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(54) **Fastening device, in particular for sports footwear**

(57) The present invention refers to a fastening device, in particular for sports footwear, comprising a link-up rod 4 that is hinged on a lever arm 2 at an end portion thereof, whereas the opposite end portion thereof is coupled to a hook-up member 8. The link-up rod 4 comprises at least a first tensioning element 11 capable of

moving telescopically relative to a second tensioning element 14 to adjust the length of said link-up rod 4. The first tensioning element 11 is subject to a compressive action exerted by at least an elastically deformable member 16 arranged between said first tensioning element 11 and said second tensioning element 14.

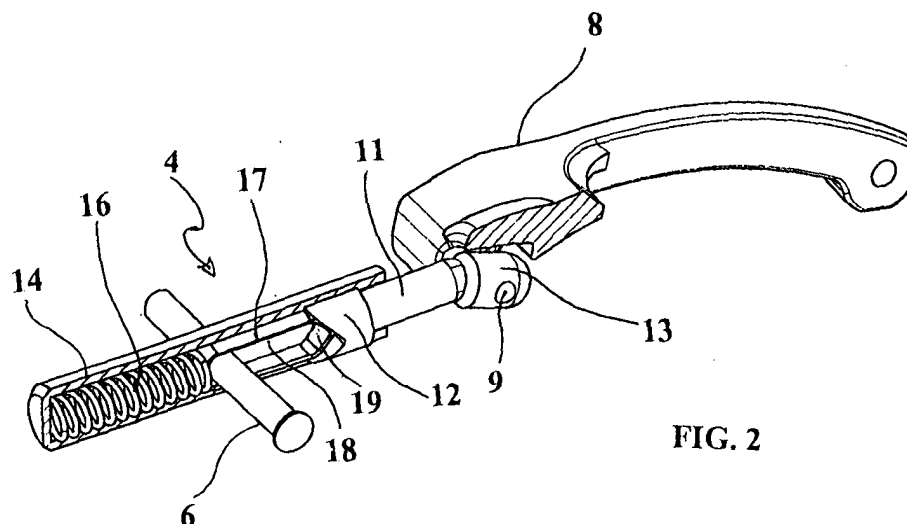


FIG. 2

Description

[0001] The present invention refers to a fastening device, in particular for sports footwear such as ski boots, mountaineering boots, skating boots, and the like.

[0002] Fastening devices such as generally known and currently used in the art include the so-called binding or fastening buckles comprising a lever arm, which is attached to the footwear on one of the edges thereof to be fastened, and to which there is associated, by means of a so-called wire or link-up rod, a hook-up member adapted to engage a rack attached to the other one of the footwear edges to be bound together. Generally, the link-up rod is formed by two members that are telescopically coupled with each other by means of a screw/nut screw system and enable the length of the same link-up rod to be adjusted micrometrically, i.e. finely, so as to in this way enable the tightening tension to be varied.

[0003] A drawback that is typically encountered in prior-art solutions lies in the fact that, owing to the clearances existing between the various parts making up the fastening device, as well as the weight of each such part, the link-up rod and the hook-up member fail to be kept into due alignment with the rack when the fastening device is unfastened, i.e. in a condition in which the hook-up member is not engaging the rack. This drawback is particularly felt with those fastening devices that are adapted to tighten the footwear around the lower portion of the leg, and are therefore positioned on the upper of for instance the boot or the skate. In this case, in fact, the force of gravity due to the inherent weight of the component parts is oriented downwards, roughly in a direction perpendicular to the direction of mutual alignment thereof, thereby exerting a torque on the link-up rod that causes the telescopic member supporting the hook-up member to rotate relative to the other telescopic member connected to the lever arm. Ultimately, such torque causes the hook-up member to swing downwards, so that it becomes misaligned relative to the rack it is due to engage.

[0004] This drawback tends to create some difficulties for the user while performing the footwear fastening operation, since he/she must in the first place bring the link-up rod again into alignment with the rack, while trying to bring the hook-up member into engaging a catch in the rack as appropriately selected by the user him/herself. This operation requires both hands to be practically used at the same time, considering that a hand must be used to keep said hook-up member engaged in the selected catch, while the other hand is used to complete the tightening of the lever, so that it proves particularly inconvenient to perform under certain environmental conditions of use of the sports footwear: in the case of ski boots, for example, the footwear is used under low-temperature conditions and, sometimes, in the presence of ice forming on the fastening device, while the user generally wears gloves that restrict the

sensitivity and motility of the hands.

[0005] As a partial solution to the above-mentioned drawback, the use has been suggested of a screw/screw nut interference coupling for the two telescopic parts of the link-up rod, to the purpose of limiting the oscillation, or swinging movement, of the hook-up member, when the latter is not engaged, through an increase of the frictional force aimed at opposing the action of the force of gravity. Another prior-art solution to the above-mentioned problem calls for either the screw or the screw nut to be plastic-coated in view of avoiding a metal-on-metal contact of the two telescopic parts.

[0006] These solutions, however, have themselves a drawback owing to them being subject to wear, so that, after a certain period of time, they eventually become ineffective and the afore-mentioned problem arises again.

[0007] It therefore is a main object of the present invention to do away with the above-cited drawbacks of prior-art solutions by providing a fastening device that is most easy and convenient to handle under any condition of use whatsoever, and is further reliable throughout its service life.

[0008] Within the above general object, an important purpose of the present invention is to provide a fastening device of the above-indicated kind, which is capable of keeping the link-up rod, the hook-up member and the rack duly aligned with each other not only under mutual engagement conditions, but also when they are unfastened, i.e. disengaged from each other.

[0009] Another purpose of the present invention is to provide a fastening device of the above-cited kind, in which the selected micrometric adjustment for a desired length of the link-up rod is capable of being maintained in a stable manner over time, without any need arising for the user to subsequently perform any further re-adjustment or correction.

[0010] A further purpose of the present invention is to provide a fastening device of the above-cited kind, in which the micrometric or fine adjustment of the length of the link-up rod is capable of being performed in such a manner as to be immediately perceived by the user.

[0011] According to the present invention, these aims, along with further ones that will be apparent in the following description, are reached in a fastening device, particularly for sports footwear, which incorporates the characteristics as recited in the appended Claim 1.

[0012] Anyway, features and advantages of the fastening device according to the present invention will be more readily understood from the description of some particular, although not sole embodiments that is given below by way of non-limiting example with reference to the accompanying drawings, in which:

- Figure 1 is an overall perspective view of a fastening device according to the present invention;
- Figure 2 is a perspective, partially cross-sectional

view of a fastening device according to the present invention;

- Figure 3 is a cross-sectional view of a component part of the link-up rod, as viewed along the plane III-III of Figure 4;
- Figure 4 is an exploded view of the link-up rod of the fastening device according to the present invention;
- Figures 5 and 6 are perspective, partially cross-sectional views of the link-up rod in a first and a second working position thereof, respectively;
- Figures 7 and 8 are perspective, partially cross-sectional views of the link-up rod in a third and a fourth working position thereof, respectively;
- Figure 9 is an exploded view of the link-up rod of a second embodiment of the fastening device according to the present invention;
- Figure 10 is an exploded view of a third embodiment of the fastening device according to the present invention

[0013] With reference to the above-noted Figures, the reference numeral 1 is used there to generally indicate a fastening device comprising an lever arm 2 that is pivotally hinged, in correspondence to a first cross-wise axis 3, on to a base (not shown) adapted to be attached to one of the edges of a sports footwear to be fastened, i.e. tightened together. A link-up rod 4 is pivotally hinged with an end thereof on said lever arm 2 along a second cross-wise axis 5 by means of a first pin 6 passing through the lever arm and the link-up rod in correspondence to respective holes 7 (not visible in the Figures) provided both in the link-up rod and the lever arm. With the other end thereof, the link-up rod 4 is coupled to a hook-up member 8, preferably by means of a second pin 9, so as to allow for just a limited extent of swinging movement of the hook-up member 8 relative to the link-up rod 8 about a third cross-wise axis 10.

[0014] The hook-up member 8 is provided with known hook-up means, such as for instance a crosspiece, tongue, pawl or the like, adapted to engage into a desired one of the catches of a rack (not shown) that is capable of being attached on the other edge portion of the footwear to the purpose of enabling the same footwear to be tightened and fastened.

[0015] The link-up rod 4 comprises a first tensioning element 11, provided at an end portion thereof with an externally threaded head 12 and, at the other end portion thereof, with a head 13 adapted to couple up with the hook-up member 8 in the manner described hereinbefore, and a second tensioning element 14 provided with a longitudinal, internally threaded dead hole 15;

Figure 3 is a cross-sectional view of this second tensioning element 14, as viewed along the plane III-III of Figure 4, in which the above-cited hole 15 is clearly shown. The threaded head 12 of the first tensioning element 11, which forms the screw, is thus adapted to engage said internally threaded dead hole 15 of the second tensioning element 14, which therefore performs as the screw nut, in such a manner as to enable the micrometric adjustment of the total length of the link-up rod 4 to be carried out through the telescopic displacement of the first tensioning element 11 relative to the second tensioning element 14.

A peculiar feature of the fastening device according to the present invention lies in the fact that, between the first tensioning element 11 and the second tensioning element 14, and in particular between the threaded head 12 and the bottom of the threaded dead hole 15, there is arranged at least an elastically deformable member 16, such as for instance a spring, which exerts a compressive action upon the first tensioning element 11, in correspondence to the threaded head 12, which is aimed at opposing the torque being applied on said head by the force of gravity acting on the hook-up member 8. In other words, the hook-up member 8 is prevented from lowering due to the rotation of the first tensioning element 11 relative to the second tensioning element 14, and these same component parts are in turn prevented in this way from displacing into misalignment with respect to the rack, when the tension imparted by the elastically deformable member 16 upon the first and the second tensioning element 11 and 14, in correspondence of the respective threads thereof, is greater than the torque generated by the force of gravity, which the hook-up member 8 is subject to when not engaging the hook-up rack, thereby ensuring a substantial alignment of the link-up rod with the hook-up member under all conditions.

[0016] In the particular embodiment illustrated in Figures 1 to 8, between the elastically deformable member 16 and the threaded head 12 there is arranged a slide 17 that is slidably housed in the threaded hole 15 of the second sensor 14 and is provided axially with an aperture 18. The end portion 19 of the slide 17, i.e. the end portion thereof that is oriented towards the threaded head 12, features two planar faces that are inclined according to a pre-defined angle, whereas the opposite end portion 20 of said slide 17 acts by abutting and bearing against the elastically deformable member 16. The end portion of the head 12 that interacts with the corresponding end portion 19 of the slide 17 is provided with an indentation-like recess 21 featuring two faces that are counter-shaped to the respective faces of the end portion 19 and inclined substantially according to the same angle.

[0017] The first pin 6 performing as the fulcrum between the lever arm 2 and the link-up rod 4 is arranged to pass through the holes 7 of the second tensioning element 14 and the aperture 18; in this way, the slide 17

is not caused to rotate by the threaded head 12 of the first tensioning element 11 when the latter is rotated in view of performing the desired micrometric adjustment of the length of the link-up rod 4.

[0018] The operation is as follows: starting from the condition illustrated in Figure 5, in which the link-up rod 4 is extended to its maximum length, the elastically deformable member 17, which is biased in a state of maximum elongation, imparts a compressive load onto the end portion 20 of the slide 17, which in turn transfers, with the opposite end portion 19 thereof, such compressive load on to the threaded head 12 and, as a result, the first tensioning element 11; the slide 17 itself is at this point in its farthest-out position relative to the second tensioning element 14, the first pin 6 being positioned in correspondence to the end portion of the aperture 18 that is adjacent to the end portion 20 of the slide 17.

[0019] When the first tensioning element 11 is rotated by the user, so as this is best illustrated in Figure 6, this causes the threaded head 12 to equally rotate by a corresponding extent, so that it, by threading through the threaded dead hole 15, moves into the second tensioning element 14 towards the bottom of the same dead hole 15. During the first 90° of such rotation, the two faces of the indentation-like recess 21 cause the slide 17, the rotation of which is prevented by the first pin 6, to perform a translational motion in the same direction in contrast with the action exerted by the elastically deformable member 16, whereas during the remaining part of the rotation, from 90° to 180°, the elastically deformable member 16 presses again the end portion 19 of the slide 17 into engaging the matching, complementarily shaped faces of the threaded head 12, thereby bringing the slide 17 and the head 12 into a new stable position of mutual engagement, while at the same time producing a snap-like effect that is perceived by the user both on a tactile and auditory level. A further 180°-rotation in the same direction will cause the head 12, and the slide 17, to further move on towards the bottom of the threaded dead hole 15, thereby reducing the total length of the link-up rod 4.

[0020] Figures 7 and 8 illustrate the condition of minimum total length of the link-up rod 4 in the stable position thereof, in which the head 12 and the slide 17 are mutually engaged, and in the state in which the first tensioning element 11 is rotated to length adjustment purposes, respectively.

[0021] Fully apparent from the above description is therefore the ability of the fastening device according to the present invention to effectively reach the afore cited aims and advantages: in fact, this fastening device is capable of maintaining the link-up rod, the hook-up member and the rack properly aligned with each other not only in the condition in which said hook-up member engages the rack, but also in the unfastened condition of the device, thanks to both the tension generated by the elastically deformable member 16 between the first

and the second tensioning element 11 and 14, and the effect of the end portion 19 of the slide 17 firmly engaging with its inclined planar faces the corresponding, complementarily shaped faces of the indentation-like recess 21 of the threaded head 12. In fact, the effect of the above-cited tension, as enhanced by the respective inclined faces of said matching parts being so firmly engaged with each other, enables the force of gravity acting of the fastening device, when the latter is unfastened, to be effectively opposed.

[0022] Such provision enables the fastening device itself to be used in a much more convenient manner under all conditions of use, and therefore also in the presence of ice forming thereon or hands wearing gloves. It further makes the device more reliable over time, since no wear and tear will take place to affect any of its parts or impair the way in which these parts work.

[0023] Furthermore, the fastening device according to the present invention is capable of ensuring that the micrometric adjustment of the length of link-up rod selected by the user will be kept unaltered over time, without any subsequent re-adjustment being required any more, thanks to the rotation prevention effect brought about by the end portion 19 of the slide 17 being firmly engaged in the corresponding recess 21 of the threaded head 12.

[0024] A further advantage of the fastening device according to the present invention derives from the fact that the micrometric, i.e. fine adjustment of the tie-rod length is performed in a stable manner and is immediately perceived by the user owing to the end portion 19 snapping into engagement with the corresponding recess 21.

[0025] It shall be appreciated that the above-described fastening device may of course be the subject of a number of modifications and variants, also in connection with different applications, without departing from the scope of the present invention.

[0026] So, for instance, Figure 9 can be noticed to illustrate a link-up rod 104 comprising a first tensioning element 111 and a second tensioning element 114 that are substantially similar to the afore described ones, as well as at least an elastically deformable member 116 extending in the direction of the threaded head 112 of the first tensioning element to form a kind of buckle consisting of two axial arms 117a and 117b connected with each other by a crosspiece 119; therefore, this buckle acts as the slide 117, which is thus formed integrally with the elastically deformable member 116 as a single-piece construction, and the crosspiece 119 of which is adapted to move into engaging the indentation-like recess 121 of the head 112, when in a stable position, and is compressed by this head, in opposition to the elastically deformable member 116, when it is rotated for micrometric adjustment.

[0027] Figure 10 illustrates a further embodiment of a link-up rod 204 for the fastening device according to the present invention. While this embodiment is substantial-

ly identical to the one that has been described hereinbefore with reference to Figures 1 to 7, it differs therefrom for the fact that the recess 221 in the head 212 is given a polyhedral conformation, in such a manner that a stable engagement thereof with the inclined planar faces of the end portion 219 of slide 217 occurs every 90° of rotation, instead of every 180° as in the other case.

[0028] It will furthermore be appreciated that the materials used to manufacture the fastening device of the present invention, as well as the shapes and the sizing of the individual component parts thereof, may each time be selected so as to more appropriately meet the particular requirements or suit the particular application, again without departing from the scope of the present invention.

Claims

1. Fastening device, in particular for sports footwear, comprising a link-up rod (4, 104, 204) that is hinged on a lever arm (2) at an end portion thereof, whereas the opposite end portion thereof is coupled to a hook-up member (8), said link-up rod (4, 104, 204) comprising at least a first tensioning element (11, 111, 211) capable of moving telescopically relative to a second tensioning element (14, 114, 214) to adjust the length of said link-up rod (4, 104, 204), **characterized in that** said first tensioning element (11, 111, 211) is subject to a compressive action exerted by at least an elastically deformable member (16, 116, 216) arranged between said first tensioning element (11, 111, 211) and said second tensioning element (14, 114, 214).
2. Fastening device according to claim 1, in which said first tensioning element (11, 111, 211) is provided at an end portion thereof with an externally threaded head (12, 112, 212) and, at the other end portion thereof, with a head (13, 113, 213) adapted to couple up with said hook-up member (8).
3. Fastening device according to claim 2, in which said second tensioning element (14, 114, 214) is provided with a longitudinal, internally threaded dead hole (15) adapted to engage said externally threaded head (12, 112, 212) so as to enable the micrometric adjustment of the length of said link-up rod (4, 104, 204) to occur through a telescopic displacement of said first tensioning element (11, 111, 211) relative to said second tensioning element (14, 114, 214), said at least an elastically deformable member (16, 116, 216) being arranged between said externally threaded head (12, 112, 212) and the bottom of said internally threaded dead hole (15).
4. Fastening device according to any of the preceding

claims or combination thereof, **characterized in that** between said elastically deformable member (16, 116, 216) and said first tensioning element (11, 111, 211) there is arranged a slide (17, 117, 217) that is slidably housed inside said second tensioning element (14, 114, 214) and is capable of interacting with said threaded head (12, 112, 212) of said first tensioning element (11, 111, 211) in opposition to said elastically deformable member (16, 116, 216), said slide further including means (6, 18; 106, 118; 206, 218) adapted to prevent rotation relative to the longitudinal axis of said link-up rod (4, 104, 204).

5. Fastening device according to claim 4, in which said rotation preventing means (6, 18; 106, 118; 206, 218) comprise a first pin (6, 106, 206) and an axial aperture (18, 118, 218) provided in said slide (17, 117, 217), said first pin (6, 106, 206) passing through corresponding holes (7, 107, 207) to extend into and through said second tensioning element (14, 114, 214) and said aperture (18, 118, 218).
6. Fastening device according to claim 5, in which said first pin (6, 106, 206) forms the fulcrum at which said lever arm (2) is pivotally connected to said second tensioning element (14, 114, 214).
7. Fastening device according to claim 4, in which the portion of said threaded head (12, 112, 212) interacting with said slide (17, 117, 217) features a recess (21, 121, 221) featuring at least two planar faces that are inclined according to a pre-defined angle.
8. Fastening device according to any of the preceding claims or combination thereof, in which, at the end portion (19, 219) thereof oriented towards said threaded head (12, 212), said slide (17, 117, 217) features at least two planar faces that are inclined according to a pre-defined angle, which is complementary to the angle of inclination of the faces of said recess (21, 221).
9. Fastening device according to any of the preceding claims or combination thereof, in which said slide (217) is made integral, i.e. in a single-piece construction with said elastically deformable member (116), which extends in the direction of said threaded head (112) so as to form two axial arms (117a, 117b) connected with each other, at the end portions thereof, by a crosspiece (119) adapted to engage said recess (121).
10. Fastening device according to any of the preceding claims or combination thereof, **characterized in that** to a rotary displacement of said first tensioning element (11, 111, 211) relative to said second ten-

sioning element (14, 114, 214) there corresponds a translational, i.e. linear displacement of said slide (17, 117, 217) relative to said first pin (6, 106, 206) as caused by the interaction of said end portion (19, 119, 219) of said slide (17, 117, 217) with said recess (21, 121, 221) of said threaded head (12, 112, 212) in opposition to said at least an elastically deformable member (16, 116, 216).

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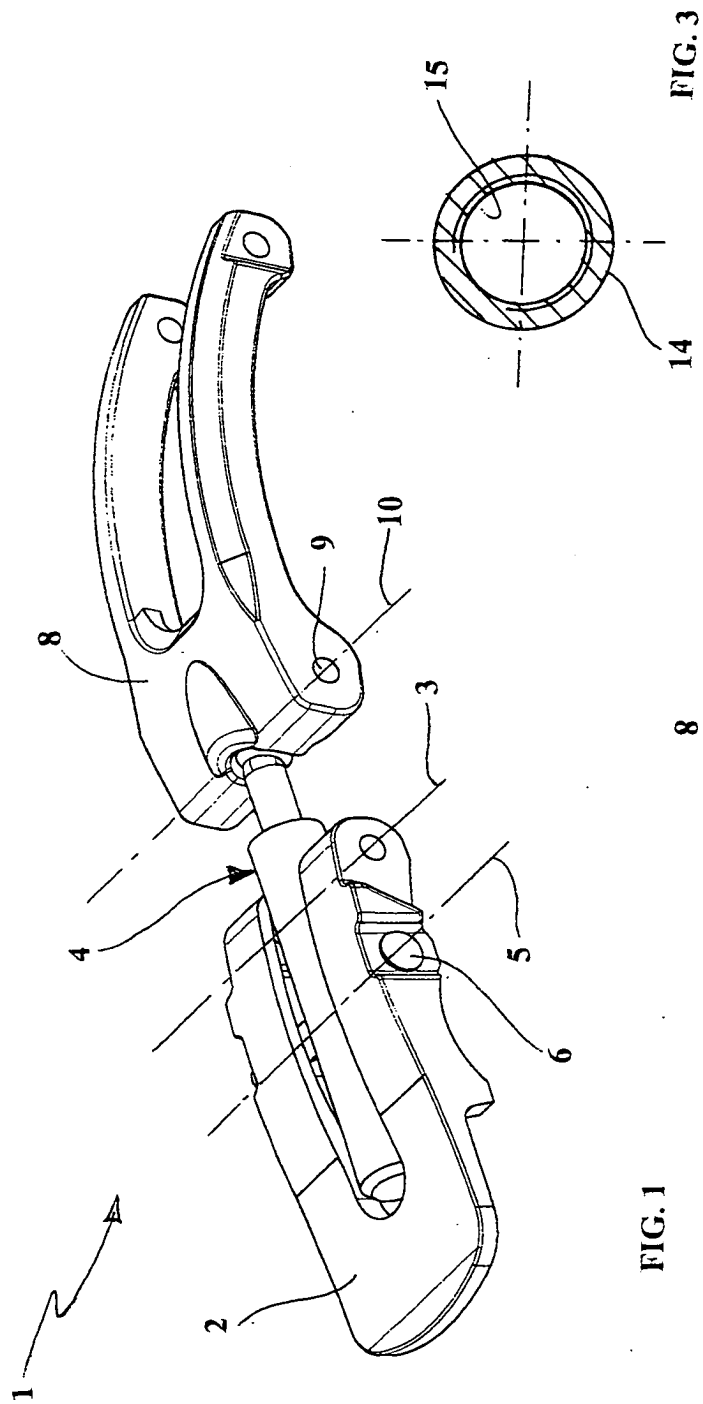


FIG. 1

FIG. 3

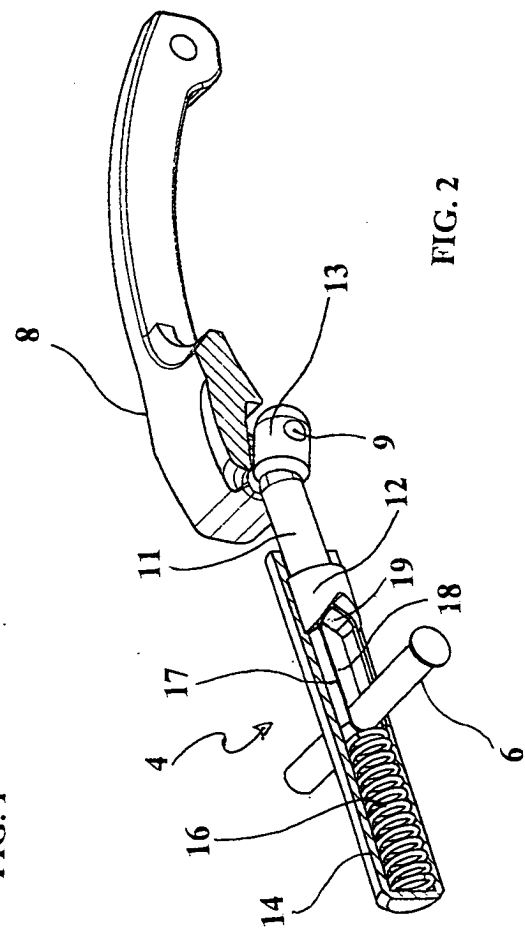


FIG. 2

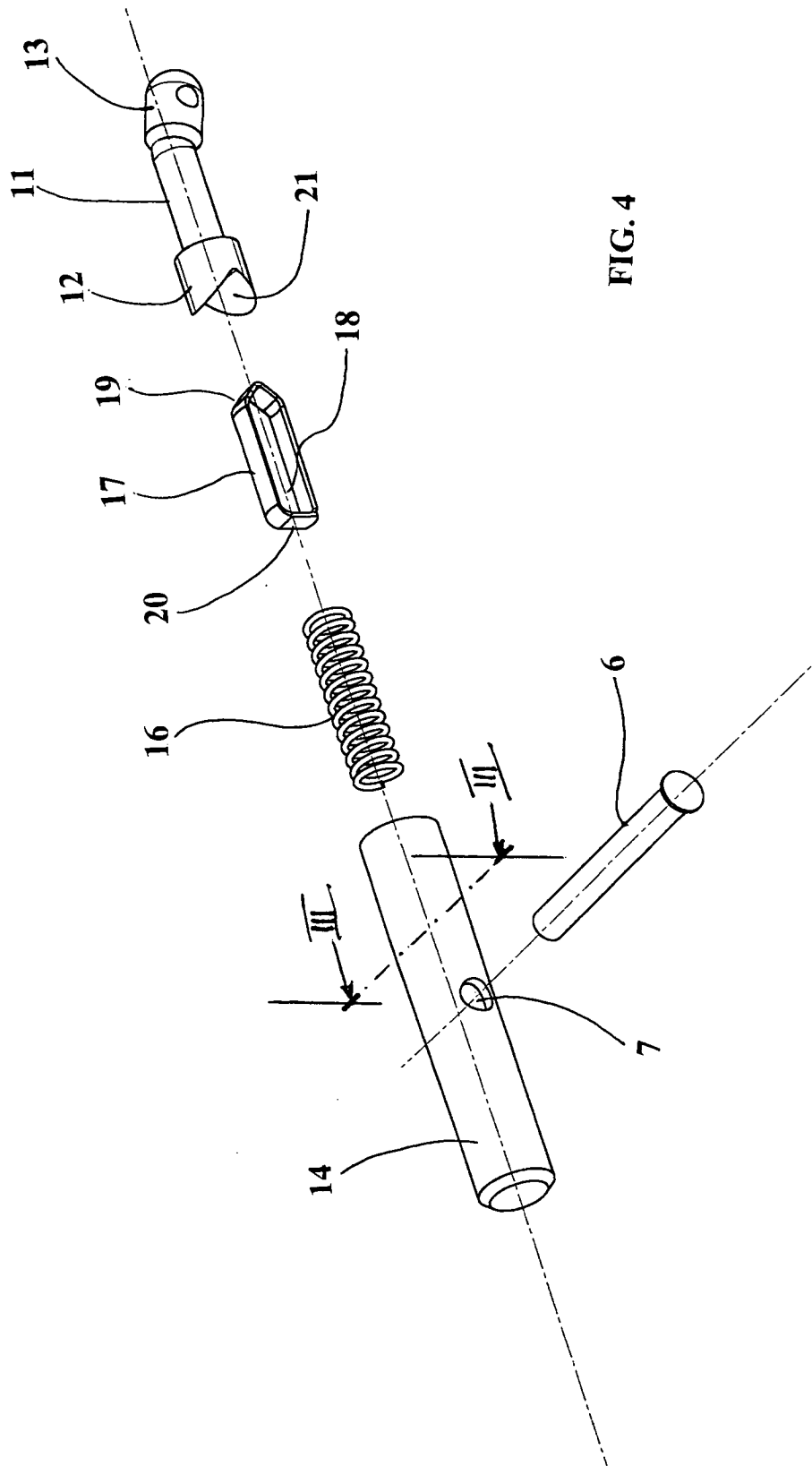


FIG. 4

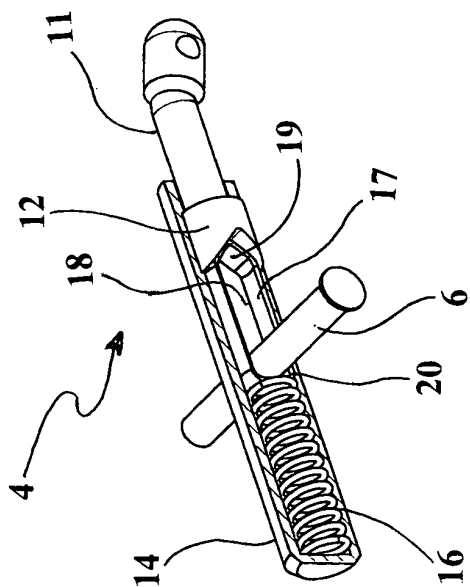


FIG. 5

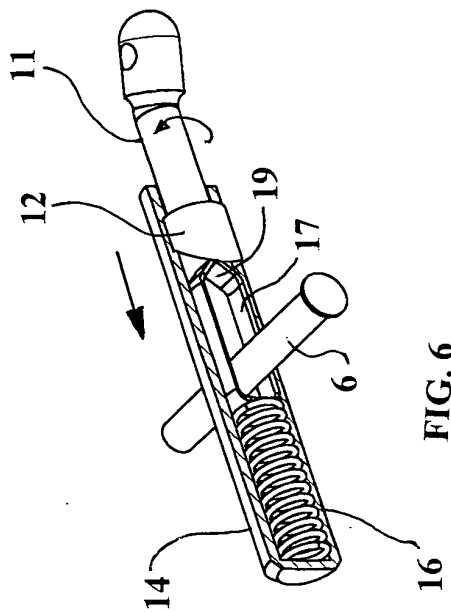


FIG. 6

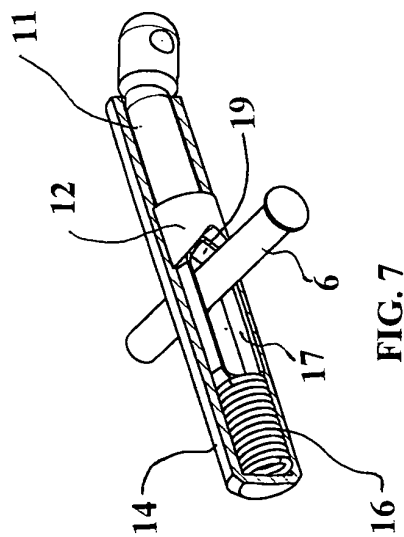


FIG. 7

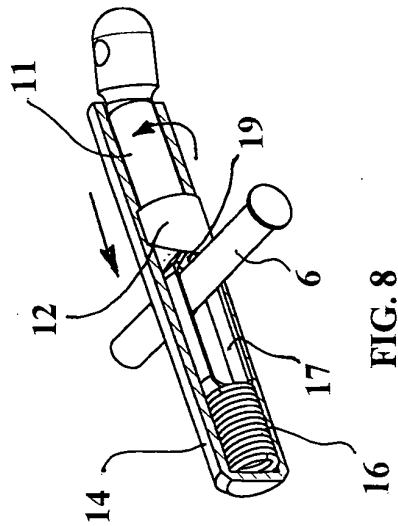
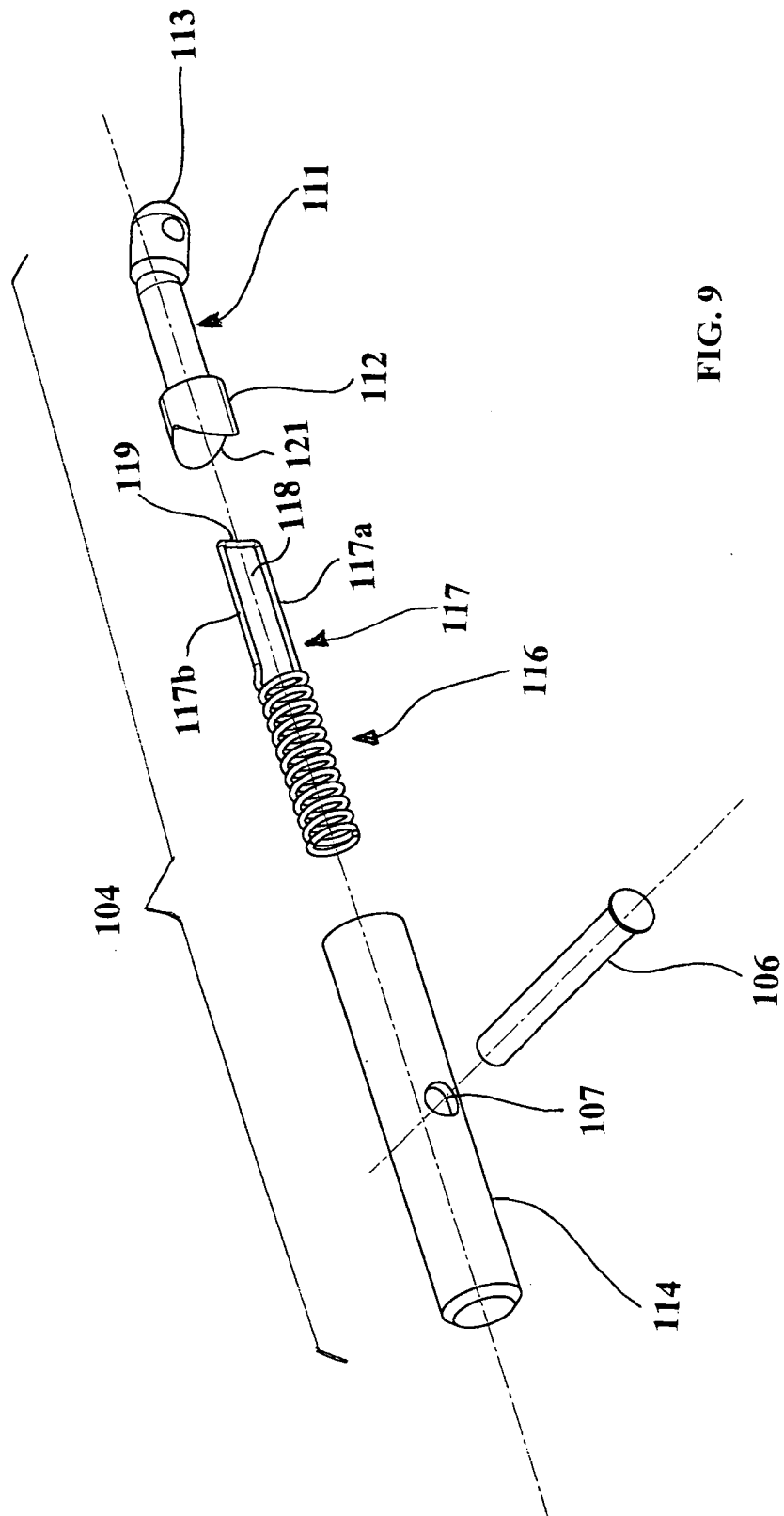
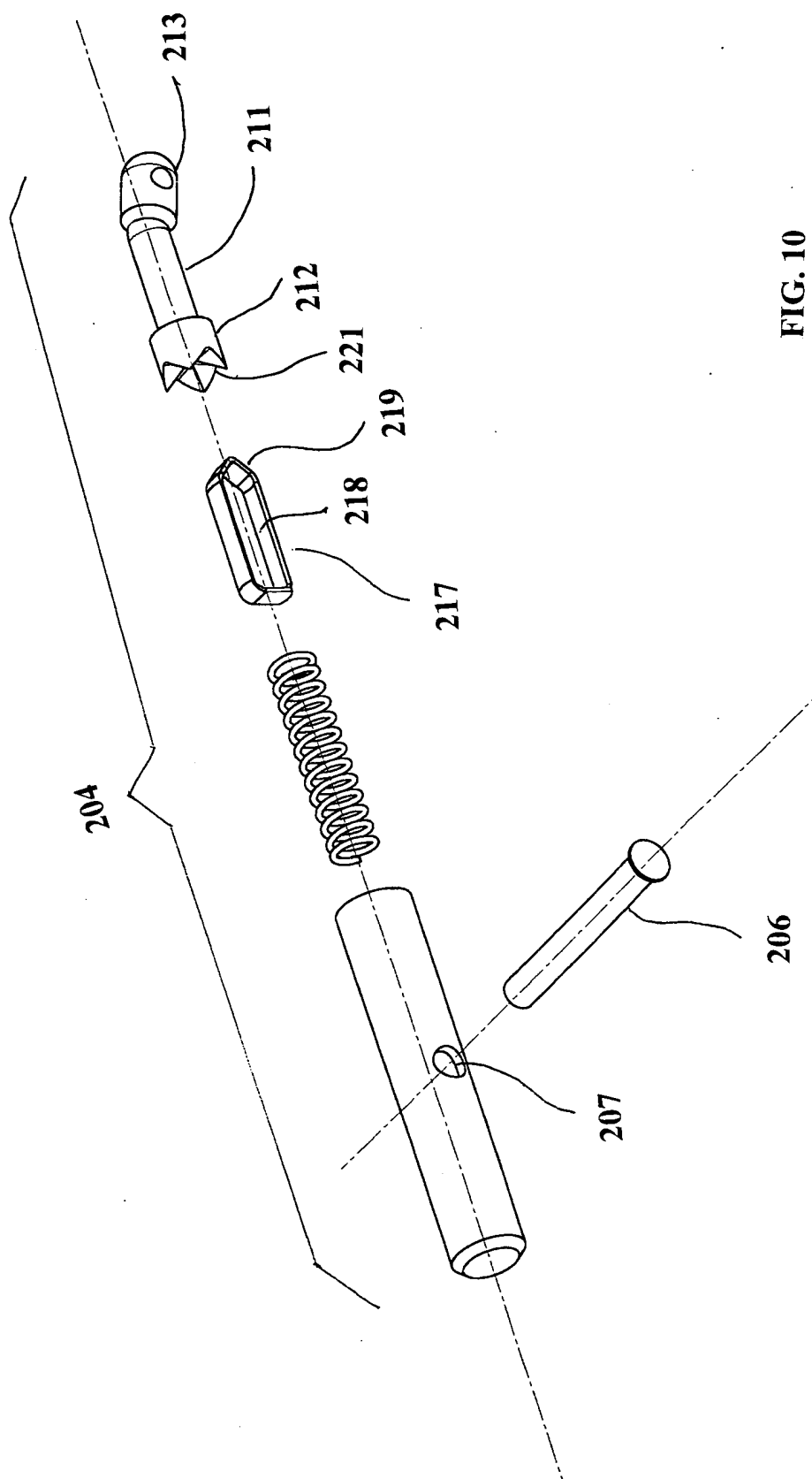


FIG. 8







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