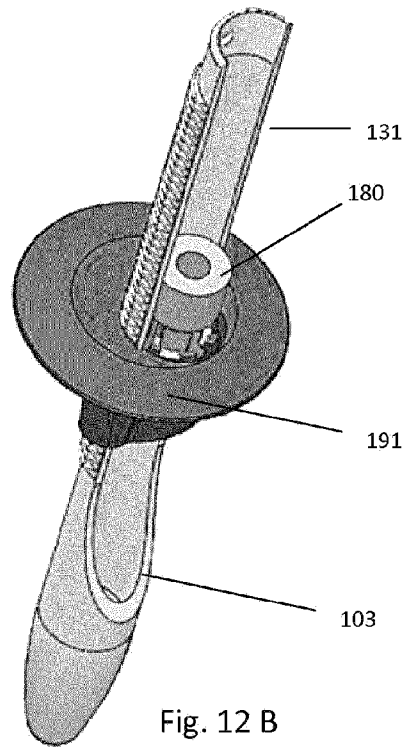
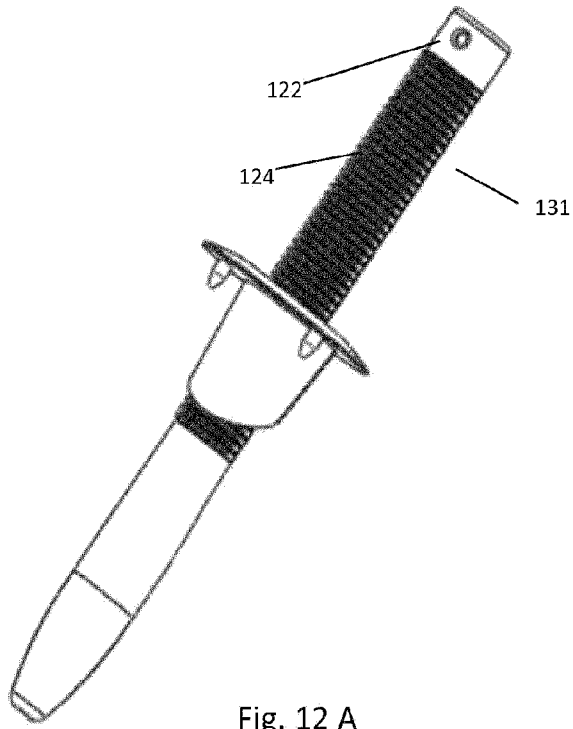


Fig. 11 G



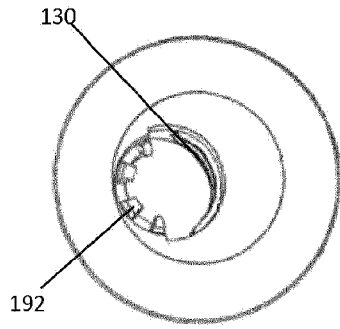


Fig. 13 A

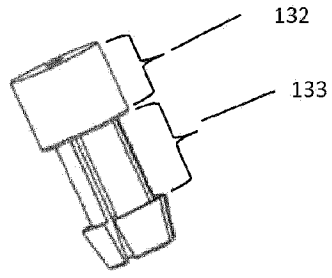


Fig. 13 B

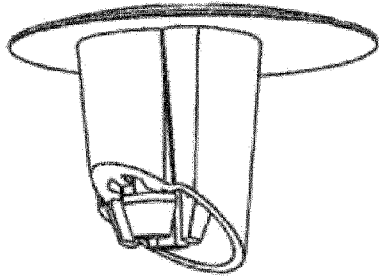


Fig. 13 C

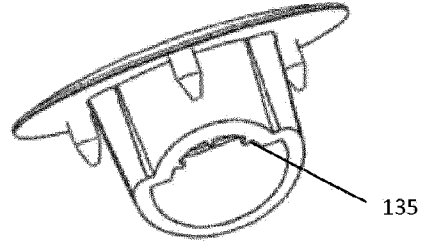


Fig. 13 D

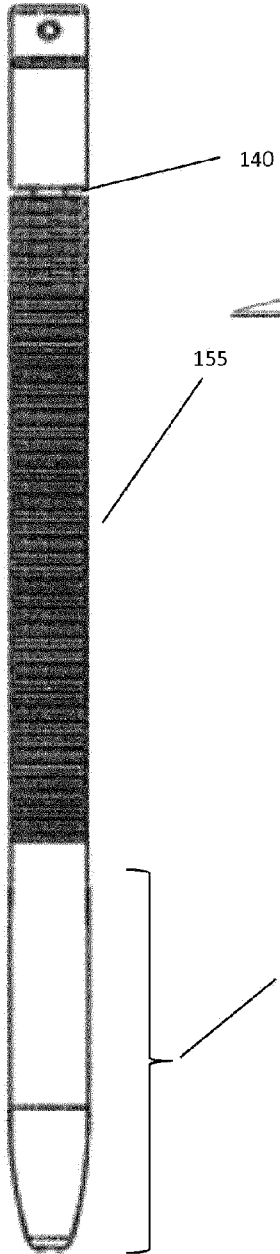


Fig. 14 A

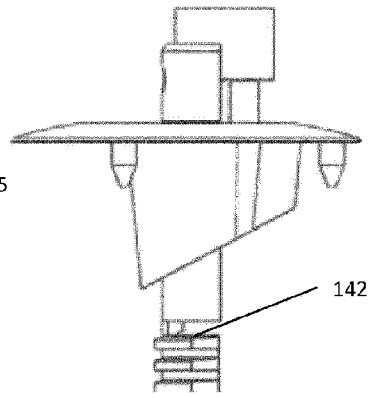


Fig. 14 B

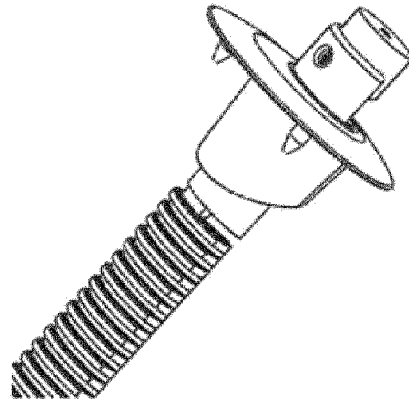


Fig. 14 C

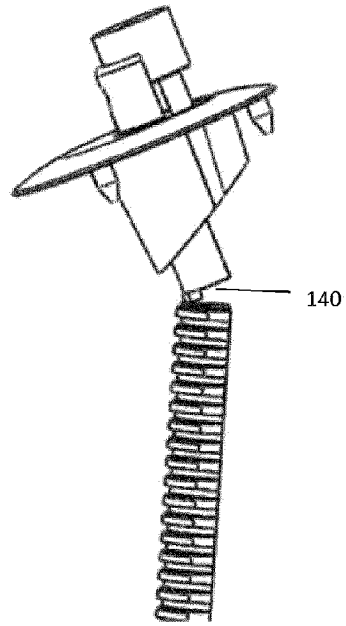


Fig. 14 D

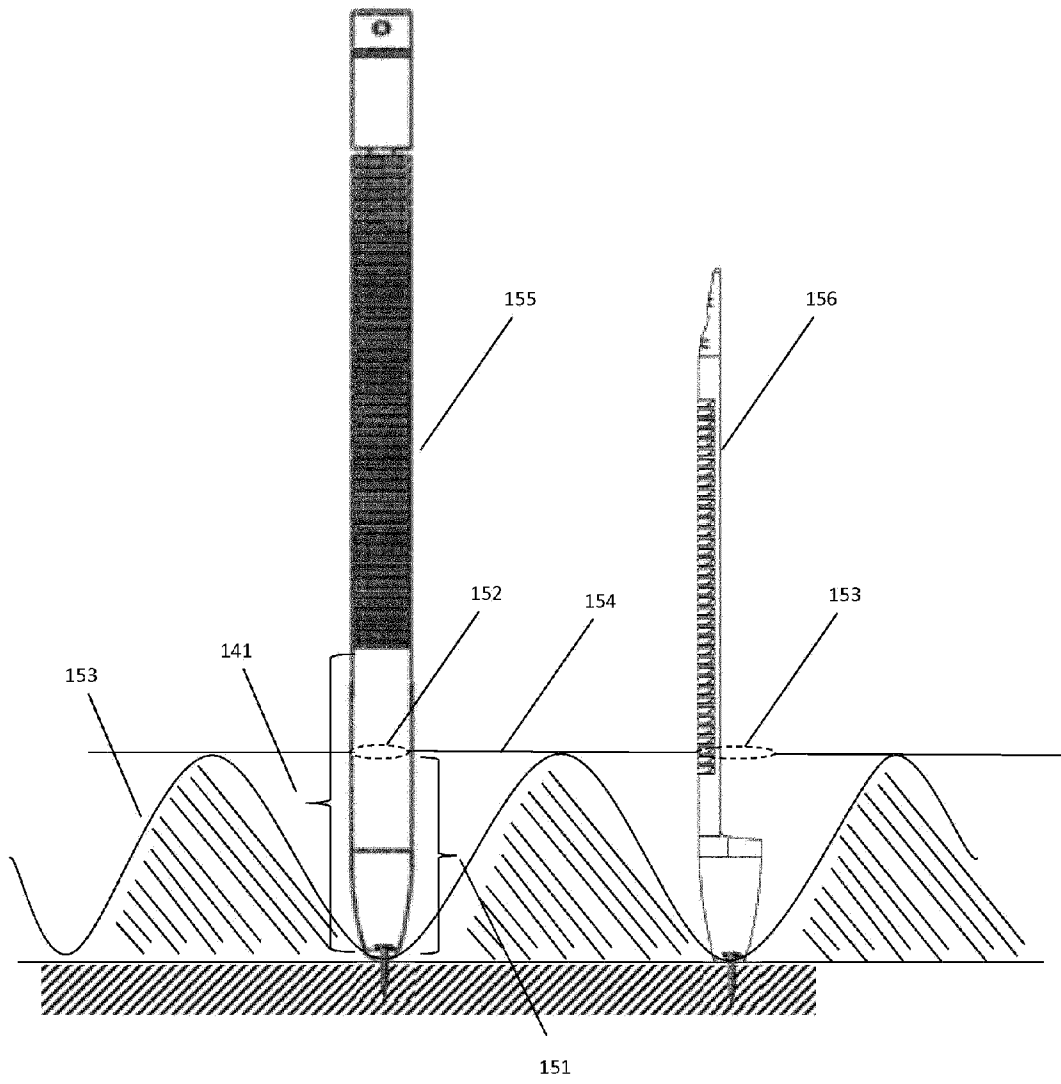


Fig. 15