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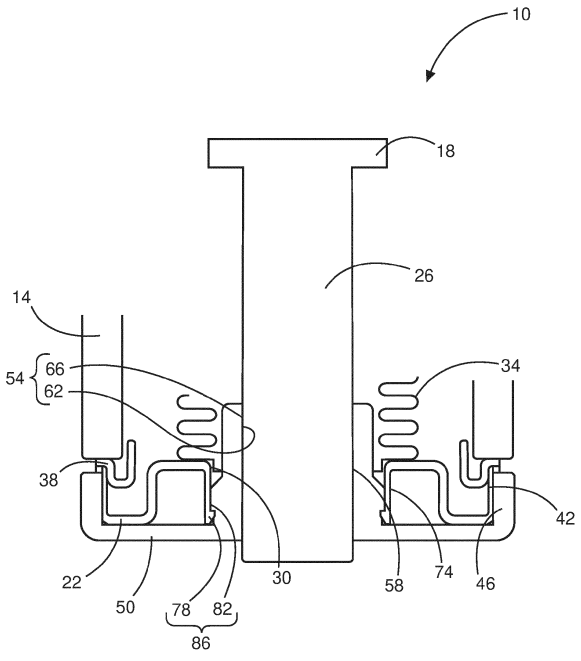
(54) **VACUUM INTERRUPTER**

(57) The present invention relates to a vacuum interrupter (10). The vaccum interrupter (10) is provided with a cover (22), which has an opening (30) for an axially movable switching rod (26). The switching rod (26) is led out of the vacuum interrupter (10) by means of a bellow (34) arranged vacuum-tight on the cover (22). Further, a torsion preventing means is provided for preventing a torsion of the switching rod (26) with respect to the cover (22). The torsion preventing means is provided by the housing cover (22) and a torsion lock element (50). The housing cover (22) provides an external gearing (42) arranged on an radial outer side of the housing cover (22), and the torsion lock element (50) provides engaging means (54) for torsion-proof cooperation with the switching rod (26) and an internal gearing (46), which in a mounted position interacts with the external gearing (42) of the cover (22).



Figure

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Description

FIELD OF THE INVENTION

[0001] The present invention relates to a vacuum interrupter.

BACKGROUND OF THE INVENTION

[0002] A vacuum interrupter usually has a movable contact and a fixed contact, which are arranged on opposite sides of a vacuum chamber. A rod of the movable contact thereby extends to an outside of the housing. In order to maintain the vacuum despite the moving contact, a bellows is provided between the housing and an inner part of the rod of the movable contact. A lifetime of this bellow is essentially reduced, if the rod conduct a torsion. Therefore, it is well known to provide a torsion preventing means for the rod of the movable contact.

[0003] Prior art DE 197 21 611 A1 discloses a vacuum chamber with a rod-like contact carrier, to which a movable contact piece is attached. A bellow is disclosed, which one end is connected to the contact carrier in a vacuum-tight manner and the other end of which is connected to a base or cover wall arranged on the end face. Further, an anti-rotation device is disclosed to prevent rotation of the contact carrier in relation to the base or cover wall. The contact carrier having a guide part arranged on the base or cover wall and is positively locked therein against rotation and slides therein in a form-fitting manner protected against rotation.

SUMMARY OF THE INVENTION

[0004] The problem to be solved by the present invention is to provide a vacuum interrupter with a torsion preventing means having a reduced size.

[0005] The problem is solved by by a vacuum interrupter having the features of claim 1. Preferred embodiments of the invention are specified in the dependent claims.

[0006] According to the invention, a vacuum interrupter is proposed. The vacuum interrupter has a cover, which has an opening for an axially movable switching rod. The switching rod is led out of the vacuum interrupter by means of a bellow arranged vacuum-tight on the cover. A torsion preventing means is provided for preventing a torsion of the switching rod with respect to the cover. The torsion preventing means thereby is provided by the housing cover and a torsion lock element, wherein the housing cover provides an external gearing, arranged on an radial outer side of the housing cover. The torsion lock element provides engaging means for torsion-proof cooperation with the switching rod and an internal gearing, which in a mounted position interacts with the external gearing of the cover.

[0007] According to the invention, the torsion lock element interacts with the housing cover and the switching rod. Thereby, a torsion between the switching rod in relation to the housing cover is prevented. As the internal gearing interacts with the external gearing of the cover, provided at an outer circumferential surface, the axial height of the torsion lock element can be reduced to a minimal height. Further, as the gearing of the cover is provided on an outer circumferential surface of the cover, instead e.g. in the region of the opening, the number of teeth of the gearing can be increased, so that the torsion lock element can be arranged more accurate to the orientation of the switching rod.

[0008] Further, compared to an arrangement where the teeth are arranged in the region of the opening, the outer diameter of the vacuum interrupter can at least be reduced to the diameter of a respective opening without having less teeth. Accordingly, the outer diameter of the vacuum interrupter can be substantially reduced, while achieving a sufficient accurate positioning of the torsion lock element with respect to the switching rod. The size of a respective vacuum interrupter therefore can be reduced.

[0009] In a preferred embodiment of the invention, a holding means is provided, mechanically connecting the torsion lock element with the housing cover, so that a separation of both parts is prevented. The holding means thereby can be a separate part. According to the invention, it is prevented that both parts separate unintentionally. With this holding means, it is ensured that during operation of the vacuum interrupter no torsion is applied on the bellow, so that the expected lifetime of the vacuum interrupter can be guaranteed.

[0010] In a further preferred embodiment, the holding means is provided by the cover and/or the torsion lock element. By providing the holding means by the cover and/or the torsion lock element no separate part is required. As no further part is required, the manufacturing costs can be reduced. Further, as a separate part usually increases the size of the vacuum interrupter, a vacuum interrupter can be provided having a small size.

[0011] Advantageously, the holding means is provided as a snap lock arrangement. A snap lock arrangement has the advantage that an easy mechanical connection between the cover and the torsion lock element can be provided. Such a snap lock arrangement can be arranged so that the axial or radial size of the vacuum interrupter needs not be increased. Further, for connecting both parts no tools are necessary, which simplify the assembling process.

[0012] Preferably, the torsion lock element is made of a plastic material. A plastic material has the advantage, that it has a low weight compared to a metal material. The weight of a respective vacuum interrupter therefore can reduced. Further, a torsion lock element made of a plastic material is easy to manufacture by injection molding. A plastic material further is substantially cheaper than e.g. metal, so that the vacuum interrupter can be manufacture more economically.

[0013] In a further advantageous development, each

of the internal and external gearing comprises at least 180 teeth. In more a preferred embodiment, the internal and external gearing each comprises more than 300 teeth. By providing the internal and external gearing with at least 180 teeth the positioning accuracy of the torsion lock element, with respect to the switching rod can be increase. With 180 teeth, an accuracy of 2° can be achieved. By providing 360 the accuracy can be increased to 1°.

[0014] In a preferred embodiment, for radial positioning of the cover a centering element is provided between a housing of the vacuum interrupter and the cover. Preferably, the centering element is provided on a rim of the housing. The centering element thereby fixes the cover at a specific position. During a connection process between the housing and the cover a disarrangement of the cover is prevented. Therefore, a high accuracy can be achieved, so that the switching rod can be arranged in a central position.

[0015] A preferred embodiment specifies that the engaging means is provided as a groove and spring connection. Preferably, the switching rod provides a groove, while the torsion lock element has a spring. The spring thereby interacts with the groove to form a torsion-proof cooperation. With such a groove and spring connection an easy torsion-proof cooperation can be achieve. In an alternative embodiment, the engaging means is provided by a form-fit connection between the switching rod and the torsion lock element.

[0016] Preferably, the engaging means extends to an inner side of the vacuum interrupter. The engaging means thereby do not extent beyond an outer axial surface of the torsion lock element. The engaging means therefore can be provided without increasing the size of the vacuum interrupter. Accordingly, a vacuum interrupter is achieved having a reduced size.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The subject matter of the Invention will be explained in more details in the following description illustrated in the drawings, in which:

Figure — Cross-sectional view of an embodiment of a part of a vacuum interrupter according to the present invention.

[0018] The figure shows a cross-sectional view of an embodiment of a part of a vacuum interrupter 10 according to the present invention. The vacuum interrupter 10 comprises a cylindrical housing 14, in which a movable contact 18 and a fixed contact (not shown) are arranged. On the cylindrical housing 14 a cover 22 is arranged, with which the housing 14 is closed. A switching rod 26 comprising the movable contact 18 at one axial end is led through an opening 30 of the cover 22. The vacuum interrupter 10 further comprises a bellow 34, which at one end is fixed with the switching rod 26 and at another end is fixed with the cover 22, so that an inside of the vacuum interrupter 10 is vacuum tight.

[0019] For radial positioning of the cover 22 on the housing 14, a centering element 38 is provided between the housing 14 and the cover 22. On an outer circumferential surface of the cover 22, an external gearing 42 is provided. This external gearing 42 interacts with an internal gearing 46 of a torsion lock element 50 for providing a torsion preventing mean with which a torsion of the switching rod 26 with respect to the cover 22 is prevented. The torsion lock element 50 in this embodiment is provided as a hollow wheel, which comprises engagement means 54 for torsion-proof cooperation with the switching rod 26. The engagement means 54 thereby is provided by a sleeve portion 58 of the torsion lock element 50, extending to an inner side of the vacuum interrupter 10. The sleeve portion 58 provides a spring element 62 interacting with a groove 66 of the switching rod 26 in order to provide a groove spring connection.

[0020] The opening 30 of the cover 22 is formed by a cover-sleeve 74, extending to an outer side of the vacuum interrupter 10. At an inner side of the cover-sleeve 74, snap-in lugs 78 are provided, which interact with protrusions 82 on an outer circumferential surface of the sleeve portion 58 of the torsion lock element 50, to form a snap lock arrangement 86, which has the function of a holding means. By means of this snap lock arrangement 86 it is prevented that the torsion lock element 50 can unintentionally separated from the cover 22.

[0021] In the shown embodiment, the cover 22 has an S-shaped cross-section. With such a shape, the external gearing 42 and the cover-sleeve 74 can be provided in a space-saving manner. Such a cover 22 therefore as a minimal axial extension.

List of reference numbers

[0022]

10	vacuum interrupter
14	cylindrical housing
18	movable contact
22	cover
26	switching rod
30	opening
34	bellow
38	centering element
42	external gearing
46	internal gearing
50	torsion lock element
54	engagement means
58	sleeve portion
62	spring element
66	groove
74	cover-sleeve
78	snap-in lug
82	protrusion
86	snap lock arrangement

Claims

1. Vacuum interrupter (10) with a cover (22), which has an opening (30) for an axially movable switching rod (26), which is led out of the vacuum interrupter (10) by means of a bellow (34) arranged vacuum-tight on the cover (22), wherein a torsion preventing means is provided for preventing a torsion of the switching rod (26) with respect to the cover (22),
characterized in that,
the torsion preventing means is provided by the housing cover (22) and a torsion lock element (50), wherein the housing cover (22) provides an external gearing (42) arranged on an radial outer side of the housing cover (22), and the torsion lock element (50) provides engaging means (54) for torsion-proof co-operation with the switching rod (26) and an internal gearing (46), which in a mounted position interacts with the external gearing (42) of the cover (22).

2. Vacuum interrupter (10) according to claim 1, **characterized in that** a holding means (86) is provided, mechanically connecting the torsion lock element (50) with the housing cover (22), so that a separation of both parts is prevented.

3. Vacuum interrupter (10) according to claim 2, **characterized in that** the holding means (86) is provided by the cover (22) and/or the torsion lock element (50).

4. Vacuum interrupter (10) according to claim 2 or 3, **characterized in that** the holding means (86) is provided as a snap lock arrangement.

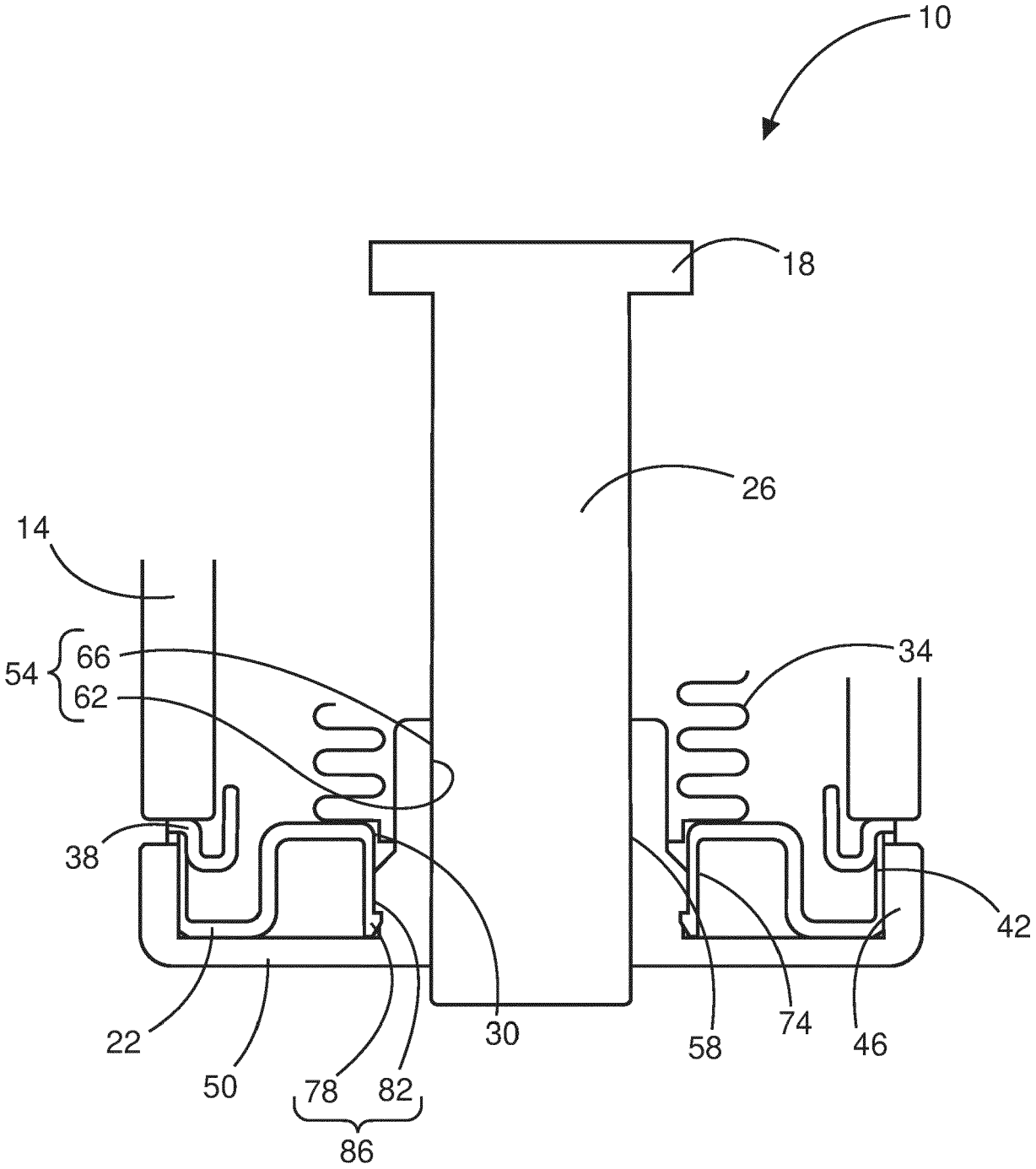
5. Vacuum interrupter (10) according to one of the preceding claims, **characterized in that** the torsion lock element (50) is made of a plastic material.

6. Vacuum interrupter (10) according to one of the preceding claims, **characterized in that** each of the internal and external gearing (42, 46) comprises at least 180 teeth.

7. Vacuum interrupter (10) according to one of the preceding claims, **characterized in that** for radial positioning of the cover (22) a centering element (38) is provided between a housing (14) of the vacuum interrupter (10) and the cover (22).

8. Vacuum interrupter (10) according to one of the preceding claims, **characterized in that** the engaging means (54) is provided as a groove and spring connection.

9. Vacuum interrupter (10) according to one of the preceding claims, **characterized in that** the engaging means (54) extends to an inner side of the vacuum interrupter (10).



Figure

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EUROPEAN SEARCH REPORT

Application Number
EP 22 20 7495

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	WO 2009/124837 A1 (SIEMENS AG [DE]; SCHRIEK UWE [DE]; KRAUSE DIETER [DE]) 15 October 2009 (2009-10-15) * page 5, line 27 - page 7, line 6; figures 1,2 *	1-9	INV. H01H33/662
A	KR 200 448 276 Y1 (LS IND SYSTEMS CO LTD) 31 March 2010 (2010-03-31) * the whole document *	1-9	
A	DE 24 40 827 A1 (SIEMENS AG) 11 March 1976 (1976-03-11) * page 5, line 9 - line 21; figure 3 *	1-9	
			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
Munich	27 April 2023	Ramírez Fueyo, M

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 20 7495

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27-04-2023

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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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