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(54) **HAIR REMOVAL DEVICE**

(57) The present invention is concerned with a hair removal device comprising a handle (2), which encases a drive unit (6) and an energy source, and a head (3), which is pivotably supported on the handle (2) and comprises at least one hair removal unit (4, 5) coupled to the drive unit (6) by means of a transmission converting a motion of the drive unit into a movement of a driven part of the at least one hair removal unit (4, 5). Pivoting of the head (3) with respect to the handle (2) is limited by abutment of a stop face (14, 16) of a stop element (7, 15) with a counter-stop element (8a, 8b, 12). The stop element (7, 15) is made by multi-component injection moulding from a first plastic material and a second plastic material which is softer than the first plastic material, wherein the stop face (14, 16) is made from the second plastic material.

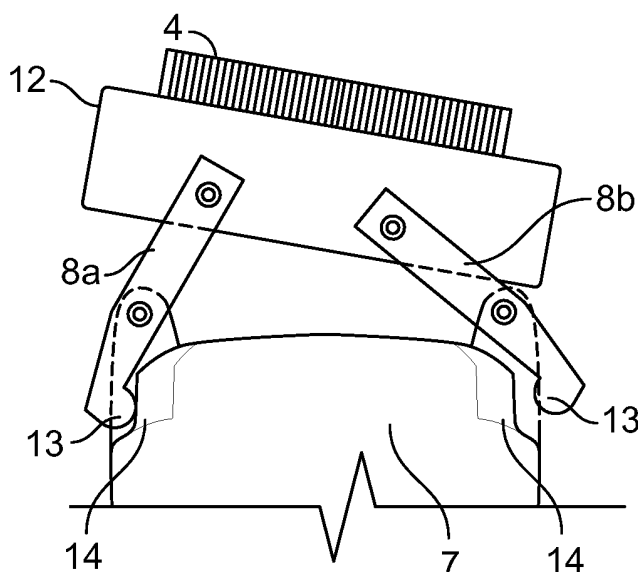
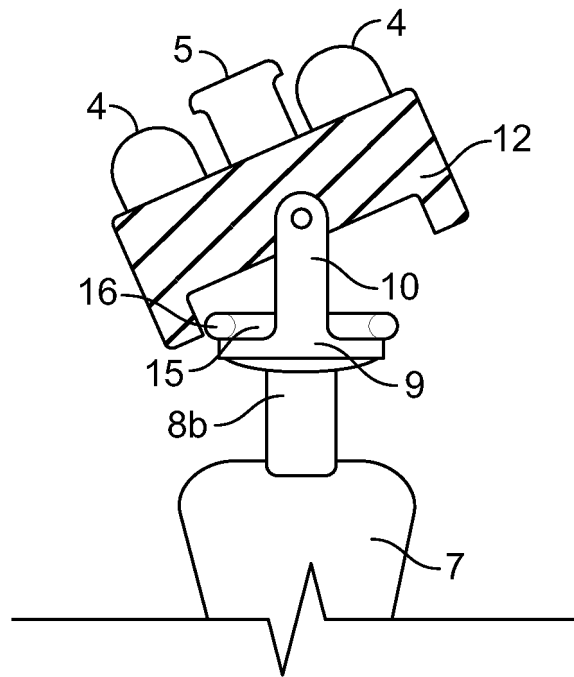


FIG. 3



Description

FIELD OF THE INVENTION

[0001] The present invention is concerned with a hair removal device, e.g. a dry shaver, a wet shaver or an epilator, comprising a handle, which encases e.g. a drive unit and an energy source, and a head, which is pivotably supported on the handle and comprises at least one hair removal unit coupled to the drive unit by means of a transmission converting a rotary motion of the drive unit into a movement of a driven part of the at least one hair removal unit.

BACKGROUND OF THE INVENTION

[0002] EP 2 404 716 B1 discloses an electrically powered shaver having a handle and a head with cutter elements which extend parallel to a pivot axis and which can swivel about the pivot axis, thereby permitting the cutters to follow the contours of the user's skin.

[0003] Pivoting of the head with respect to the handle is typically limited by abutment of a stop face of a stop element with a counter-stop element. This limitation may be required for protecting other component parts of the device during usage or if the device is subject to external impact forces, e.g. when dropping the device. However, abutment of the stop face with the counter-stop element may generate an undesired tactile and/or audible feedback to a user in the form of a clacking noise and the impression of a hard end stop.

[0004] It is an object of the present invention to provide an improved hair removal device enhancing the sensation during use of the device. More particularly it is a further object of the present invention to improve the above mentioned hair removal device which comprises a hair removal head which is moveable relative to the handle in that the head movement noise is suppressed or avoided or reduced.

SUMMARY OF THE INVENTION

[0005] In accordance with one aspect of the present disclosure, a hair removal device comprises a handle, which encases at least a drive unit and an energy source, and a head, which is pivotably supported on the handle and comprises at least one hair removal unit coupled to the drive unit by means of a transmission converting an, e.g. rotary or linear, motion of the drive unit into a movement of a driven part of the at least one hair removal unit. Pivoting of the head with respect to the handle is limited by abutment of at least one stop face of at least one stop element with at least one counter-stop element. The at least one stop element is made by multi-component injection moulding from a first plastic material and at least one second plastic material which is softer than the first plastic material, wherein the at least one stop face is made from the second plastic material.

[0006] Multi-component injection moulding is a highly efficient method for producing component parts of different materials having material characteristics tailored to the respective requirements. The combination of a harder or more rigid plastic material withstanding e.g. mechanical loads with a softer plastic material permits damping of the abutment limiting the pivoting of the head with respect to the handle. This increases user's comfort and enhances the sensation during use of the device. In addition, the softer plastic material may cushion e.g. mechanical loads if the device is subject to external impact forces, e.g. when dropping the device. Providing such a multi-purpose component part contributes in reducing cost and effort for producing and assembling the device due to a reduced number of component parts compared with separate component parts each fulfilling only one function.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007]

- Figure 1 shows in a schematic perspective view a device according to an embodiment of the invention,
 Figure 2 shows in a schematic side view components of the device of Figure 1,
 Figure 3 shows in a schematic side view details of the device of Figure 1, and
 Figure 4 shows in a schematic side view details of the device of Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

[0008] Before describing advantageous embodiments of the invention related to the Figures 1 to 4, different aspects of the invention are described more in detail. These aspects disclose further features, advantages and possibilities of use of the present invention that might be combined in any useful combination. All features described and/or shown in the drawings are subject matter of the invention, irrespective of the grouping of the features in the claims and/or their back references.

[0009] The at least one stop element is made by multi-component injection moulding from a first plastic material and at least one second plastic material which is softer than the first plastic material. With respect to the present disclosure, the stop element may be made by two-component injection moulding, i.e. comprising only the first plastic material and a second plastic material. However, it may be desirable to use more than two different plastic materials, especially if the stop element has additional functions. For example, the softer second plastic material may be a thermoplastic elastomer (TPE) or a (liquid) silicone rubber (LSR). The first plastic material is typically a thermoplastic material which is rigid at ambient temperature, for example polypropylene (PP) or polybutylene terephthalate (PBT).

[0010] The hair removal device may comprise an outer housing and an inner housing hermetically encapsulating component parts which should be sealed off against humidity, for example the drive unit and/or the energy source. The at least one stop element may be a shell or part of a shell assembly sealing at least a portion of the hair removal device off against the environment. In other words, the stop element may be a portion of the outer housing or the inner housing. Preferably, the at least one stop element comprises at least one sealing portion, for example a sealing lip or the like, made from the second plastic material. According to an independent aspect of the present disclosure, a component part of the hair removal device is made by two-component injection moulding or multi-component injection moulding, wherein the softer material fulfills a sealing function and in addition a function as a stop element.

[0011] As an alternative or in addition to the sealing function, wherein the at least one stop element may comprise at least one soft rib made from the second plastic material, wherein the soft rib exerts a biasing force on a component part abutting the soft rib. The component part abutting the soft rib may be an axle, such that the soft rib removes clearances between the axle and further parts hinged to the axle.

[0012] The at least one stop element may comprise separate regions consisting of the softer second plastic material. As an alternative, regions consisting of the softer second plastic material may be connected with each other, such that they form a common piece of the second plastic material. Preferably, the at least one stop face and the at least one sealing portion are connected with each other by a web made from the second plastic material.

[0013] As mentioned above, the head of the hair removal device is pivotably supported on the handle of the device. If the device is a shaver comprising a cutter element performing substantially the longitudinal movement in use, the pivoting of the head with respect to the handle may be a swiveling movement about the swiveling axis which is e.g. substantially parallel to the direction of the longitudinal movement of the cutter element. As an alternative or in addition, the pivoting of the head with respect to the handle may be a tilting movement about a tilting axis which is e.g. substantially perpendicular to the direction of the longitudinal movement of the cutter element. Further, the head or the cutter element may be movable in a direction parallel to the main extension of the handle, e.g. a plunging movement with respect to the handle.

[0014] According to an embodiment the head may be pivotably supported on the handle by means of at least two levers which are each pivotably hinged to a support of the handle and to the head, respectively. The levers may form a so-called 4-bar-mechanism permitting a tilting movement of the head with respect to the handle. For example, at least one of the levers is a metal component which may have a substantially U-shaped cross-section.

A part of the support of the handle may be the stop element having at least one stop face made from the second plastic material for each lever. Further, each lever may comprise a portion forming the at least one counter-stop element. According to a further aspect, the support of the handle is a lid hermetically sealing an inner housing of the handle, which inner housing encases the drive unit and the energy source.

[0015] In addition or as an alternative, the head may be supported on the handle pivotably about a swivel axis. The head may comprise a frame supported on at least one, e.g. two, swivel bearings aligned with the swivel axis. Abutment of the frame with a component part which is constrained to the handle with respect to rotation about the swivel axis may limit pivoting of the head relative to the handle about the swivel axis. For example, the component part which is constrained to the handle with respect to rotation about the swivel axis is an, e.g. plate-shaped, head part, wherein at least one stop face made from the second plastic material is provided on the plate. The head part or plate may have an opening receiving a drive shaft of the transmission. Still further, the at least two levers may be pivotably hinged to the head part or a further base plate which is constrained to the head part. The further base plate may comprise two arms, wherein each arm comprises one of the swivel bearings.

[0016] The hair removal device may be a dry shaver, a wet shaver or an epilator. For example, the hair removal device comprises at least one hair removal unit having a foil-type upper cutter and a lower cutter with several blades. The transmission may be coupled to the lower cutter for driving the lower cutter in a translational movement relative to the upper cutter. In addition or as an alternative, the at least one hair removal unit may comprise two or more combs moving relative to each other for cutting or removing hairs.

[0017] Turning now to the exemplary embodiment depicted in the Figures, a hair removal device 1 is depicted in Figure 1 which comprises a handle 2 and a head 3 having several hair removal units 4, 5. The two hair removal units 4 each comprise a foil-type upper cutter and a lower cutter (not shown) with several blades which in use move axially with respect to the foil-type upper cutter for shearing off hairs. The hair removal unit 5 comprises two combs moving relative to each other for cutting hairs.

[0018] In the depicted exemplary embodiment, the handle 2 has an elongate shape defining a main axis of the hair removal device 1. The handle 2 may house component parts like a drive unit 6, an energy source, e.g. a rechargeable battery, a control unit or the like. This is schematically indicated in Figure 2 in dashed lines.

[0019] The head 3 is supported on the handle 2 such that the head 3 may perform a relative movement with respect to the handle 2 permitting the hair removal units to follow the contour of the user's skin. This is depicted in Figure 2 in more detail in which component parts of the head 3 and of the handle 2 are omitted. The handle 2 comprises a support 7 which may be a lid sealing off

an interior space which houses for example the drive unit 6 and the energy source. Four levers are pivotably hinged to the support 7, wherein two levers may be connected with each other to form an, e.g. U-shaped, lever unit 8a, 8b. The levers are further pivotably hinged to a base plate 9 which may be tilted, i.e. pivoted to the left and to the right in Figure 2, relative to the support 7 by means of the levers. For example, the lever units may be sheet-metal parts.

[0020] The base plate 9 comprises two arms 10 each having a swivel bearing 11, which bearings 11 are located on a swivel axis I, for example substantially perpendicular to the main axis of the handle 2. The hair removal units 4, 5 are mounted in a frame 12 which is pivotably supported on the arms 10 by the swivel bearings 11. In combination with the lever units 8a, 8b, the swivel bearings 11 result in a gimbal-like mounting of the frame 12 with respect to the support 7 permitting a swivel movement about the swivel axis I and a tilting movement about an axis substantially perpendicular to the swivel axis I.

[0021] The frame 12 may be received in or may be part of a casing of the head 3 as indicated in Figure 1. Further, the hair removal units 4, 5 may be movable with respect to the frame 12 and/or the casing of the head 3 in a plunging direction substantially parallel to the main extension of the handle 2.

[0022] The pivoting movement of the levers may be limited by abutment of the levers with the support 7 and/or the base plate 9. In the example depicted in Figure 3 each lever comprises a nose 13 in the vicinity of the end facing away from the hair removal units 4, 5. As indicated in Figure 3, the nose 13 of the left lever unit 8a contacts the support 7, thereby limiting tilting of the base plate 9 to the right. In a similar manner the nose 13 of the right lever unit 8b would contact the support 7 if the base plate would be tilted to the left. Thus, the support 7 defines a stop element and the nose 13 defines a counter-stop element which together limit pivoting of the head 3 with respect to the handle 2.

[0023] The support 7 is a component part of the hair removal device 1 which has to bear mechanical loads, for example due to the support of the head 3. Thus, the support 7 mainly consists of a rigid material. In the embodiment depicted in Figure 3, the support 7 is made by two-component injection moulding using a first rigid plastic material and a second softer plastic material. At least the area of the support 7 contacting the respective nose 13 of the lever for limiting the pivoting of the head 3 with respect to the handle 2, i.e. the stop face 14 of the support 7, consists of the second softer plastic material, e.g. a thermoplastic elastomer. In other words, although the support 7 is one component part, it consists of at least two different materials, namely the rigid first plastic material and the softer second plastic material forming the stop face 14 for abutment with the nose 13. This results in a soft stop between the nose 13 and the support 7, thereby preventing undesired noise emission or the sensation of a hard stop.

[0024] In addition or as an alternative, the stop face made from the second softer plastic material may be provided on the levers and/or on the frame 12.

[0025] In a similar manner Figure 4 depicts an interface between the frame 12 and the base plate 9, which interface comprises a soft stop. In more detail, the frame 12 is provided with an edge or protrusion contacting the base plate 9 or a separate plate 15 attached to the base plate 9 if that baseplate 9 is swiveled about swivel axis I as shown in Figure 4. This abutment of the plate 15 which defines a stop element and the frame 12 which defines a counter-stop element limits pivoting of the head 3 with respect to the handle 2 about swivel axis I. The plate 15 is made by two-component injection moulding using a first rigid plastic material and a second softer plastic material. At least the area of the plate 15 contacting the respective portion of the frame 12 for limiting the pivoting of the head 3 with respect to the handle 2, i.e. the stop face 16 of the plate 15, consists of the second softer plastic material, e.g. a thermoplastic elastomer. Again, this results in a soft stop limiting the pivoting of the head 3 with respect to the handle 2.

[0026] While the plate 15 is shown in Figure 4 as a separate component part constrained to the base plate 9, the stop face 16 may be provided directly on the base plate 9. As a further alternative or in addition to the above embodiments, a stop face consisting of the second softer plastic material may be provided on the frame 12, for example on the edge or protrusion contacting the baseplate 9 or of the plate 15 for limiting the pivoting of the head 3 with respect to the handle 2.

[0027] The component parts made by two-component injection moulding using a first rigid plastic material and a second softer plastic material, i.e. the support 7 and/or the plate 15, may have additional functions and/or additional areas consisting of the second softer plastic material.

[0028] For example, the support 7 may be a lid hermetically closing an inner housing encasing for example the drive unit 6 and/or the energy source. For this purpose the support may be provided with a sealing lip 18 consisting of the second softer plastic material for sealing of the lid (support 7) with respect to other inner housing components. In an alternative embodiment not depicted in the Figures, the sealing lip 18 may be a separate portion of the second softer plastic material not directly connected with the stop face 16. As an alternative, the sealing lip may be connected with the stop face 16 by a web of the second softer plastic material, e.g. channels 17 used for distributing the second softer plastic material during injection molding.

[0029] As a further example the base plate 9 and/or the plate 15 may be a lid hermetically closing the head 3 with respect to the environment. For this purpose the baseplate 9 and/or the plate 15 maybe provided with a sealing lip (not shown) consisting of the second softer plastic material for sealing of the lid with respect to other portions of the head 3. Again, the stop face 14 may be a

separate portion of the second softer plastic material or may be connected with the sealing lip by a web of the second softer plastic material.

[0030] As a still further example, the second softer plastic material may have a portion formed as a soft rib 19 provided on the base plate 9 and/or the plate 15. The soft rib 19 may be arranged such that it acts on a pivot axle 20 of one of the lever units 8a, 8b connecting the baseplate 9 and/or the plate 15 with the support 7. In more detail, the soft rib 19 may be arranged such that it is slightly compressed by abutment with the pivot axle 20, thereby eliminating clearances between the axle 20, the lever units 8a, 8b and the base plate 9 and/or the plate 15. Again, the stop face 14 may be a separate portion of the second softer plastic material or may be connected with the soft rib 19 by a web of the second softer plastic material.

[0031] Thus, the electric dry shaver comprises a moveable shaver head which swiveling range is limited by stops elements having counter-stop elements made from a softer material than the stop element and thus softening the abutment when the shaver head reaches its extreme end positions. Almost no noise is therefore created by such shaver head movements even if those reach the end positions. Advantageously the counter-stop elements made from soft material, as e.g. TPE are made in multi-component injection molding process. The part equipped with the soft counter stop element is provided with second functional soft component part either on the same side as the counter stop element or on the opposite side of the part. This second functional soft component part is provided to serve for a different purpose than a stop or counter-stop element, i.e. for providing a sealing lip or pretension protrusion rib. Therefore, the soft material counter-stop is not only cost efficiently provided by the multi component injection molding process but also the material serves for a double function in the same part.

[0032] The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as "40 mm" is intended to mean "about 40 mm."

Reference numerals:

[0033]

1	hair removal device
2	handle
3	head
4	hair removal unit
5	hair removal unit
6	drive unit
7	support
8a, b	lever unit
9	base plate

10	arm
11	swivel bearing
12	frame
13	nose
5 14	stop face
15	plate
16	stop face
17	channel
18	sealing lip
10 19	soft rib
20	pivot axle

I swivel axis

15

Claims

1. A hair removal device comprising a handle (2), which encases a drive unit and an energy source, and a head (3), which is pivotably supported on the handle (2) and comprises at least one hair removal unit (4, 5) coupled to the drive unit by means of a transmission converting a motion of the drive unit into a movement of a driven part of the at least one hair removal unit (4, 5), wherein pivoting of the head (3) with respect to the handle (2) is limited by abutment of at least one stop face (14, 16) of at least one stop element (7, 15) with at least one counter-stop element (8a, 8b, 12), wherein the at least one stop element (7, 15) is made by multi-component injection moulding from a first plastic material and a second plastic material which is softer than the first plastic material, and wherein the at least one stop face (14, 16) is made from the second plastic material.
2. The hair removal device according to claim 1, wherein the at least one stop element (7, 15) is made by two-component injection moulding.
3. The hair removal device according to claim 1 or 2, wherein the first plastic material is polypropylene or polybutylene terephthalate and/or the second plastic material is a thermoplastic elastomer or a liquid silicone rubber.
4. The hair removal device according to any of the preceding claims, wherein the at least one stop element (7, 15) is a shell or part of a shell assembly sealing at least a portion of the hair removal device (1) off against the environment, and wherein the at least one stop element (7, 15) comprises at least one sealing portion (18) made from the second plastic material.
5. The hair removal device according to any of the preceding claims, wherein the at least one stop element (7, 15) comprises at least one soft rib (19) made from the second plastic material, wherein the soft rib (19)

exerts a biasing force on a component part (20) abutting the soft rib (19).

6. The hair removal device according to claim 4 or 5, wherein the at least one stop face (14, 16) and the at least one sealing portion (18) and/or soft rib (19) are connected with each other by a web (17) made from the second plastic material. 5
7. The hair removal device according to any of the preceding claims, wherein the head (3) is pivotably supported on the handle (2) by means of at least two levers (8a, 8b) which are each pivotably hinged to a support (7, 12) of the handle (2) and to the head (3), respectively. 10 15
8. The hair removal device according to claim 7, wherein at least a part of the support (7) of the handle (2) is the stop element (7) having at least one stop face (14) made from the second plastic material for each lever (8a, 8b), wherein each lever (8a, 8b) comprises a portion forming the at least one counter-stop element. 20
9. The hair removal device according to claim 7 or 8, wherein the support (7) of the handle (2) is a lid hermetically sealing an inner housing of the handle (2), which inner housing encases the drive unit (6) and the energy source. 25 30
10. The hair removal device according to any of claims 7 to 9, wherein at least one of the levers (8a, 8b) is a metal component and/or has a substantially U-shaped cross-section. 35
11. The hair removal device according to any of the preceding claims, wherein the head (3) is supported on the handle (2) pivotably about a swivel axis (I), wherein the head (3) comprises a frame (12) pivotably supported on the swivel axis (I), and wherein abutment of the frame (12) with a component part (9, 15) which is constrained to the handle (2) with respect to rotation about the swivel axis (I) limits pivoting of the head (3) relative to the handle (2) about the swivel axis (I). 40 45
12. The hair removal device according to claim 11, wherein the component part (9, 15) which is constrained to the handle (2) with respect to rotation about the swivel axis (I) is a head part with an opening receiving a drive shaft of the transmission, wherein at least one stop face (16) made from the second plastic material is provided on the head part (9, 15). 50
13. The hair removal device according to claims 7 and 12, wherein the at least two levers (8a, 8b) are pivotably hinged to the head part (15) or a further base plate (9) which is constrained to the head part (15). 55

14. The hair removal device according to claim 13, wherein the further base plate (9) comprises two arms (10), wherein each arm (10) comprises one of the swivel bearings (11).

15. The hair removal device according to any of the preceding claims, wherein the at least one hair removal unit (4, 5) of the head (3) comprises a foil-type upper cutter and a lower cutter with several blades, wherein the transmission is coupled to the lower cutter for driving the lower cutter in a translational movement relative to the upper cutter.



FIG. 1

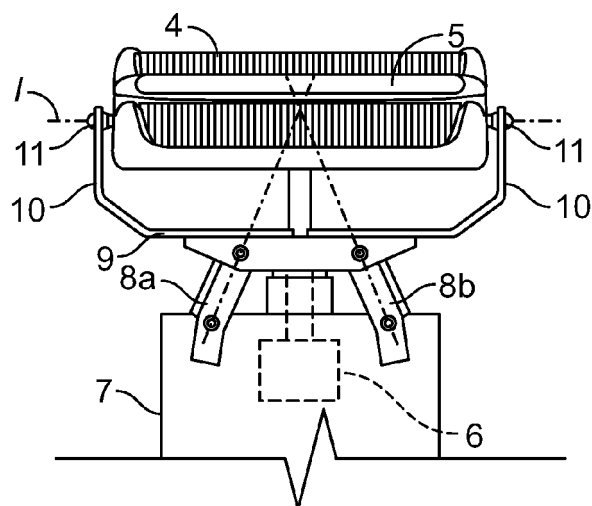


FIG. 2

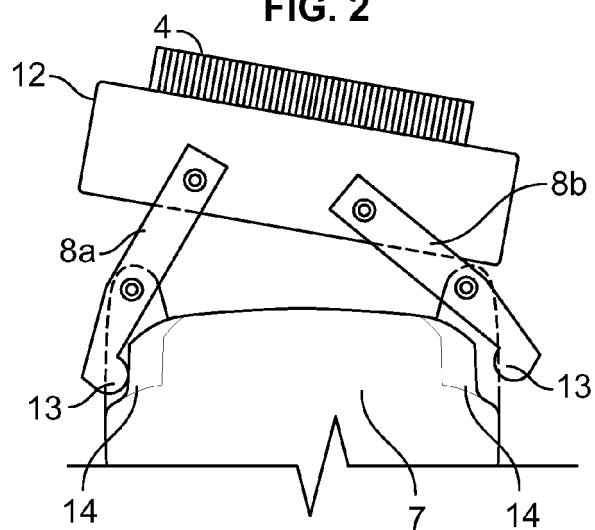


FIG. 3

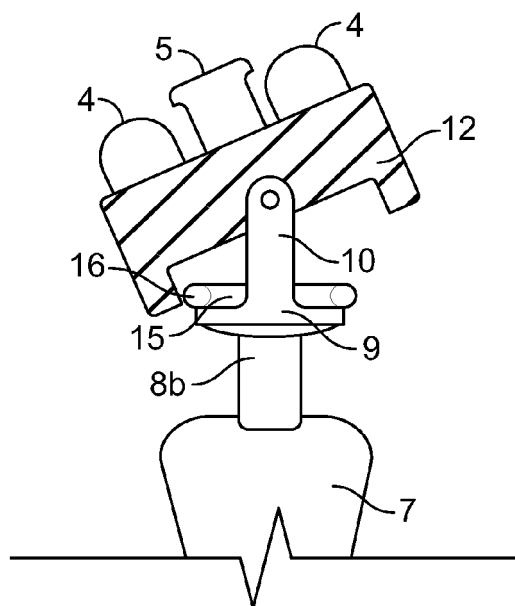


FIG. 4



EUROPEAN SEARCH REPORT

Application Number
EP 18 16 4821

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Place of search Munich		Date of completion of the search 1 October 2018	Examiner Rattenberger, B
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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