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PT RO SE SI SK TR**(72) Inventor: **Belloni, Francesco****I-24124, Bergamo (IT)**(74) Representative: **Giavarini, Francesco et al****Zanoli & Giavarini S.r.l.****Via Melchiorre Gioia, 64****20125 Milano (IT)**(71) Applicant: **ABB Technology AG****8050 Zürich (CH)**(54) **Medium voltage line switch contact arrangement.**

(57) A Medium Voltage line switch contact arrangement 1 comprising a fixed contact 2 and a movable contact assembly 3 operatively connectable to said fixed contact 2; the movable contact assembly 3 comprising a first 31 and a second 32 substantially flat blades parallel to each other, pivotally mounted on a support and rotationally connectable to said fixed contact 2; the fixed contact 2 comprises a contact element having a substantially flat body 20 with a first 21 and a second 22 contact surfaces delimited by a base 23 connected to a contact holder 24 and by a first 25, a second 26, a third 27 and a fourth 28 segments. The first segment 25 is substantially perpendicular to the third segment 27, with the first 25 and second 26 segments facing said movable contact assembly 3; the second segment 26 connects said first segment 25 to said third segment 27 and is inclined toward said fourth segment 28 so that the length 1 of the third segment 27 is shorter than the width L of said substantially flat body 20 as measured in correspondence of the connection point between said first 25 and second 26 segment.

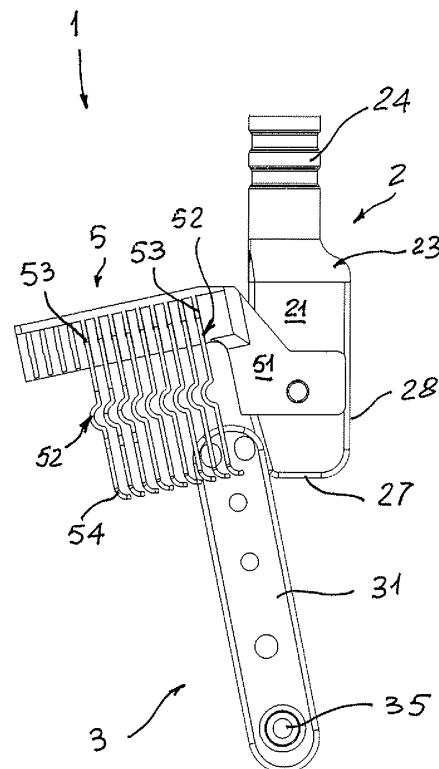


Fig. 1

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Description

DESCRIPTION

[0001] The present invention relates to a contact arrangement, in particular to a contact arrangement of a Medium Voltage line switch, having improved resistance to arcing phenomena. For the purposes of the present application the term Medium Voltage is referred to applications in the range of between 1 and 52 kV.

[0002] Medium Voltage line switch are well known in the art and usually comprises, for each phase a contact assembly having a fixed contact and a corresponding movable contact. An arc chamber, provided with an arcing electrode, is also present in order to control the arcing phenomena and minimize the arcing effects occurring during opening/closing operations of the line switch. Various solutions have been proposed in order to minimize the arcing effects on the contacts, said solutions being directed to improve the design of the main contacts and/or of the arcing chamber and/or to increase the speed of opening/closing operations.

[0003] However, at the present state of the art, the design of the contact arrangement is not totally satisfactory. Indeed, erosion of the contacts, normally silver-plated copper contacts, still occurs as a consequence of relatively long pre-arcing times and/or the location of the arc foot point in correspondence of the current-carrying contacts. This reduce the life of the apparatus and may also have negative consequences on the operation line switch

[0004] It is therefore an object of the present invention to provide a Medium Voltage line switch contact arrangement in which the above-mentioned drawbacks are avoided or at least reduced.

[0005] More in particular, it is an object of the present invention to provide a Medium Voltage line switch contact arrangement in which contact erosion is reduced.

[0006] As a further object, the present invention is aimed at providing a Medium Voltage line switch contact arrangement in which the prearcing time is reduced.

[0007] A further object of the present invention is to providing provide a Medium Voltage line switch contact arrangement in which the arc bums far away from the main contacts, thereby preventing or considerably reducing contact erosion.

[0008] Still another object of the present invention is to provide a Medium Voltage line switch contact arrangement with reduced manufacturing and installation costs.

[0009] Thus, the present invention relates to a Medium Voltage line switch contact arrangement which is **characterized in that** it comprises a fixed contact and a movable contact assembly operatively connectable to said fixed contact. In the line switch of the invention, the movable contact assembly comprises a first and a second substantially flat blades parallel to each other, said flat blades being pivotally mounted on a support and rotationally connectable to said fixed contact. The fixed contact of the line switch of the invention comprises a contact

element having a substantially flat body having a first and a second contact surfaces delimited by a base connected to a contact holder and by a first, a second, a third and a fourth segment, the first segment being substantially perpendicular to said third segment, the first and second segment facing said movable contact assembly, the second segment connecting said first segment to said third segment and being inclined toward said fourth segment so that the length l of the third segment is shorter than the width L of said substantially flat body as measured in correspondence of the connection point between said first and second segment.

[0010] It has been seen that, thanks to the particular design of the contact arrangement, in particular of the fixed contact, the prearcing time was considerably reduced. Consequently, also erosion of the contacts is considerably reduced.

[0011] For the purpose of the present invention the width L of the flat body is measured along the perpendicular line drawn from the connection point between said first and second segment to the fourth segment.

[0012] A Medium Voltage line switch comprising a contact arrangement as described above is also part of the present invention.

[0013] Further characteristics and advantages of the invention will emerge from the description of preferred, but not exclusive embodiments of a Medium Voltage line switch contact arrangement according to the invention, non-limiting examples of which are provided in the attached drawings, wherein:

Figure 1 is a side view of a first embodiment of a line switch contact arrangement according to the invention;

Figure 2 is front view of the line switch contact arrangement of figure 1;

Figure 3 is a perspective view of a first embodiment of a fixed contact used in a line switch contact arrangement according to the invention;

Figure 4 is a side view of the fixed contact of figure 3; Figure 5 is front view of the fixed contact of figure 3; Figure 6 is a perspective view of a second embodiment of a line switch contact arrangement according to the invention.

[0014] With reference to the attached figures, a Medium Voltage line switch contact arrangement according to the invention, globally designated with the reference numeral 1, generally comprises a fixed contact 2 and a movable contact assembly 3 which can be operatively connected to and disconnected from said fixed contact 2.

[0015] The movable contact assembly 3 normally comprises a first 31 and a second 32 substantially flat blades which are arranged parallel to each other and at a distance from each other. The flat blades 31, 32 are pivotally mounted on a support (not shown) in correspondence of a pivot point 35. By rotation around the pivot point 35, the flat blades 31 and 32 can be connected to and dis-

connected from the fixed contact 2.

[0016] The fixed contact 2 comprises contact element having a substantially flat body 20 having a first 21 and a second 22 contact surfaces which, in the closed position of the switch, interact with the inner surfaces of the flat blades 31 and 32 to close the circuit.

[0017] The substantially flat body 20 is delimited by a base 23, which is electrically and mechanically connected to a contact holder 24, and by a first 25, a second 26, a third 27 and a fourth 28 segments so as to have a particular shape.

[0018] In details, the substantially flat body 20 is positioned so as to have the first 21 and the second 22 contact surface substantially parallel to the flat blades 31 and 32 of the movable contact assembly 3, with the first 25 and second 26 segments facing said movable contact assembly 3.

[0019] For what concerns the shape of the substantially flat body 20, the first segment 25 is substantially perpendicular to said third segment 27, with the second segment 26 connecting said first segment 25 to said third segment 26 and being inclined toward said fourth segment 28 so that the length l of the third segment 27 is shorter than the width L of said substantially flat body 20 as measured in correspondence of the connection point 29 between said first 25 and second 26 segment.

[0020] In other words, as shown in the attached figures, at least a portion of the substantially flat body 20 of the fixed contact 2, in particular the portion facing the movable contact assembly 3, is cut away.

[0021] As already said, for the purpose of the present invention the width L of the flat body 20 is considered as the distance between the connection point 29 and the fourth segment 28 as measured along the line drawn from the connection point 29 perpendicularly to the fourth segment 28, as shown in figure 4.

[0022] Thanks to the particular shape of the flat body 20 of the fixed contact and to its position with respect to the movable contact assembly 3, in particular with respect to the substantially flat contact blades 31 and 32, the prearcing time is reduced thereby greatly minimizing the erosion phenomena on the fixed contact.

[0023] According to preferred embodiments of the Medium Voltage line switch contact arrangement 1 according to the invention, the length l of said third segment 27 is between $0.75L$ and $0.85L$, and more preferably is between $0.77L$ and $0.83L$.

[0024] Preferably, the base 23 of the substantially flat body 20 is substantially parallel to the third segment 27.

[0025] It has also been seen that the performances of the Medium Voltage line switch contact arrangement 1 of the invention can be further improved by properly dimensioning the length and inclination of the second segment 26. In particular, according to preferred embodiments of the invention, the distance d between the third segment 27 and the connection point 29 between the first 25 and the second 26 segments is preferably between $0.30D$ and $0.40D$, where D is the length of the

substantially flat body 20 as measured from the base 23 to the third segment 27.

[0026] More preferably, the distance d between said third segment 27 and the connection point 29 between the first 25 and the second 26 segments is between $0.33D$ and $0.38D$.

[0027] For the purposes of the present invention, and as shown in figure 4 and 5, the distance d between said third segment 27 and the connection point 29 is considered as the distance between said connection point 29 and the third segment 27 as measured along the line drawn from the connection point 29 perpendicularly to the third segment 27.

[0028] In particularly preferred embodiments of the invention, shown in the attached figures, said first 25 and fourth 28 segments are substantially parallel to each other and substantially perpendicular to said third segment 27. Thus, according to these embodiments the substantially flat body 20 has a substantially rectangular shape with a corner, i.e. the one facing the movable contact assembly 3, cut away. In this case, the length D of the substantially flat body 20 substantially corresponds to the length of the fourth segment 38, while the width L of the flat body 20 substantially corresponds to the distance between said substantially parallel first 25 and fourth 28 segments as measured along their perpendicular line.

[0029] Preferably, the corners between said second 26 and third 27 segments and between said third 27 and fourth 28 segments are rounded. In such a case, the length l of the third segment 27 is considered as the distance between the points 81 and 82, i.e. the distance between the interception point 81 of the prolongation of the fourth 28 and third 27 segments and the interception point 82 of the prolongation of the second 26 and third 27 segments. Figure 4 shows how length l is measured in a particular embodiment of the invention.

[0030] According to a preferred embodiment of the Medium Voltage line switch contact arrangement 1 of the invention, the edges of said substantially flat body 20 defined by said first 25, second 26, third 27 and fourth 28 segments are rounded. In other words, said edges are preferably not constituted by flat surfaces perpendicularly connected to the contact surfaces 21 and 22, but they have at least a partially curved profile.

[0031] In a particularly preferred embodiment of the invention, the length l of said third segment 27 is between $0.77L$ and $0.83L$, the distance d between said third segment 27 and the connection point 29 between the first 25 and the second 26 segments is between $0.33D$ and $0.38D$, the first 25 and fourth 28 segments are substantially parallel to each other and substantially perpendicular to said third segment 27, the corners between said second 26 and third 27 segments and between said third 27 and fourth 28 segments are rounded, the edges of said substantially flat body 20 defined by said first 25, second 26, and third 27 segments are also rounded.

[0032] The Medium Voltage line switch contact arrangement 1 of the invention usually also comprises an

arc chamber 5. The arc chamber 5 comprises a supporting element 51 which is fixed to said fixed contact 2 and extends in the direction of the movable contact assembly 3. To this purpose a hole can be provided in the flat body 20 of the fixed contact 2, the supporting element being fixed by fixing means (not shown in the figures), e.g. by screw means, to said hole. Other fixing arrangement are also possible.

[0033] The arc chamber 5 further comprising a plurality of plates 52 having a first end 53 operatively connected to said supporting element 51 and a second end 54 which is substantially U shaped and defines a passage for said first 31 and second 32 flat blades of said movable contact assembly 3. As shown in figure 2, the U shaped end can be obtained by using two substantially parallel arms 541 and 542 protruding from the body of the plates 52. Other set-up of the arc chamber 5, which in itself is well known in the art, are also possible.

[0034] According to a particular embodiment, shown in figure 6, the Medium Voltage line switch contact arrangement 1 of the invention comprises an arcing electrode 55 which is positioned on the supporting element 51 of the arc chamber 5. The arcing electrode 55 is preferably positioned in correspondence of the connection point 29 between said first 25 and second 26 segments and protrudes in the direction of said movable contact assembly 3, so as to be closely above the first 31 and second 32 flat blades of the movable contact assembly 3, when said blades 31 and 32 are in the proximity of the substantially flat body 20 of the fixed contact 2.

[0035] It has been seen that the use of the arcing electrode 55 helps improving the performances of the Medium Voltage line switch contact arrangement 1 of the invention. In particular, due to the presence of said arcing electrode 55, inception of the arc does not occur on the fixed contact 2 but on the arcing electrode 55. Consequently the arc bums far away from the fixed contact, thereby avoiding or at least minimizing the problems of contact erosion due to the arc.

[0036] As it can be seen from the above description, the Medium Voltage line switch contact arrangement of the present invention has a number of advantages with respect to the Medium Voltage line switches equipped with conventional contact arrangements. For instance, thanks to the particular shape and positioning of the fixed contact, prearcing time is considerably reduced, thereby reducing also the erosion phenomena on the fixed contact.

[0037] It is also possible to have inception of the arc not located on the main fixed contact, but on an additional arcing electrode properly positioned, thereby further reducing the problems of contact erosion of the fixed main contact.

[0038] The Medium Voltage line switch contact arrangement thus conceived may undergo numerous modifications and come in several variants, all coming within the scope of the inventive concept. Moreover, all the component parts described herein may be substituted by oth-

er, technically equivalent elements. In practice, the component materials and dimensions of the device may be of any nature, according to need and the state of the art.

Claims

1. A Medium Voltage line switch contact arrangement (1) **characterized in that** it comprises a fixed contact (2) and a movable contact assembly (3) operatively connectable to said fixed contact (2), the movable contact assembly (3) comprising a first (31) and a second (32) substantially flat blades parallel to each other, said flat blades (31, 32) being pivotally mounted on a support and rotationally connectable to said fixed contact (2); the fixed contact (2) comprising a contact element having a substantially flat body (20) having a first (21) and a second (22) contact surfaces delimited by a base (23) connected to a contact holder (24) and by a first (25), a second (26), a third (27) and a fourth (28) segments, the first segment (25) being substantially perpendicular to said third segment (27), the first (25) and second (26) segments facing said movable contact assembly (3), the second segment (26) connecting said first segment (25) to said third segment (26) and being inclined toward said fourth segment (28) so that the length l of the third segment (27) is shorter than the width L of said substantially flat body (20) as measured in correspondence of the connection point between said first (25) and second (26) segment.
2. The Medium Voltage line switch contact arrangement (1) according to claim 1, **characterized in that** the length l of said third segment (27) is between $0.75L$ and $0.85L$, where L is the width of said substantially flat body (20).
3. The Medium Voltage line switch contact arrangement (1) according to claim 2, **characterized in that** the length l of said third segment (27) is between $0.77L$ and $0.83L$.
4. The Medium Voltage line switch contact arrangement (1) according to one or more of the preceding claims, **characterized in that** the distance d between the third segment (27) and the connection point between the first (25) and the second (26) segments is between $0.30D$ and $0.40D$, where D is the length of the substantially flat body (20) as measured from the base (23) to the third segment (27).
5. The Medium Voltage line switch contact arrangement (1) according to claim 4, **characterized in that** the distance d between said third segment (27) and the connection point between the first (25) and the second (26) segments is between $0.33D$ and $0.38D$.

6. The Medium Voltage line switch contact arrangement (1) according to one or more of the preceding claims, **characterized in that** said first (25) and fourth (28) segments are substantially parallel to each other and substantially perpendicular to said third segment (27). 5

7. The Medium Voltage line switch contact arrangement (1) according to one or more of the preceding claims, **characterized in that** the corners between said second (26) and third (27) segments and between said third (27) and fourth (28) segments are rounded. 10

8. The Medium Voltage line switch contact arrangement (1) according to one or more of the preceding claims, **characterized in that** the edges of said substantially flat body (20) defined by said first (25), second (26), third (27) and fourth (28) segments are rounded. 15
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9. The Medium Voltage line switch contact arrangement (1) according to one or more of the preceding claims, **characterized in that** it comprises an arc chamber (5) comprising a supporting element (51) fixed to said fixed contact (2) and extending in the direction of said movable contact assembly (3), said arc chamber (5) further comprising a plurality of plates (52) having a first end (53) operatively connected to said supporting element (51) and a second end (54) which is substantially U shaped and defines a passage for said first (31) and second (32) flat blades of said movable contact assembly(3). 25
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10. The Medium Voltage line switch contact arrangement (1) according to claim 9, **characterized in that** it comprises an arching electrode (55) positioned on said supporting element (51) in correspondence of the connection point between said first (25) and second (26) segments and protruding in the direction of said movable contact assembly (3). 35
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11. A Medium voltage line switch comprising a contact arrangement (1) according to one or more of the preceding claims. 45

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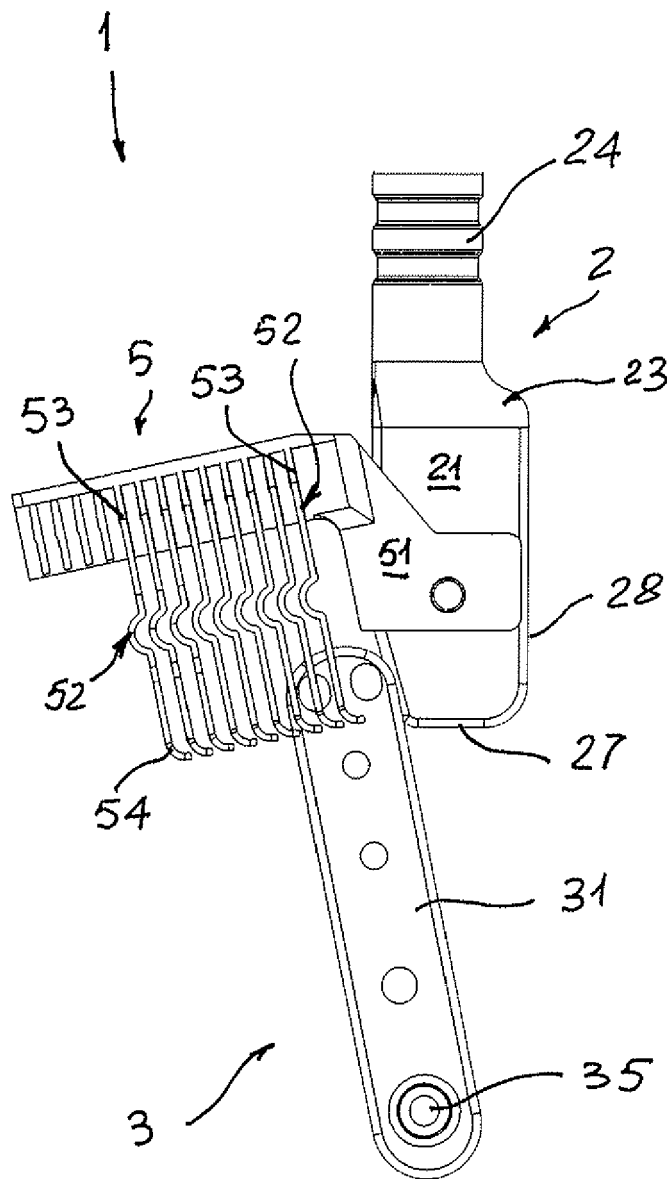


Fig. 1

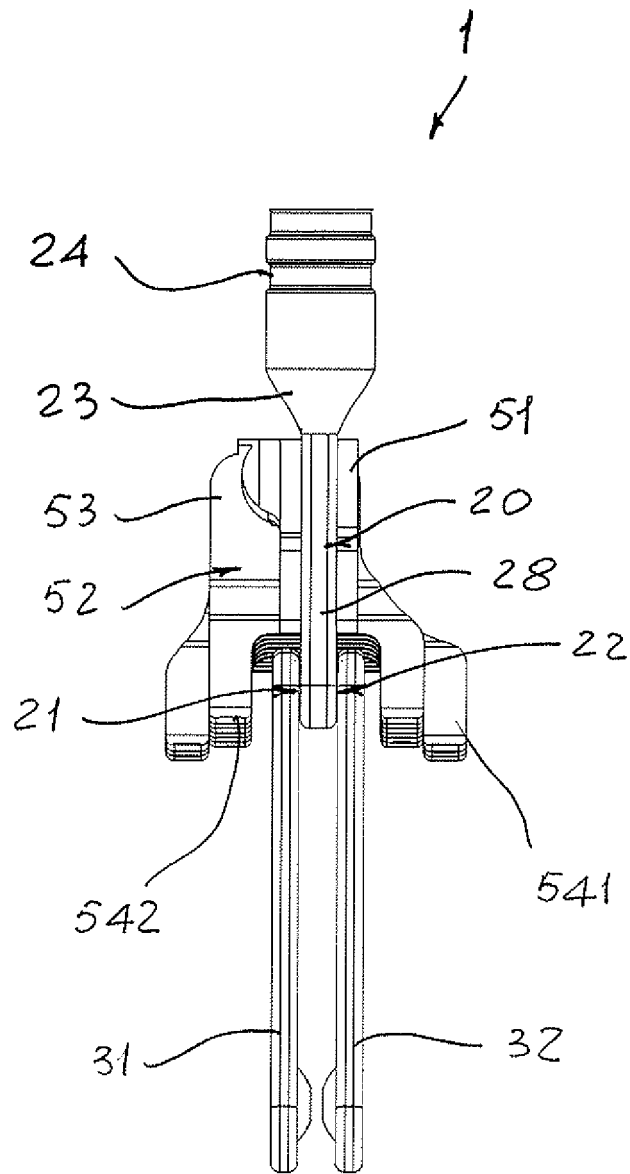


Fig. 2

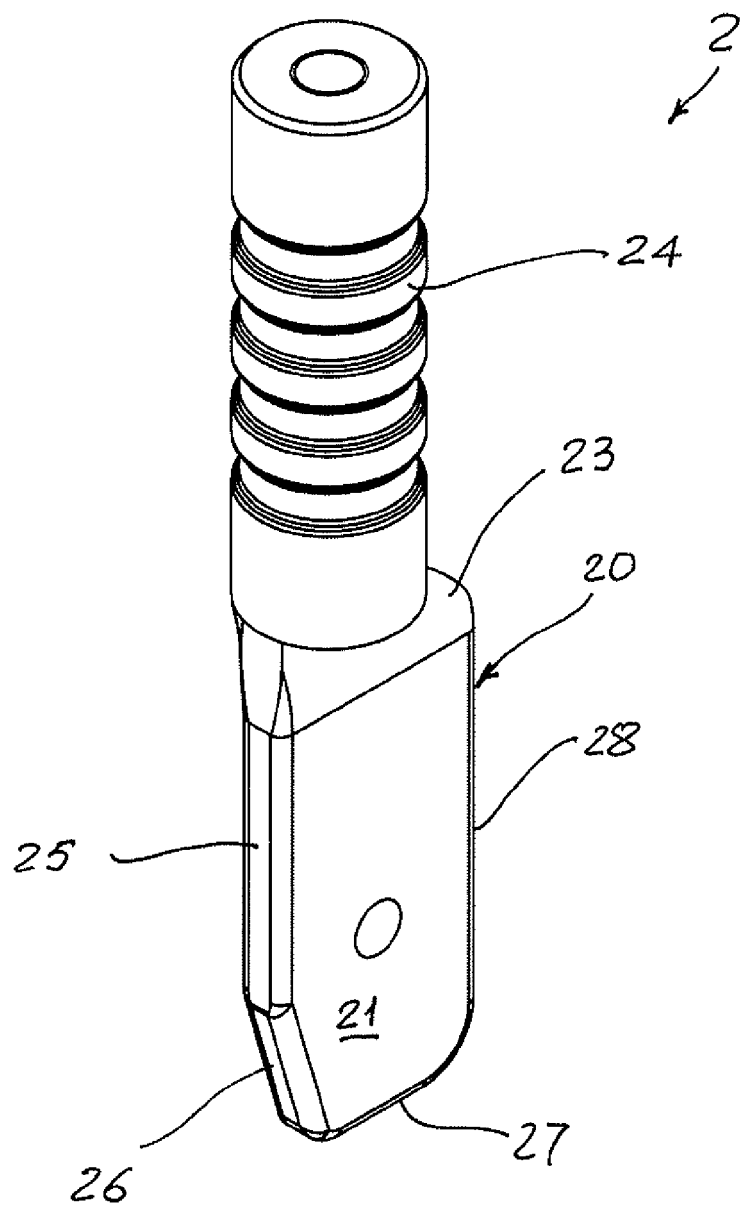
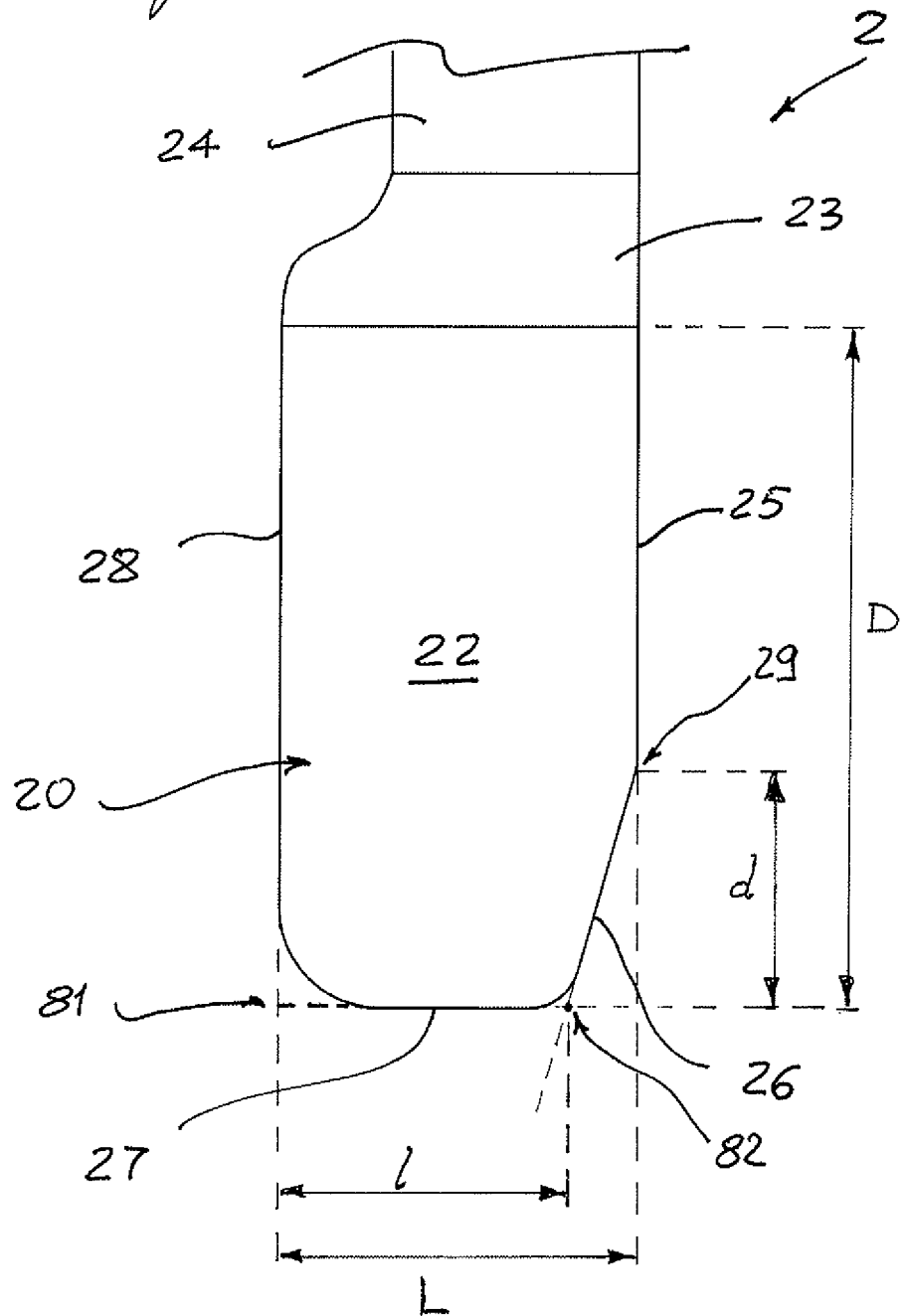


Fig. 3

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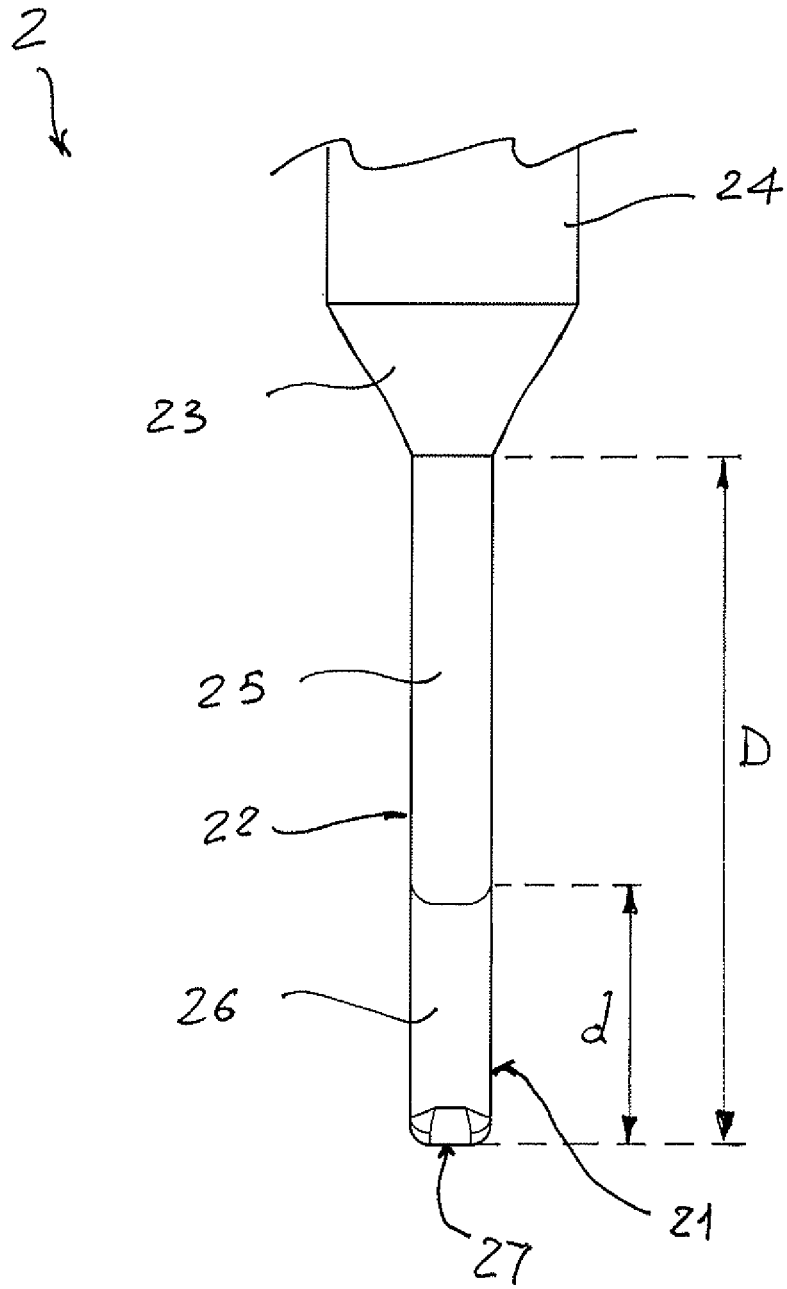


Fig. 5

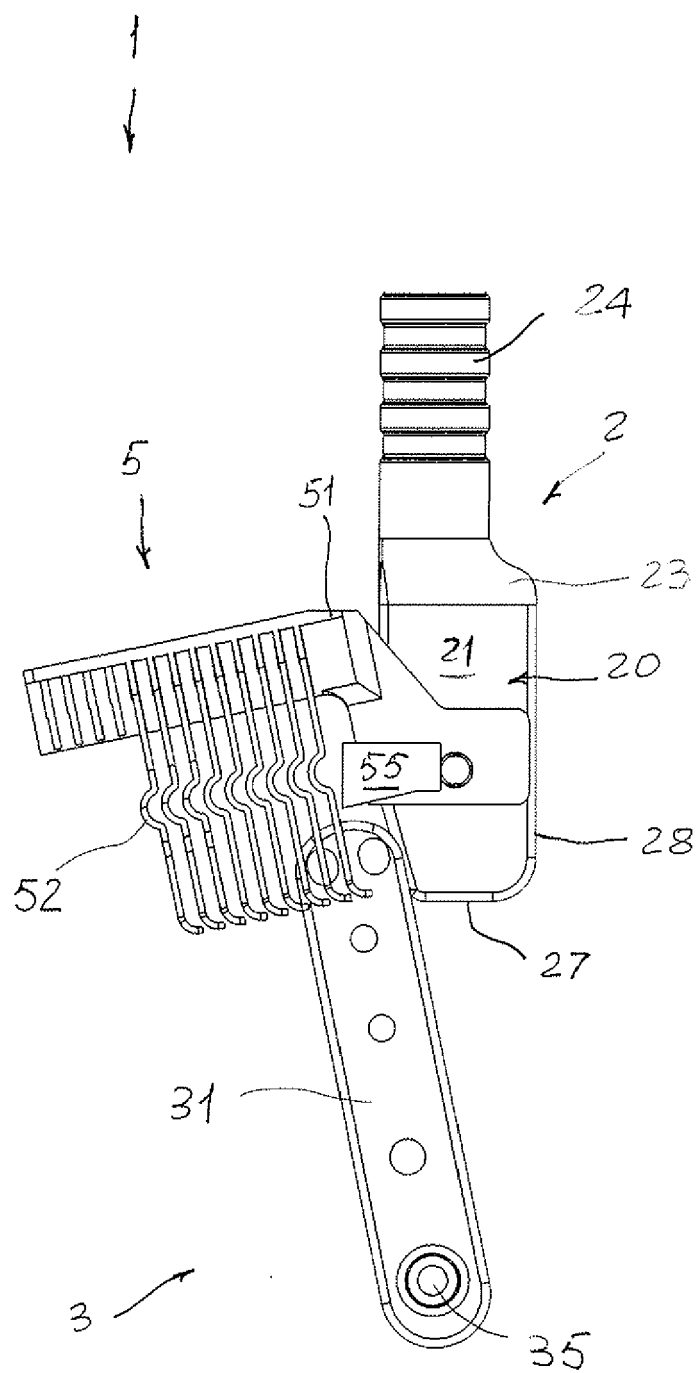


Fig. 6



EUROPEAN SEARCH REPORT

Application Number
EP 09 15 9292

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 38 20 489 A1 (FELTEN & GUILLEAUME ENERGIE [DE]) 21 December 1989 (1989-12-21) * abstract; figures 1-3 *	1-11	INV. H01H1/42
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			TECHNICAL FIELDS SEARCHED (IPC)
			H01H
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		11 September 2009	Starck, Thierry
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
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 15 9292

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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