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(72) Inventor: **Dal Lago, Silvio**
36100 Vicenza (IT)

(74) Representative: **Modiano, Guido, Dr.-Ing. et al**
Modiano & Associati,
Via Meravigli, 16
20123 Milano (IT)

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(71) Applicant: **COMEM S.p.A.**
36054 Montebello Vicentino (Vicenza) (IT)

(54) **Surge voltage arrester**

(57) A surge voltage arrester, comprising a stack (11) of resistive elements (12) arranged between end electrodes (13) that are mutually coupled by locking means (14), the end electrodes being provided with means (17) for keeping the stack (11) compressed. The stack (11) with the end electrodes (13) and with the locking means (14) is surrounded by an insulating outer sheath (35). The locking means (14) comprise a tubular cage (20) for containing the stack (11) substantially without interference. Interlocking means (21) for the end electrodes (13) are provided at the ends of the tubular cage (20).

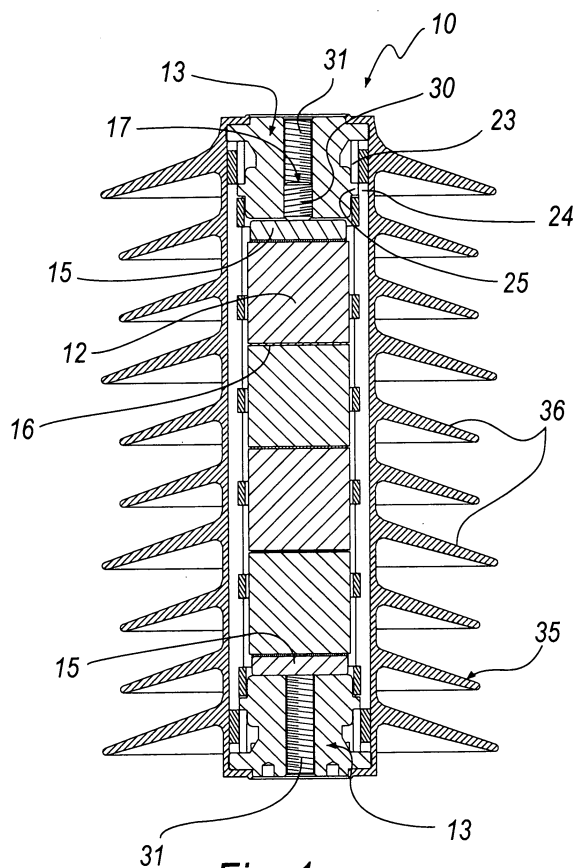


Fig. 1

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Description

[0001] The present invention relates to a surge voltage arrester.

[0002] As it is known, a surge voltage arrester is a device that is capable of protecting electrical lines and systems by constituting a barrier against surge voltages.

[0003] The market of surge voltage arresters, particularly in medium-voltage systems, is constituted by two main segments: power distribution companies (the predominant part) and manufacturers of electrical devices such as distribution transformers, switches and shunting systems.

[0004] There are various kinds of surge voltage arrester, all of which can anyway be traced back to a common structure, which is constituted by a coaxial stack of cylindrical resistive elements, such as zinc-oxide varistors, optionally spaced by metallic disks, locked between a pair of end electrodes.

[0005] Such end electrodes are mutually coupled in various manners, such as for example elastic cables that connect them (thus also keeping the stack compressed) or wrappings formed by fabric tapes impregnated with unpolymerized epoxy resin or fiberglass-reinforced plastics, which wrap around the stack and the end electrodes.

[0006] In order to ensure good pressure between the various resistive elements, a respective threaded through pin is provided coaxially to one end electrode, or optionally to both electrodes, and pushes against one end of the stack.

[0007] Such stack of varistors is wrapped externally by an insulating protective sheath, which is provided laterally, toward the outside, with a coaxial series of inclined surfaces; the sheath is typically made of a polymeric material, such as for example silicone rubber.

[0008] The manufacturing method that is currently used entails assembling the stack of varistors with the end electrodes, precompressing the stack by screwing the threaded pin on the end electrode, and inserting the assembly in a mold for injection molding.

[0009] At this point, the protective sheath is overmolded directly inside the mold onto the stack and covers it; the arrester thus formed is then extracted from the mold.

[0010] These arresters thus structured and manufactured in this manner have drawbacks.

[0011] A first drawback is linked to the fact that the precompression of the stack by screwing the threaded pin tends to displace the mutually contiguous varistors both with respect to the respective axes and with respect to the axis of the stack, thus reducing the area of contact between said varistors.

[0012] Another drawback is that the arresters, due to the "wrapping" (or other equivalent means for connection between the end electrodes) that cover the stack of varistors completely, in case of short circuits within the blocks that produce electric arcs and generate gas, can

explode due to the increase of the pressure inside said wrapping, with the consequent risk of expulsion of fragments at high speed.

[0013] Further, another drawback is that the arresters must often withstand important axial loads, which the structure of the stack of varistors with wrappings, elastic cables or other means is not always able to withstand.

[0014] The aim of the present invention is to provide a surge voltage arrester that solves the drawbacks noted in known types of arrester.

[0015] Within this aim, an object of the present invention is to provide a surge voltage arrester that allows to have a substantially uniform surface for contact among the components of the stack of resistive elements.

[0016] Another object of the present invention is to provide a surge voltage arrester that cannot explode due to the increase in pressure generated by electric arcs caused by internal short-circuits.

[0017] Another object of the present invention is to provide a surge voltage arrester that can withstand important axial loads.

[0018] Another object of the present invention is to provide a method for assembling parts of surge voltage arresters that allows to avoid the relative displacement of the resistive elements during assembly.

[0019] Another object of the present invention is to provide a surge voltage arrester that can be manufactured with known systems and technologies.

[0020] This aim and these and other objects that will become better apparent hereinafter are achieved by a surge voltage arrester, comprising a stack of resistive elements arranged between end electrodes that are mutually coupled by locking means, said end electrodes being provided with means for keeping said stack compressed, said stack with at least part of said end electrodes and with said locking means being surrounded by an insulating outer sheath, said surge voltage arrester being characterized in that said locking means comprise a tubular cage for containing said stack substantially without interference, interlocking means for said end electrodes being provided at the ends of said tubular cage.

[0021] Further characteristics and advantages of the present invention will become better apparent from the following detailed description of a preferred but not exclusive embodiment thereof, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a partially sectional front view of a surge voltage arrester according to the invention;

Figure 2 is an exploded view of the surge voltage arrester according to the invention, in which the outer insulating sheath is not shown;

Figure 3 is a perspective view of a component of said surge voltage arrester according to the invention;

Figure 4 is a sectional view of the component of Fig-

ure 3;

Figure 5 is a longitudinal sectional view of a centering and locking fixture to be used in the assembly of a surge voltage arrester according to the invention.

[0022] With reference to the figures, a surge voltage arrester according to the invention is generally designated by the reference numeral 10.

[0023] The surge voltage arrester 10 comprises a stack 11 of resistive elements 12, which are arranged between end electrodes 13, which are mutually coupled by locking means 14, described hereinafter.

[0024] The stack 11 of resistive elements 12 comprises, at its ends, circular metallic plates 15 for contact with the end electrodes 13.

[0025] In particular, the resistive elements 12 are constituted by cylindrical zinc oxide varistors, which in this embodiment are spaced by metallic contact disks 16.

[0026] The circular metallic plates 15 and the metallic contact disks 16 are both preferably made of aluminum.

[0027] The end electrodes 13 are provided with means 17, also described hereinafter, for keeping the stack 11 compressed.

[0028] The locking means 14 comprise a tubular cage 20 for containing the stack 11 substantially without interference.

[0029] Interlocking means 21 for the end electrodes 13 are provided at the ends of the tubular cage 20 and are constituted by a bayonet-type interlocking guide, which in this embodiment is composed of four longitudinal tracks 23 for accessing an annular undercut locking receptacle 24 for four corresponding tabs 25 provided symmetrically on the lateral surface of each one of the end electrodes 13.

[0030] In particular, the end electrodes 13 are composed of a first part 13a, to be inserted in the cage 20, and a second part 13b, which is external to said cage.

[0031] The tubular cage 20 forms openings 26, which are arranged in pairs so that they are mutually opposite with respect to the longitudinal axis of said cage.

[0032] The openings 26 are provided in four longitudinal series, which are arranged symmetrically to each other with respect to the axis of the cage 20.

[0033] In particular, the openings 26 proximate to the ends of the cage are open onto a corresponding one of the circular metallic plate 15 and onto the surface of the resistive element 12 that is adjacent thereto, while the other openings 26 are open onto portions of the surface of contiguous resistive elements 12 and accordingly onto the lateral surface of the disks 16.

[0034] The means 17 for keeping the stack 11 compressed comprise a threaded pin 30, which is arranged in one of the complementarily threaded through holes 31 provided coaxially in the end electrodes 13.

[0035] The end electrode 13 on which the threaded pin 30 is not screwed has, on its second outer part 13b, two mutually opposite locators 32, which are formed by

two parallel locator holes 33 for locking the electrode during the assembly of the arrester, as will become better apparent hereinafter.

[0036] The stack 11, with the tubular cage 20 and the end electrodes 13, is surrounded by an insulating outer sheath 35, of a per se known type, which is made of polymeric material, such as for example silicone rubber, and is provided laterally, toward the outside, with a coaxial series of inclined circular surfaces 36.

[0037] To provide the surge voltage arrester, it is first of all necessary to couple one of the end electrodes 13 to the tubular cage 20 and arrange inside said cage, according to a preset sequence, the components of the stack 11: therefore, in this embodiment, the plates 15, the resistive elements 12, and the disks 16.

[0038] The remaining end electrode is then coupled to the cage and the resulting assembly is arranged on a centering and locking fixture, shown schematically and designated by the reference numeral 37 in Figure 5.

[0039] The centering and locking fixture 37 comprises two lateral cylindrical half-shells 38, which when closed together enclose the arrester 10, and two end caps 39, one of which has two centering references 40, such as for example centering pins 40a to be coupled to the parallel locator holes 33.

[0040] At right angles, the lateral cylindrical half-shells 38 have complementary jaws 29, which engage opposite to each other inside respective mutually opposite openings 26.

[0041] In particular, the jaws 29 are constituted by pads 41, which press corresponding and mutually opposite contiguous portions of the elements of the stack 11.

[0042] The pads 41 can slide at right angles inside corresponding cavities 42, and have elements 43 for contrasting their retraction into the cavities 42.

[0043] Having thus blocked any possibility of movement of the components of the stack 11, the means 17 for keeping the stack 11 compressed are operated, substantially by screwing the threaded pin that pushes against the corresponding plate 15, compressing the other components of the stack.

[0044] The assembly thus locked in then inserted in a mold for injection-molding and is overmolded with silicone rubber to form the insulating outer sheath 35.

[0045] In practice, it has been found that the invention thus described solves the problems noted in known types of surge voltage arrester; in particular, the present invention provides a surge voltage arrester that has a substantially uniform surface for contact among the components of the stack.

[0046] Moreover, the present invention provides a surge voltage arrester which, by way of the tubular cage that ensures the venting of the gases formed with the electric arcs caused by short-circuits, does not allow explosions to occur.

[0047] Further, the present invention provides a surge voltage arrester that can withstand important axial loads

by way of the outer rigid tubular cage.

[0048] Moreover, the present invention provides a method for assembling parts of a surge voltage arrester that allows to avoid the relative displacement of the resistive elements during assembly.

[0049] This occurs by virtue of the tubular cage, which allows to block the components of the stack during the screwing of the threaded pin that compresses said stack.

[0050] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

[0051] In practice, the materials employed, so long as they are compatible with the specific use, as well as the dimensions, may be any according to requirements and to the state of the art.

[0052] The disclosures in Italian Patent Application No. PD2003A000228, from which this application claims priority, are incorporated herein by reference.

[0053] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A surge voltage arrester, comprising a stack (11) of resistive elements (12) arranged between end electrodes (13) that are mutually coupled by locking means (14), said end electrodes (13) being provided with means (17) for keeping said stack (11) compressed, said stack (11) with at least part of said end electrodes (13) and with said locking means (14) being surrounded by an insulating outer sheath (35), said surge voltage arrester being **characterized in that** said locking means (14) comprise a tubular cage (20) for containing said stack (11) substantially without interference, interlocking means (21) for said end electrodes (13) being provided at the ends of said tubular cage (20).
2. The surge voltage arrester according to claim 1, **characterized in that** said stack (11) comprises, at its ends, circular metallic plates (15) for contact with said end electrodes (13), said tubular cage (20) forming openings (26), which are arranged in mutually opposite pairs with respect to the longitudinal axis of said cage (20).
3. The surge voltage arrester according to claim 2, **characterized in that** each one of said openings (26) is open onto at least one portion of the surface

of at least one resistive element (12).

4. The surge voltage arrester according to claim 3, **characterized in that** it comprises at least two of said openings (26), which are open onto a corresponding one of said circular metallic plates (15) and on the surface of the resistive element (12) that is contiguous to it.
5. The surge voltage arrester according to one or more of the preceding claims, **characterized in that** said tubular cage (20) comprises four longitudinal series of said openings (26), which are arranged symmetrically to each other relative to the axis of said cage (20).
6. The surge voltage arrester according to one or more of the preceding claims, **characterized in that** said interlocking means (21) for said end electrodes (13) comprise at least one bayonet-type interlocking guide for at least one tab (25), which is provided on the lateral surface of said end electrodes (13).
7. The surge voltage arrester according to claim 6, **characterized in that** said end electrodes (13) comprise four of said one or more tabs (25), arranged symmetrically to each other relative to the axis of said cage (20), said at least one bayonet-type interlocking guide being composed of four corresponding longitudinal tracks (23) for accessing an annular receptacle (24) for the undercut locking of said four tabs (25).
8. The surge voltage arrester according to one or more of the preceding claims, **characterized in that** at least one of said end electrodes (13) is composed of a first part (13a), which can be inserted in said cage (20), and of a second part (13b), which is external to said cage (20), mutually opposite reference locators (32) being provided on said second part (13b) in order to lock said end electrode (13) during the assembly of the arrester (10).
9. The surge voltage arrester according to claim 8, **characterized in that** said mutually opposite locators (32) are constituted by parallel holes (33).
10. The surge voltage arrester according to one or more of the preceding claims, **characterized in that** said stack (11) is composed of cylindrical varistors spaced by metallic contact disks (16), said disks being also interposed between said metallic circular contact plates (15) and the respective said end electrodes (13), said means (30) for keeping said stack (11) compressed comprising a threaded pin (30), which is arranged in a complementarily threaded through hole (31), which is provided coaxially in at least one of said end electrodes (13).

11. A method for assembling parts of a surge voltage arrester according to one or more of the preceding claims, consisting in:

- coupling end electrodes (13) to a tubular cage (20) and arranging inside said cage, according to a preset sequence, components of a stack (11) of resistive elements (12), 5
- coupling a remaining end electrode (13) to said tubular cage (20) and arranging the resulting assembly on a centering and locking fixture (37), arranged mutually opposite locators (32) on references (40) formed in said centering and locking fixture (37) and actuating complementary jaws (29), which act mutually opposite inside mutually opposite openings (26), 10 15
- actuating means (17) for keeping said stack (11) compressed.

12. The method according to claim 11, **characterized in that** said centering and locking fixture (37) comprises two lateral cylindrical half-shells (38) and two end caps (39), said lateral cylindrical half-shells (38) enclosing said arrester (10), one of said two end caps (39) being provided with centering references (40) to be coupled to said mutually opposite locators (32), said lateral cylindrical half-shells (38) having said complementary jaws (29) that engage in a mutually opposite manner inside respective said mutually opposite openings (26). 20 25 30

13. The method according to claim 12, **characterized in that** said jaws (29) comprise pads (41), which can slide within corresponding cavities (42), which are formed in said half-shells (38) and have elements (43) for contrasting their retraction into said cavities (42), said pads (41), during centering and locking, pressing corresponding and mutually opposite contiguous portions of the elements of said stack (11). 35 40

14. The method according to one or more of the preceding claims, **characterized in that** said centering references (40) comprise centering pins (40a) to be coupled to said parallel locator holes (33). 45

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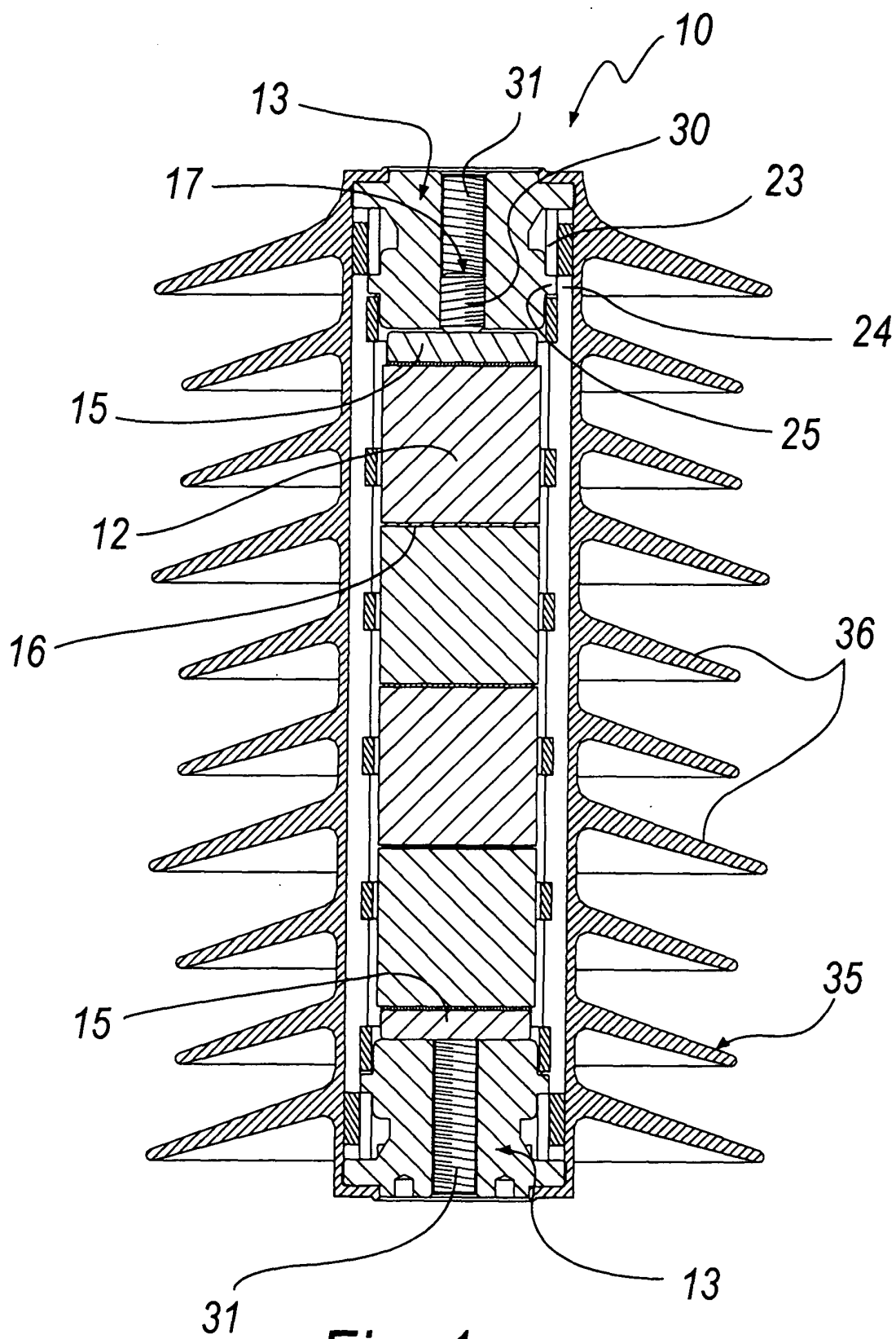


Fig. 1

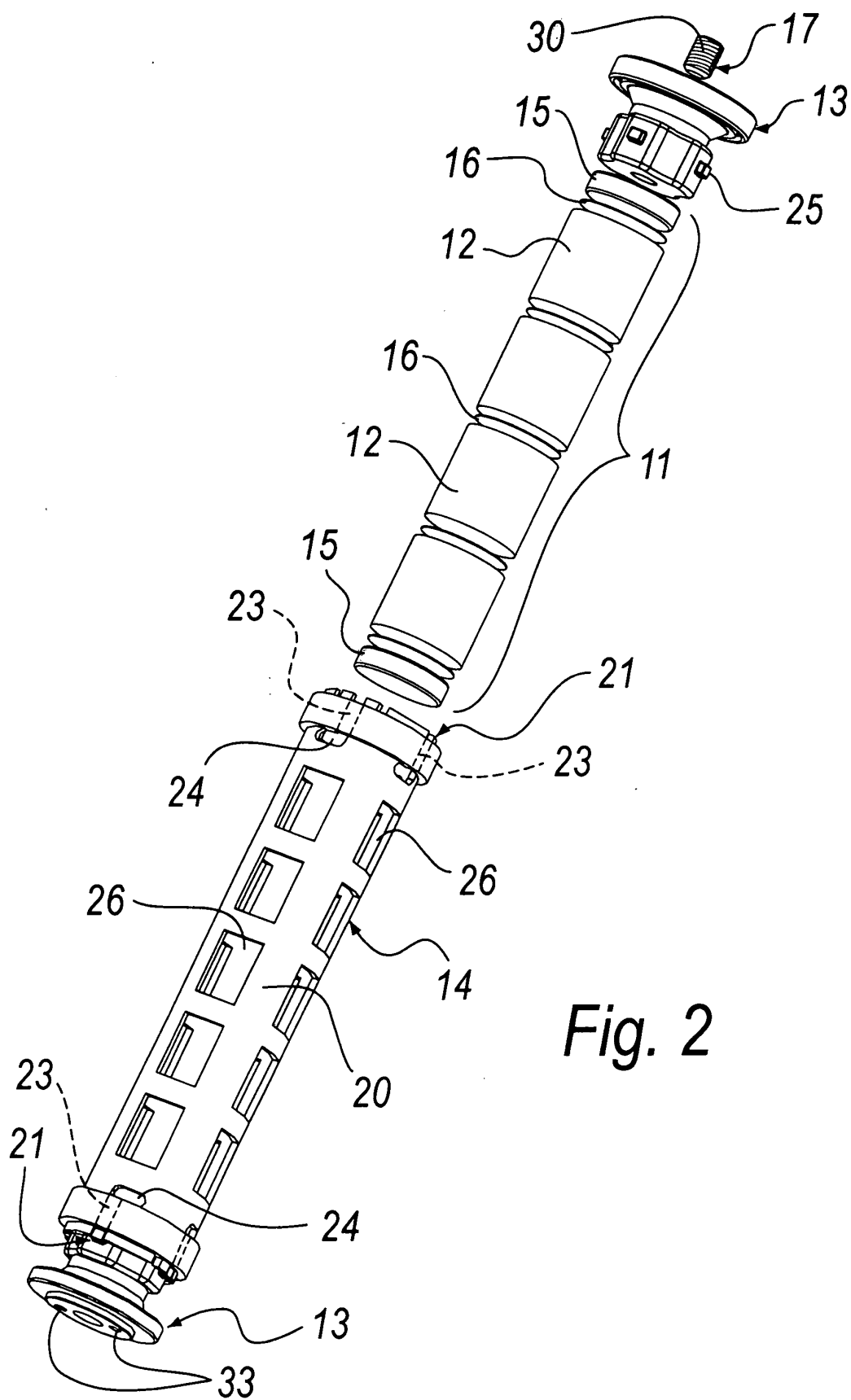


Fig. 2

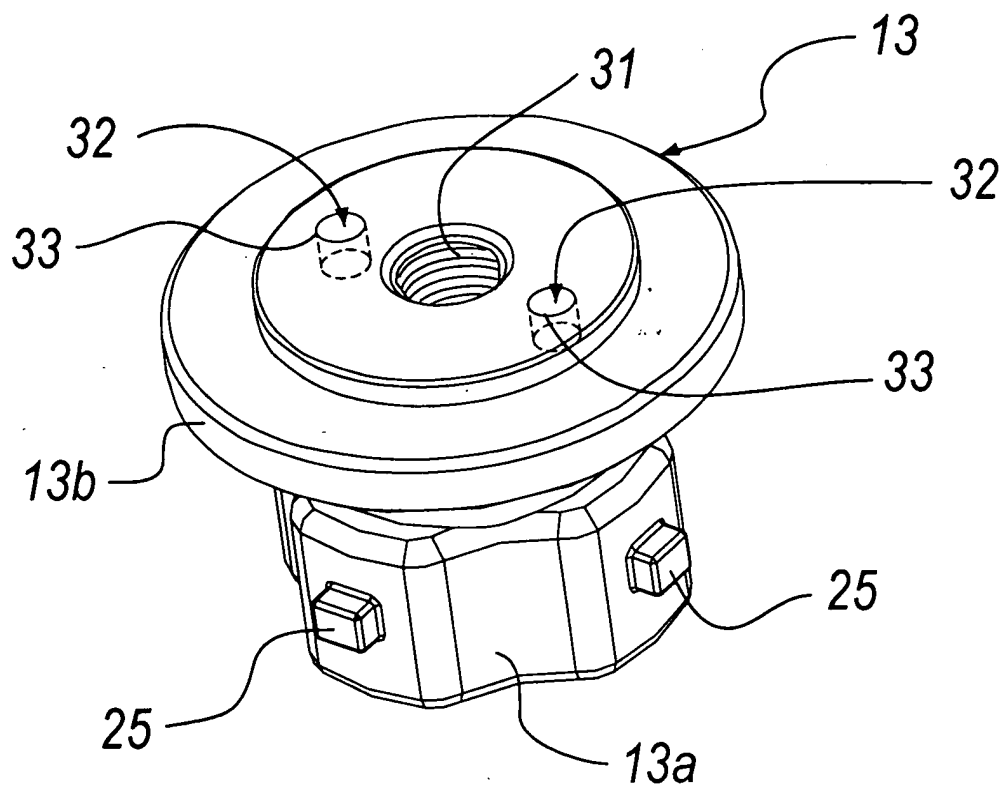


Fig. 3

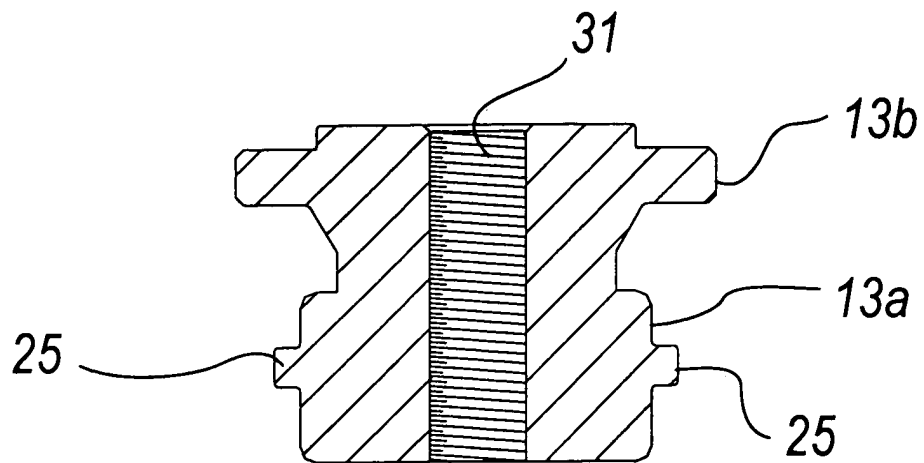


Fig. 4

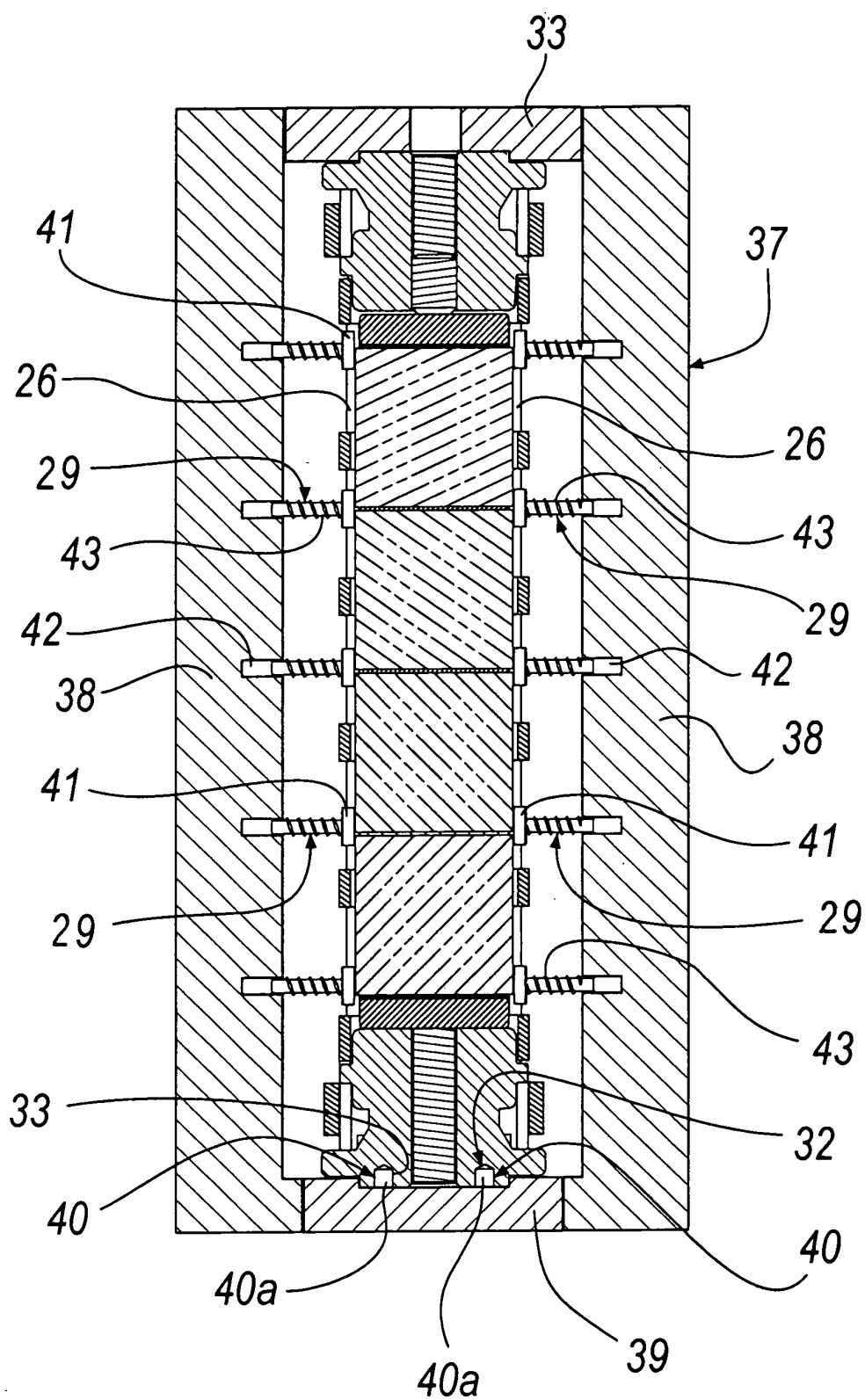


Fig. 5



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Application Number
EP 04 02 2945

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Y	* column 5, line 4 - column 8, line 25; figures 1.1A-1C,2,3,2A-2C *	2-4	
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A	* column 3, line 23 - line 41; figures 1,2 *	1,5-14	
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			H01C
Place of search		Date of completion of the search	Examiner
Munich		10 December 2004	Frias Rebelo, A
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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