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(54) High voltage current coil

(57) The invention deals with a high voltage current coil which is an element of a current transformer used in a combined instrument transformer which comprises of a current transformer and a voltage transformer located in a common enclosure. A combined instrument transformer is applicable in high-voltage electric power measuring systems. The current coil according to the invention is distinguished by the fact that it comprises a metal tube (10) which is an element of the current bushing of the current transformer (1), which tube is furnished with a metal protective guard (14) in the shape of a truncated cone whose base with the larger diameter faces a joining sleeve (12), and the edge of the cone base with the smaller diameter is permanently joined with the external surface of the metal tube (10), while the edge of the cone base with the larger diameter is folded inside the cone.

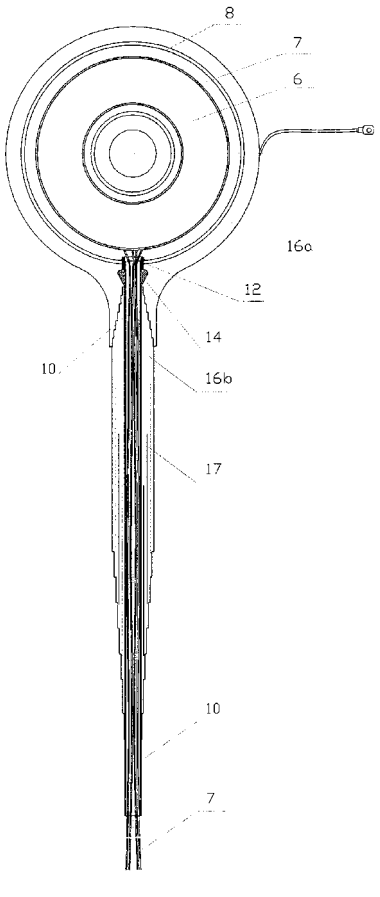

Fig. 2

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Description

[0001] The invention deals with a high voltage current coil which is an element of a current transformer used in a combined instrument transformer which is comprised of a current transformer and a voltage transformer located in a common enclosure. A combined instrument transformer is applicable in high voltage electric power measuring systems.

[0002] A combined instrument transformer known from patent description PL193711 comprises an inductive toroidal core-type current transformer and an inductive three-leg core-type potential transformer, located in the upper and lower parts of the combined instrument transformer, respectively, in metal enclosures and it has an insulator filled with insulating medium in which equipotential screens of an electrically conductive material are located. The primary winding of the voltage transformer and the secondary winding of the voltage transformer are wound on a cylindrical tube of an insulating material, located on the central column of the core which is a composition of two rectangular cores. The equipotential screens are built into an insulating material spread over the high-voltage output lead of the voltage transformer and they are connected with the equipotential screens built into the insulating material spread over the tube with the output leads of the secondary windings of the current transformer. Then, a galvanic connection is formed between screens of the same induced voltage. The insulating medium is located in the space between the insulated windings of the current and voltage transformers and their metal enclosures as well as in the space between the insulated input leads of the windings of the transformers running along the insulator and the internal surface of the insulator.

[0003] There is known a combined instrument transformer of a similar design, so called JUK123 made by ABB Sp.z o.o., in which the current coil of the current transformer, which surrounds the current lead, is located in a metal enclosure. Output leads of the current coil windings are taken through a current bushing in the form of a metal tube to a terminal box connected to the voltage transformer casing. The current bushing is connected with the metal enclosure through a screw joint in which the male thread is made at the end of the bushing tube, and the female thread is made in the opening of a joining sleeve which is tightly fitted in the opening made in the metal casing of the current coil. The metal enclosure of the current coil together with the current bushing are located in paper-and-oil insulation. The screw joint of the current bushing with the joining sleeve enables the occurrence of blades formed by the protruding thread and by the edges of the sleeve, which may weaken the strength of the paper-and-oil insulation at the place where the bushing joins the current coil enclosure.

[0004] The essence of the high-voltage current coil according to the invention, comprising a cylindrical core located in a metal enclosure of the coil together with secondary windings whose ends are located in a joining sleeve and in a metal tube joined non-permanently with the joining sleeve by a screw joint, the metal tube being an element of the current bushing of the current transformer, which bushing together with the metal enclosure is located in insulating material is that the metal tube constituting an element of the bushing of the current transformer is provided with a metal protective guard in the shape of a truncated cone. The cone base with the larger diameter faces the joining sleeve. The edge of the cone base with the smaller diameter is permanently joined with the external surface of the metal tube of the transformer bushing. The edge of the cone base with the larger diameter is folded inside the cone.

[0005] Preferably, the protective guard is located in insulating material.

[0006] Preferably, the protective guard has a transverse port.

[0007] Preferably, in the protective guard, the edge of the smaller-diameter base of the cone is joined with the external surface of the metal tube of the current bushing in a place situated below the male thread of the metal tube of the bushing.

[0008] Preferably, in the protective guard, the edge of the smaller-diameter base of the cone is joined with the external surface of the metal tube of the bushing by means of a weld.

[0009] Preferably, the high-voltage current coil is an element of a current transformer which together with a voltage transformer and an insulator make a combined instrument transformer.

[0010] The advantage of the solution according to the invention is that the sharp edges of the screw joint which can weaken the paper-and-oil insulation at the place where the bushing and the current coil enclosure are joined are covered.

[0011] The invention is presented as an example of an embodiment in the drawing, where fig. 1 shows the combined instrument transformer in half-view and in broken-out frontal half section showing the insulator in section, fig. 2 - the current coil in frontal section, fig. 3 - the tube of the current bushing with the joining sleeve and the protective guard and with a part of the metal enclosure of the coil, and fig. 4 - the protective guard in perspective view.

[0012] The combined instrument transformer comprises a current transformer 1 and a voltage transformer 2 located in the upper and lower parts of the transformer, respectively, in metal enclosures 1a and 2a and it has an insulator 3 filled with an insulating medium 4. The current transformer 1 is located in a metal head 5 in which there is at least one cylindrical core 6. Secondary windings 7 of the current transformer 1 are wound on the core 6. The windings 7 with the core 6 are located in a metal enclosure 8. A primary winding 9 whose terminal is connected to the metal head 5 of the instrument transformer runs through the center of the cores. The output leads of the secondary windings 7 of the instrument transformer

1 are brought into a metal tube 10 which is an element of a current bushing of the transformer 1, which is located inside the insulator 3. At its one end, the metal tube 10 has a male thread 11, shown in fig. 3, used to join the tube 10 with the metal enclosure 8 through a joining sleeve 12, tightly fitted in an opening in the enclosure 8 through which the output leads of the secondary windings 7 of the current transformer 1 are taken. The sleeve 12 has a female thread 13. The female thread 13 of the sleeve 12 and the male thread 11 of the tube 10 form a screw joint of the current bushing and the enclosure 8. The end of the tube 10 with the male thread 11 is furnished with a metal protective guard 14 which is fixed to the external surface of the tube 10 below the part of the tube with the thread 11. The guard 14 has the shape of a truncated cone whose smaller-diameter base has an opening adjusted to the external diameter of the tube 10 onto which the guard 14 is pulled and permanently fixed to it for example by welding with a weld 15. The cone base with the larger diameter faces the enclosure 8 and it has its edge folded inside the cone, forming its gentle rounding. The folded edge of the cone is situated at the height of the end of the screw joint between the tube 10 and the sleeve 12. The guard 14 has a transverse port 14a which is used to introduce a set screw into it and to allow penetration of the inside of the guard and of the thread covered by it by an insulating medium. The metal enclosure 8, a part of the sleeve 12, the guard 14 and the tube 10 are located in insulating material 16 in the form of paper-and-oil insulation 16a surrounding the enclosure 8, and 16b surrounding the tube 10. Equipotential screens 17 are located in the insulation 16b. The output leads of the secondary windings 7 are taken outside the tube 10 at its other end and they are connected with the external terminals located in the terminal box attached to the lower part of a casing 2b of the voltage transformer 2. In the upper part of the casing 1a of the current transformer there is a compensating bellows 18 whose function is to compensate variations in the volume of the insulating medium 4 which can be insulating oil, sulfur hexafluoride, or nitrogen. The insulating material 16b and the equipotential screens 17 of the output leads of the secondary windings 7 of the current transformer which cover the tube 10 with the output leads of the windings, are gradated. The output of the secondary windings 7, built in this way, runs along the insulator 3 down to its lower part and to the connection with the casing of the voltage transformer 2a located under the insulator 3. A primary winding 19 of the voltage transformer 2 is insulated with insulating material with built-in equipotential screens of electrically conducting material.

[0013] The primary winding 19 is wound onto secondary windings 20 of the voltage transformer 2 which are wound onto a cylindrical tube 21 of insulating material. Inside the tube 21 there are columns of two magnetic cores 22 which form a jacket core system for the windings of the voltage transformer 2. At the bottom, the combined instrument transformer is closed by the bottom part of the casing 2b with four openings used to fasten the transformer to the frame by means of bolts, not shown in the drawing.

[0014] In operating conditions, the metal protective guard 14 permanently joined with the metal tube 10 by means of a weld shields the screw joint of this tube with the metal enclosure of the current coil 8 made of aluminum sheet or as an aluminum casting with the sleeve 12 and thus protects the paper-and-oil insulation against the occurrence of partial discharges originating from the sharp edges of the thread. The screw joint can be a metric thread, a unified screw thread, or any other thread depending on the design needs.

List of markings in the drawing:

[0015]

1. current transformer

    1 a - current transformer casing

2. voltage transformer

    2a - voltage transformer casing
    2b - bottom casing of voltage transformer

3. insulator
4. insulating medium
5. metal head
6. cylindrical core of the current transformer
7. secondary windings of the current transformer
8. metal enclosure of the current coil
9. primary winding of the current transformer
10. metal tube
11. male thread of the tube
12. joining sleeve
13. female thread of the sleeve
14. metal protective guard

    14a - port in the guard

15. weld
16. insulating material

    16a - insulation surrounding the current coil enclosure
    16b - insulation surrounding the metal tube

17. equipotential screens
18. compensatory bellows
19. primary winding of the voltage transformer
20. secondary winding of the voltage transformer
21. cylindrical tube of insulating material
22. magnetic core of the voltage transformer

Claims

1. A high voltage current coil comprising a cylindrical core located in a metal enclosure of the coil together with secondary windings whose ends are located in a joining sleeve and in a metal tube joined non-permanently with the joining sleeve by a screw joint, the metal tube being a current bushing of the current transformer, which bushing together with the metal enclosure is located in insulating material, **characterized in that** the metal tube (10) constituting an element of the bushing of the transformer is provided with a metal protective guard (14) in the shape of a truncated cone whose base with the larger diameter faces the joining sleeve (12), and the edge of the cone base with the smaller diameter is permanently joined with the external surface of the metal tube (10), while the edge of the cone base with the larger diameter is folded inside the cone.

2. A coil according to claim 1, **characterized in that** the protective guard (14) is located in insulating material (16a).

3. A coil according to claim 1, **characterized in that** the protective guard (14) has a transverse port (14a).

4. A coil according to claim 1, **characterized in that** in the protective guard (14), the edge of the cone base with the smaller diameter is joined with the external surface of the metal tube (10) in a place situated below the male thread (11) of the tube (10).

5. A coil according to claim 3 **characterized in that** in the protective guard, (14) the edge of the cone base with the smaller diameter is joined with the external surface of the metal tube (10) by means of a weld (15).

6. A coil according to claims 1 through 4, **characterized in that** it is an element of a current transformer (1) which together with a voltage transformer (2) and an insulator (3) make a combined instrument transformer.

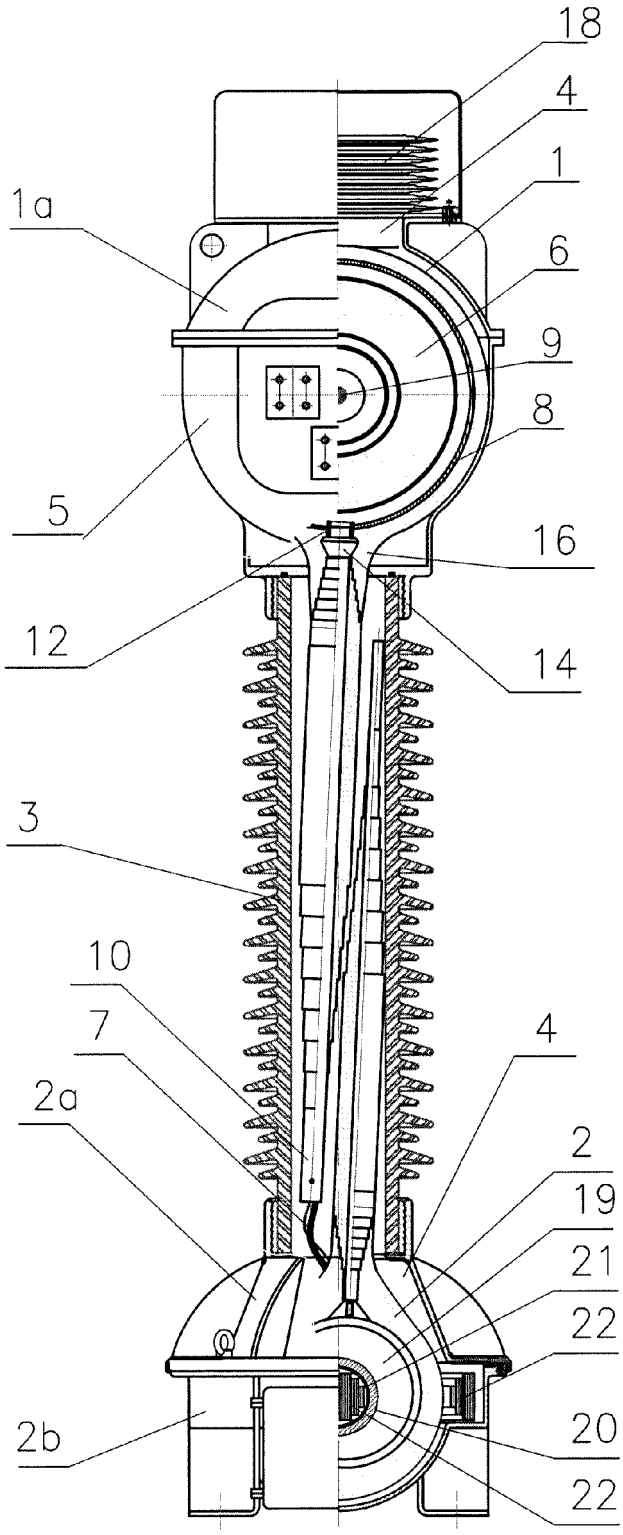

Fig. 1

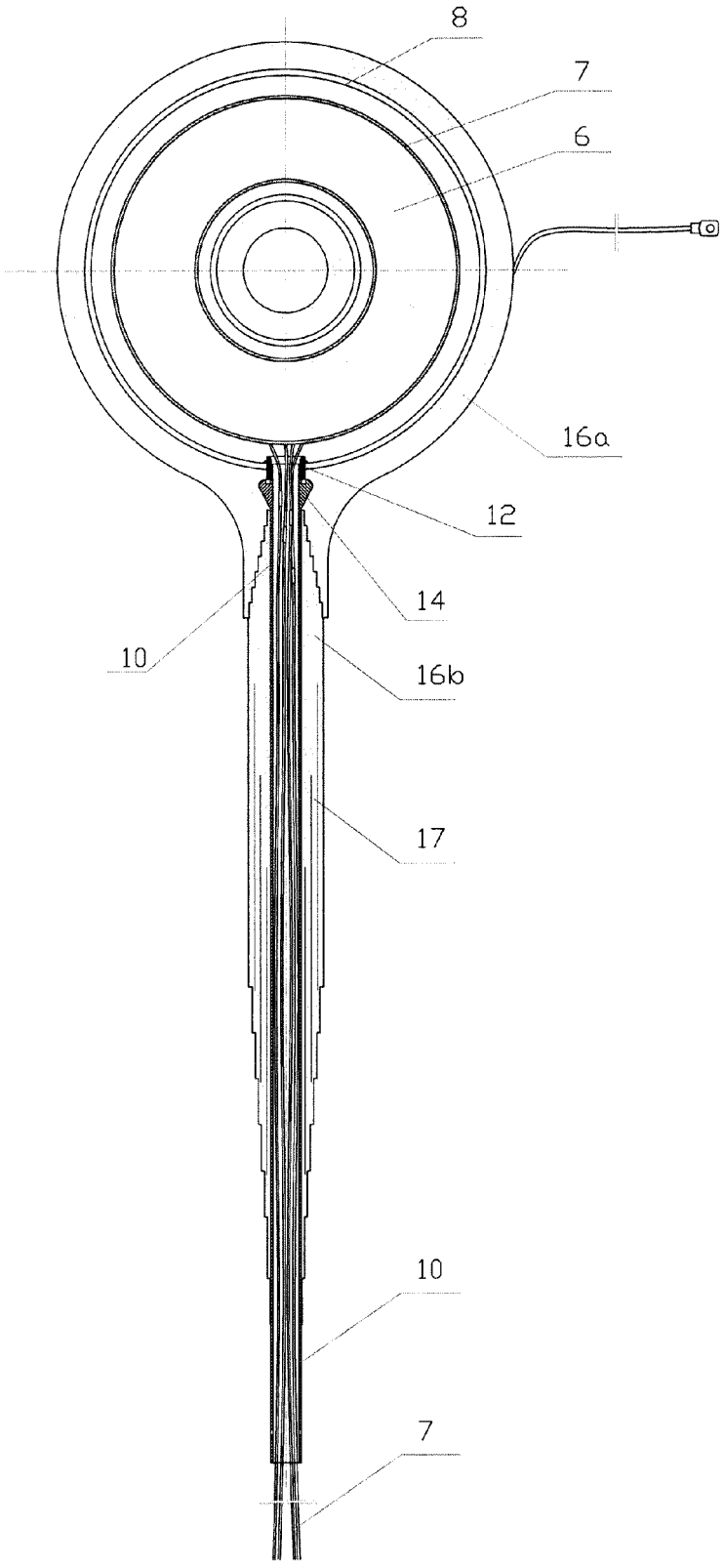

Fig. 2

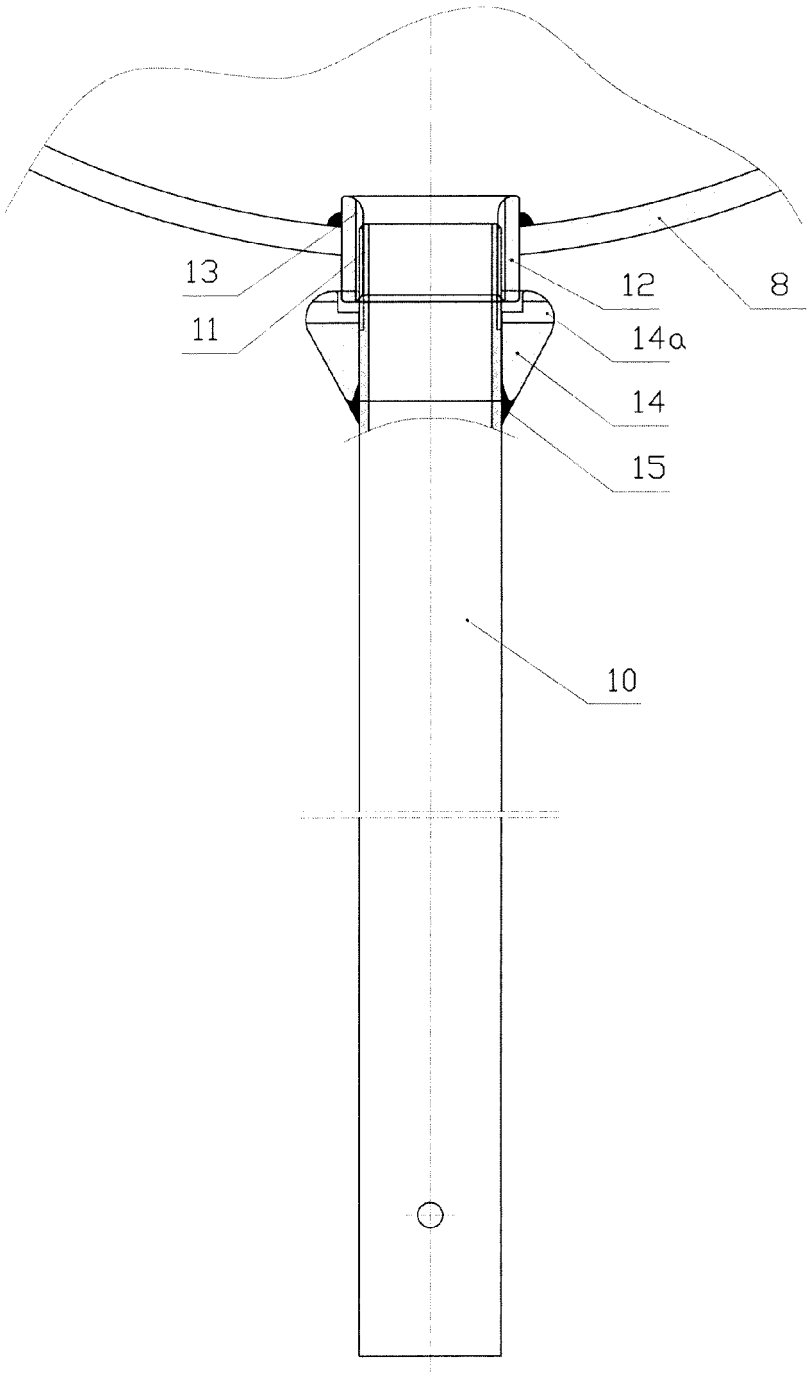

Fig. 3

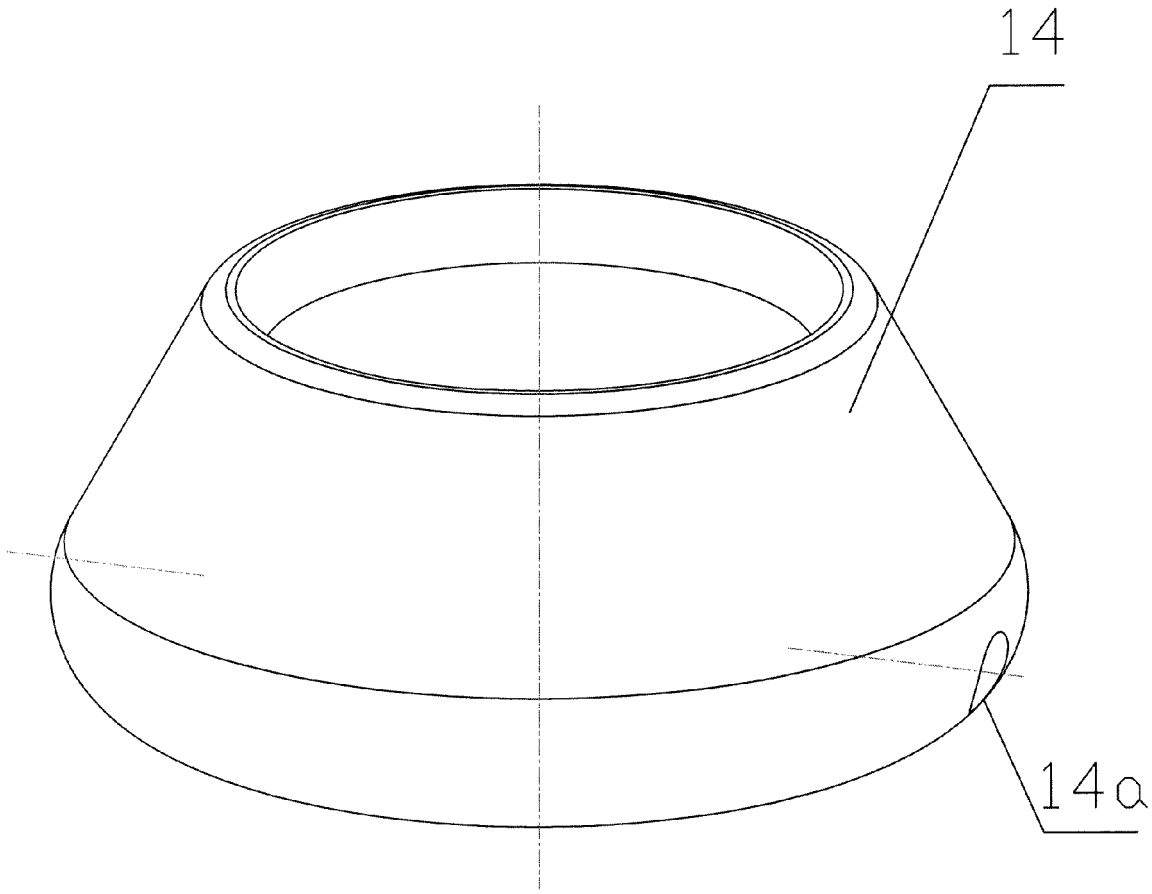

fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 12 46 0049

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 239 744 A1 (ABB TECHNOLOGY AG [CH]) 13 October 2010 (2010-10-13) * paragraphs [0004], [0015] * * figure 1 *	1,6	INV. H01F38/28
A	US 3 668 513 A (TSUBOUCHI DENJI ET AL) 6 June 1972 (1972-06-06) * column 1, lines 5-7 * * column 2, lines 41-52 * * column 3, lines 26-29 * * figure 1 *	1,6	
A	US 5 952 617 A (BERGSTROM SCOTT J [US]) 14 September 1999 (1999-09-14) * column 1, lines 9-27 * * column 5, line 53 - column 6, line 20; figure 1 *	1,3	

TECHNICAL FIELDS SEARCHED (IPC)
H01F
H01B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	31 January 2013	Van den Berg, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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31-01-2013

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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