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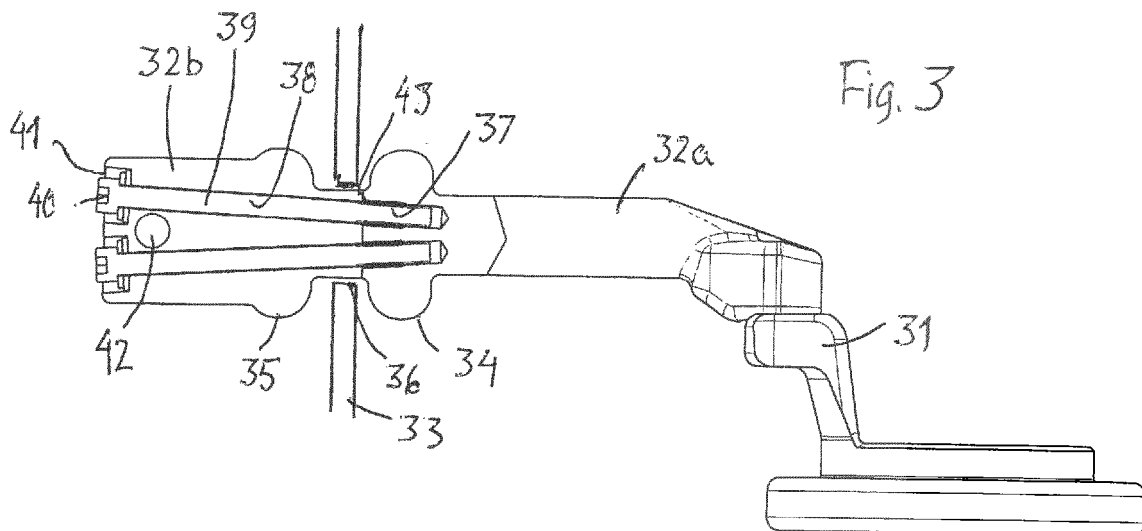
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(74) Representative: **Ahrengart, Kenneth****ABB AB****Intellectual Property****Ingenjör Bååths Gata 11, T2 Floor E****721 83 Västerås (SE)**(54) **A tap selector and a method for assembling a tap selector**

(57) The invention relates to a tap selector for a tap changer. The tap selector includes a plurality of moving contacts (31). Each moving contact (31) is electrically connected to a respective current collector arm (32) and each current collector arm (32) is electrically connected to a conductor for electrical connection with a diverter switch.

According to the invention each of at least some of the current collector arms (32) is assembled from two separate parts (32a, 32b) joined together. One of these is an inner part (32a) that is electrically connected to a respective moving contact (31). The other one is an outer part (32b) that is electrically connected to the conductor.

The invention also relates to a method for assembling such a tap selector.



Description

Field of invention

[0001] The present invention in a first aspect relates to a tap selector for a tap changer, which tap selector includes a plurality of moving contacts, each moving contact being electrically connected to a respective current collector arm, each current collector arm being electrically connected to a conductor for electrical connection with a diverter switch.

[0002] In a second aspect, the invention relates to a method for assembling a tap selector for a tap changer, which method includes providing a rod with a plurality of fixed contacts.

Background of invention

[0003] A tap changer is commonly used in connection with a transformer in order to vary the transformation rate thereof. In a transformer with a tap changer one of the windings in the transformer has a fixed amount of turns connected to the circuit. The other winding has one fixed connection point, whereas the other connection point can be selected among a number of moving contacts to attain a required voltage. The selectable moving contacts may be located after each other along a portion of the winding corresponding to 70% to 100% of its full extension.

[0004] Upon a change in the load connected to the transformer or due to other influences it might be required to change the connection point. The need of changing the tap point is often triggered automatically in response to sensed parameters. Tap changing includes a plurality of manoeuvres including the opening and closing of switches e.g. via a spring loaded energy accumulator and moving a fine selector arm to a new fixed contact. These manoeuvres have to be performed in a certain sequence and in a certain time relation.

[0005] A tap changing manoeuvre includes the change of connection from one connection point to an adjacent connection point. This is performed by a fine selector arm establishing the contact with the respective moving contact.

[0006] Illustrative example of tap selectors are disclosed e.g. in US3652812, US5374781, EP325139, DE3936420, JP63148607 and CN101572174.

[0007] When the movable contact has been brought into contact with one of the moving contact, a circuit thereby is established in which the tap via the movable contact and the fixed contact are connected to the diverter switch. The connection from the moving contact is established by the current collector arm related to the fixed contact in question. Each current collector arm is connected to the diverter switch via a conductor that is common for all current collector arms.

[0008] The length required for the current collector arms might entail various problems at assembling the tap selector.

[0009] One such problem is that a tap selectors of this kind typically has an insulating cylinder enclosing the set of fixed contacts, whereby the conductor to which the current collector arms are connected is located outside this insulating cylinder. The current collector arms thus have to extend through this cylinder. Due to the length of the current collector arms thereby required, it is problematic to assemble the tap selector. The current collector arms attached to the moving contacts are obstacles against inserting the component on which the moving contacts are mounted into the shielding. This can be avoided by having a segment cylinder wall, but such becomes mechanically too weak for many applications.

Summary of invention

[0010] The object of the present invention is to overcome these problems relating to the assembling of a tap selector

[0011] This object is achieved in that a tap selector according to the kind described in the introduction to the description includes the specific features that each of at least some of the current collector arms is assembled from two separate parts joined together, namely an inner part electrically connected to a respective of the moving contacts and an outer part connected to the conductor.

[0012] Since a current collector arms is made up of two separate parts it will be possible to insert the unit with the moving contacts into a surrounding insulating cylinder with only the inner part of the respective current collector arm attached to the moving contact. Thereby the assembly can be made much easier. The outer part of the respective current collector arm can be attached to the inner part after insertion of these into the insulating cylinder.

[0013] In order to facilitate the assembly it is in principle sufficient that only some of the current collector arms are divided into two parts. However, it is in most cases preferred that all the current collector arms are of this type since that contributes the most to achieve a simple assembly. This also has the advantage that the construction will be more unitary.

[0014] According to a preferred embodiment, the tap selector includes a rod on which each of the moving contacts are mounted and a cylindrical insulating wall surrounding the rod, the cylindrical insulating wall having a plurality of openings through which openings a respective current collector arm extends.

[0015] It is normally an advantageous layout to have the fixed contacts arranged on such a rod, which leads to a compact structure that provides a logical arrangement of the moving contacts and allows a rational manufacturing. Since, as mentioned above, one of the more pertinent problems at assembling is when the tap selector is of the type having a cylindrical insulating wall, the application of the invention when an insulating wall is present is of particular interest.

[0016] According to a further preferred embodiment at least a major portion of the inner part is located on the

inside of the cylindrical insulating wall and at least a major portion of the outer part is located on the outside of the insulating wall.

[0017] When solving the assembling problem related to the presence of an insulating wall, this relative location and extension of the respective part further contribute to a simple assembly.

[0018] According to a further preferred embodiment, the inner part has a length that is larger than the length of the outer part.

[0019] This makes it easier to attach the parts to each other.

[0020] According to a further preferred embodiment, at least one of the inner and outer parts has a shielding projection.

[0021] The shielding projection on either or both parts makes it possible to operate at higher voltages without disturbing effects from the current collector arm. Preferably there is a shielding projection on each part. It is advantageous to arrange the shielding projection as a ring around the respective part so as to provide shielding in all directions perpendicular to the current collector arm. The shielding projection is preferably made in one piece with the respective part in order to facilitate manufacture.

[0022] According to a further preferred embodiment, each shielding portion is located close to the shielding wall.

[0023] The shielding thereby is provided in the region where it is most important to attain this.

[0024] According to a further preferred embodiment, the inner and outer parts are joined together by screw means.

[0025] A simple and safe joining of the parts thereby is achieved and the joint is easily releasable if the need for dismounting should occur.

[0026] According to a further preferred embodiment, the screw means includes at least one screw, each screw having a direction that mainly extends in the longitudinal direction of the current collector arm, and each screw is inserted through a hole in the outer part and extends into a threaded hole in the inner part.

[0027] Screwing the parts together thereby will be particularly easy. Preferably two screws are used. A screw joint of this kind also has the advantage that the parts do not have to be rotated in relation to each other when joining them. The angular orientation of the outer part thereby will be well defined which is advantageous for the connection thereof to the conductor leading to the diverter switch.

[0028] According to a further preferred embodiment, the screw means includes two screws directed such that the screws converge in a direction from the outer part towards the inner part.

[0029] The oblique arrangement of the screws allows to have a distance between the screw heads at the outer end of the outer part that is sufficient large for conveniently screwing the screws, whereas the inner part can be relatively thin and need not be dimensioned thicker

only for the purpose of providing a corresponding distance at that end of the screws.

[0030] The invention also relates to a tap changer that includes a tap selector according to the present invention, in particular according to any of the preferred embodiments thereof.

[0031] Further, the invention relates to a transformer that is provided with a tap changer according to the present invention.

[0032] The object of the present invention is according to the second aspect thereof achieved in that a method of the kind mentioned in the introduction to the description includes the specific steps of

- attaching an inner part of a current collector arm to each moving contact,
- providing an insulating cylinder,
- making a plurality of openings in the insulating cylinder,
- inserting the rod axially into the inside of the insulating cylinder
- positioning the rod such that each said inner part is in alignment with one of said openings,
- inserting an outer part of said current collector arm through each said opening, and
- connecting each said inner part to a respective one of said outer parts.

[0033] According to preferred embodiments, the method is performed with components corresponding to the components of the invented tap selector, in particular to any of the preferred embodiments thereof.

[0034] The invented tap changer, the invented transformer and the invented method have advantages of similar kinds as those of the invented tap selector and the preferred embodiments thereof, which advantages have been described above,

[0035] The above described preferred embodiments of the invention are specified in the dependent claims. It is to be understood that further preferred embodiments of course can be constituted by any possible combination of the preferred embodiments above and by any possible combination of these and features mentioned in the description of an example below.

[0036] The invention will be further explained through the following detailed description of an example thereof and with reference to the accompanying drawings.

Short description of the drawings

[0037]

Fig 1 a-1 c schematically illustrates a tap changer for which the tap selector of the present invention is suitable.

Fig. 2 is a side view of parts of a tap selector according to the present invention.

Fig. 3 is a side view, partly in section, of a current

collector arm according to the present invention.

Fig. 4 is a side view of the current collector arm of fig 3.

Fig. 5 is a top view of the current collector arm of fig. 3.

Description of examples

[0038] Fig 1a - 1 c schematically illustrates a tap changer. Fig. 1 a is a single-phase diagram of a tap changer 100 of a kind for which the device according to the present invention is intended. The tap changer 100 is connected to a regulating winding of a transformer and has a set of different taps 102, in this case the number of taps is 16, but the number might be some other, for example any number from 5 to 35.. The tap changer of fig. 1 a is of diverter switch type, and comprises a diverter switch 120 and a tap selector 110.

[0039] The tap selector 110 of Fig.1 operates with pre-selection and fine selection, and thus comprises a pre-selector arm 51 and a fine selector arm 101. Both the pre-selector arm 51 and the fine selector arm 101 operate by a respective rotational movement as illustrated in fig 1 b and 1 c. The pre-selector arm 51 is movable between two fixed contacts and the fine selector arm 101 can be brought into contact with either of 5-9 different contacts. The combined positioning of the pre-selector arm 51 and the fine selector arm 101 thereby represents up to 35 different taps.

[0040] The diverter switch 120 in a known manner has a set of breakers, e.g. vacuum breakers. When it is required to change from one tap to another, these breakers are opened and closed in a certain sequence. This allows the selector arms 51, 101 to respectively move from one fixed contact to an adjacent fixed contact.

[0041] Fig. 2 is a side view of parts of a tap selector according to the invention. A central rod 30 is provided with a plurality of moving contacts 31. A fixed contact (not shown) can be brought into contact with a selected one of the moving contacts 31. To each moving contact 31 a current collector arm 32 is fixedly connected. The outer end of each current collector arm 32 is arranged to be fixedly connected to a conductor (not shown) leading to the diverter switch.

[0042] The rod 30 is concentrically surrounded by an insulating cylinder 33, of which only a part is shown in the figure. Each current collector arm 32 extends through a respective opening 36 in the insulating cylinder 33. The current collector arm 32 might be a solid metal bar e.g. of copper, brass or the like.

[0043] The current collector arm 32 is made from two separate parts that are joined together, an inner part 32a and an outer part 32b. The inner part 32a extends from the moving contact radially outward to a short distance from the insulating cylinder 33. The outer part 32b extends from its outer end connectable to the conductor and through the opening 36 in the insulating cylinder 33 until it meets the inner part 32a just inside the insulating cylinder 33.

[0044] Fig. 3 illustrates the current collector arm 32 more in detail, partly in section. The two parts thereof meet each other at the outer end surface 43 of the inner part 32a, which is located just inside the insulating cylinder 33. The two parts are joined together by a pair of screws 39. Each screw 39 extends through a non-threaded hole 38 in the outer part 32b and into threaded hole 37 in the inner part 32a. The screws extend mainly in the longitudinal direction of the current collector arm 32, but are slightly converging to each other in the inward direction. Recesses 41 are provided for the screw heads 40. A hole 42 is provided for connection to the conductor to the diverter switch.

[0045] The inner part 32a at its outer end has a shielding projection 34 that is ring-shaped around the same. A similar ring-shaped shielding projection 35 is arranged at the inner end of the outer part 32b.

[0046] In fig. 4 the current collector arm 32 is shown in a side view and in fig. 5 in a view from above. By these figures the shape of the outer end of the outer part 32b can be seen, with a flat surface 44 in a vertical plane is arranged on each side for the mounting to the conductor to the diverter switch.

[0047] When the tap selector is to be assembled the rod 30 with the moving contacts 31 and the inner parts 32a of the current collector arms 32 connected to a respective one of these is inserted axially into the cylindrical insulating wall 33. This can easily be done by aid of gravity. Then the rod 30 is oriented such that each inner part 32a becomes aligned with a respective opening 36 in the cylindrical insulating wall 33. Thereafter an outer part 32b is inserted through each opening 36 such that it comes into contact with a respective inner part 32a and with the holes 37, 38 aligned with each other..

[0048] In each outer part 32b, the screws 39 are then inserted through the holes 38 in these and further into the threaded holes 37 of the aligned inner part 32a. The two parts are then secured to each other by screwing the screws 39. When assembled the outer part 32b of each current collector arm 32 can be connected to the conductor to the diverter switch by means of the mounting holes 42 at the flat surfaces 44 at the very outer ends thereof.

Claims

1. A tap selector for a tap changer, which tap selector includes a plurality of moving contacts (31), each moving contact (31) being electrically connected to a respective current collector arm (32), each current collector arm (32) being electrically connected to a conductor for electrical connection with a diverter switch, **characterized in that** each of at least some of the current collector arms (32) is assembled from two separate parts (32a, 32b) joined together, namely an inner part (32a) electrically connected to a respective of the moving contacts (31) and an outer

part (32b) connected to the conductor.

2. A tap selector according to claim 1, **characterized in that** the tap selector includes a rod (30) on which each of the moving contacts (31) are mounted, and a cylindrical insulating wall (33) surrounding the rod (30), the cylindrical insulating wall (33) having a plurality of openings (36) through which openings a respective current collector arm (32) extends. 5
3. A tap selector according to claim 2, **characterized in that** at least a major portion of said inner part (32a) is located on the inside of the cylindrical insulating wall (33) and at least a major portion of said outer part (32b) is located on the outside of the insulating wall (33). 10
4. A tap selector according to any of claims 1-3, **characterized in that** the inner part (32a) has a length that is larger than the length of the outer part (32b). 15
5. A tap selector according to any of claims 1-4, **characterized in that** at least one of said inner (32a) and outer (32b) parts has a shielding projection (34, 35). 20
6. A tap selector according to claim 5, **characterized in that** each shielding portion (34, 35) is located close to the insulating wall (33). 25
7. A tap selector according to any of claims 1-6, **characterized in that** the inner (32a) and outer (32b) parts are joined together by screw means. 30
8. A tap selector according to claim 7, **characterized in that** the screw means includes at least one screw (39), each screw (39) having a direction that mainly extends in the longitudinal direction of the current collector arm (32), and each screw (39) is inserted through a hole (38) in the outer part (32b) and extends into a threaded hole (37) in the inner part (32a). 35
9. A tap selector according to claim 8, **characterized in that** the screw means includes two screws (39) directed such that the screws (39) converge in a direction from the outer part (32b) towards the inner part (32a). 40
10. A tap changer **characterized in that** the tap changer includes a tap selector according to any of claims 1-9. 45
11. A transformer **characterized in that** the transformer includes a tap changer according to claim 10. 50
12. A method for assembling a tap selector for a tap changer, the method including the step of providing a rod (30) with a plurality of moving contacts (31), **characterized in that** the method further includes the steps of
 - attaching an inner part (32a) of a current collector arm (32) to each moving contact (31),
 - providing an insulating cylinder (33),
 - making a plurality of openings (36) in the insulating cylinder (33),
 - inserting the rod (30) axially into the inside of the insulating cylinder (33)
 - positioning the rod (30) such that each said inner part (32a) is in alignment with one of said openings (36),
 - inserting an outer part (32b) of said current collector arm (32) through each said opening (36), and
 - connecting each said inner part (32a) to a respective one of said outer parts (32b).
13. A method according to claim 12, **characterized in that** the method is performed with components corresponding to the components according to any one of claims 1-9. 55

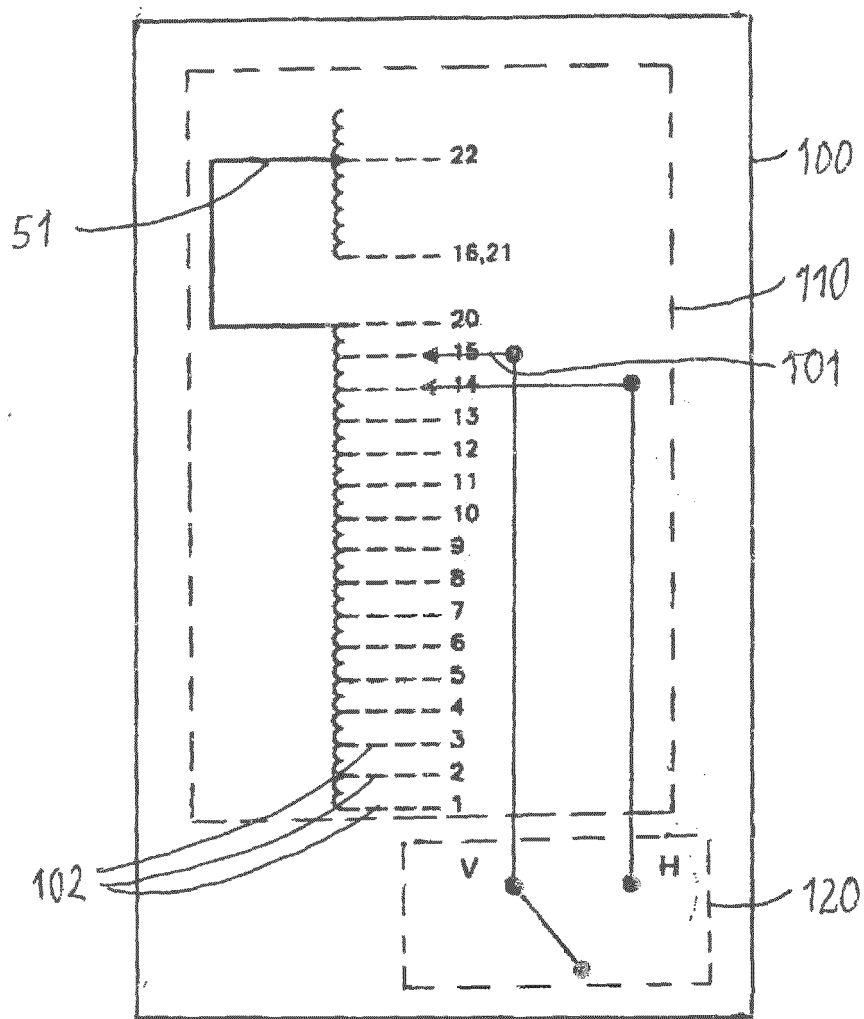


Fig. 1a

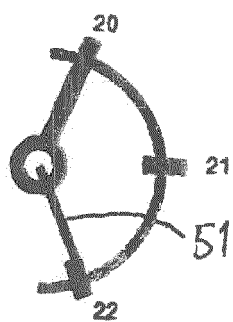


Fig. 1b

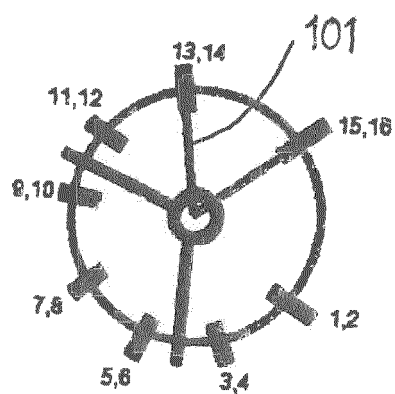


Fig. 1c

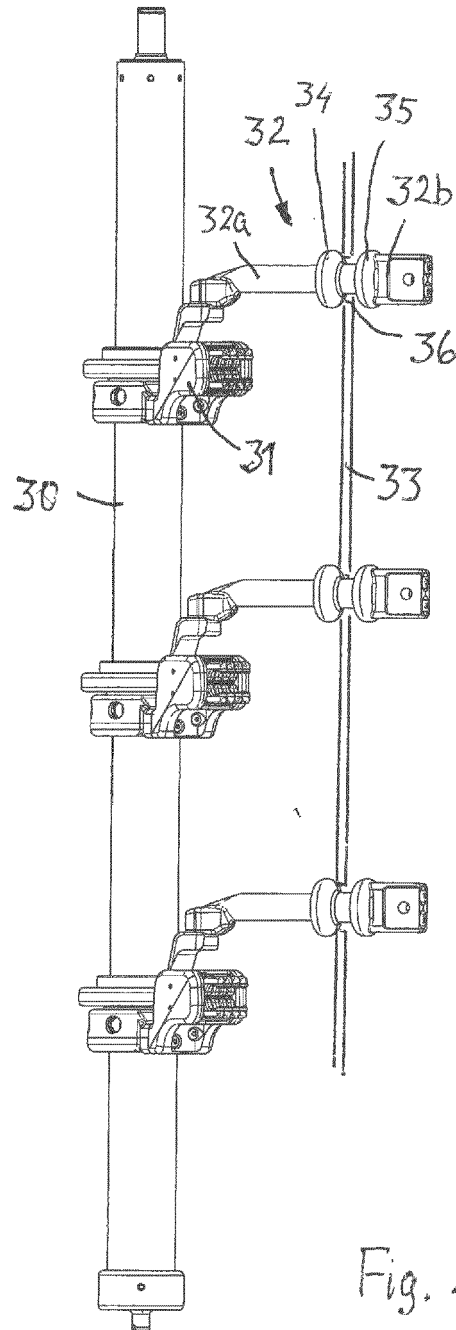
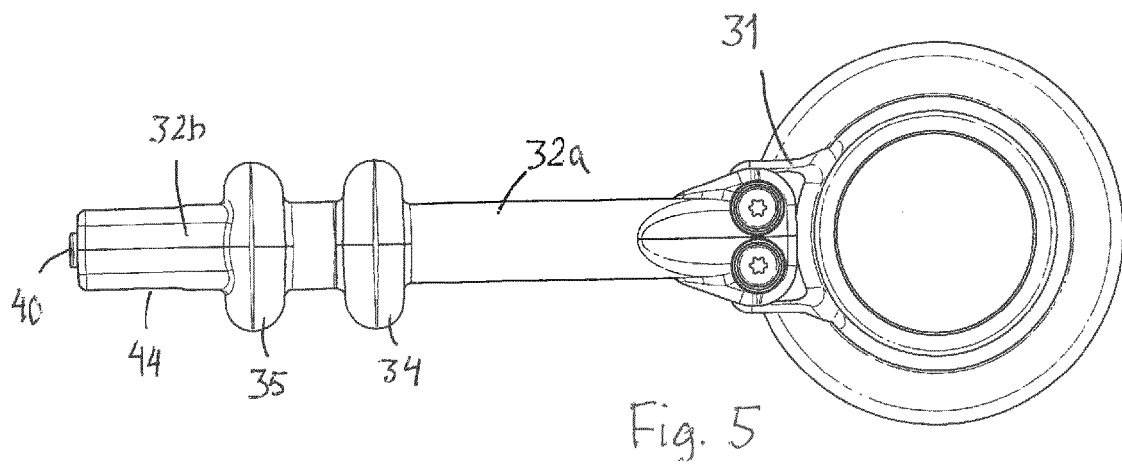
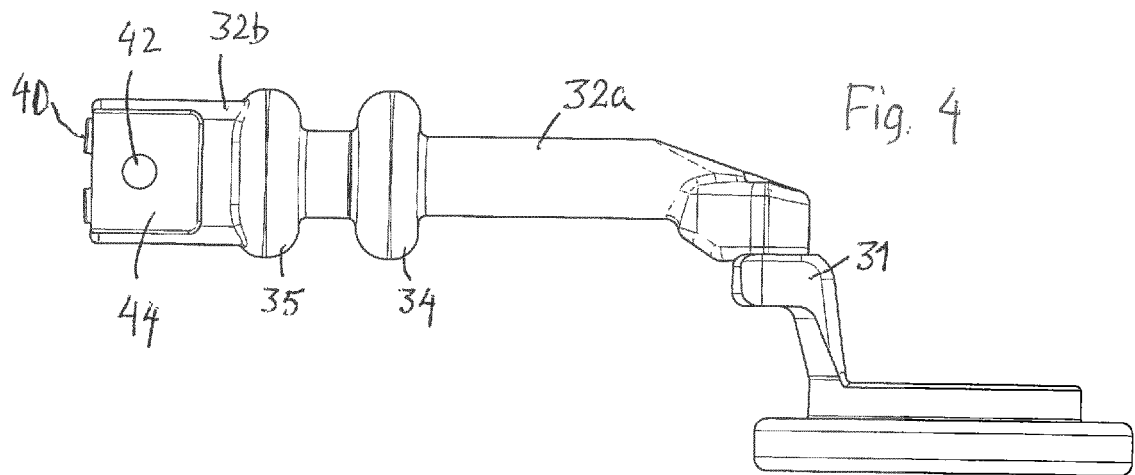
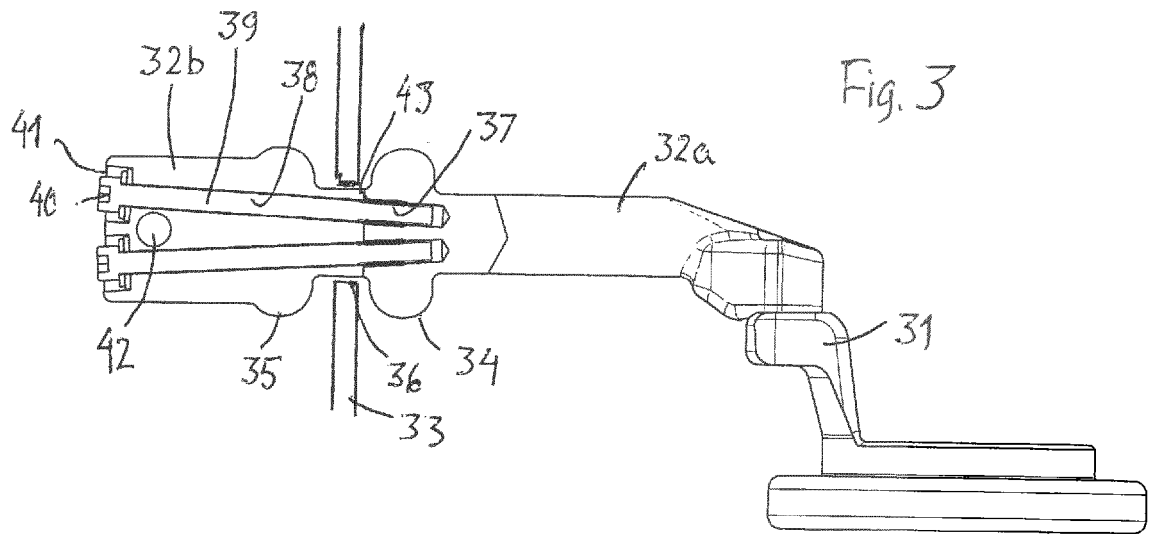


Fig. 2





EUROPEAN SEARCH REPORT

Application Number
EP 12 15 8342

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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 31 July 2012	Examiner Simonini, Stefano
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