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(54) **VACUUM INTERRUPTER**

(57) The present invention relates to vacuum interrupter (10) with a housing (14). The housing (14) has an opening (26) for an axially movable switching rod (22), which is led out of the housing (14) by means of a bellow (30) arranged vacuum-tight to the housing (14), wherein a torsion preventing means for preventing a torsion of the switching rod (22) with respect to the housing (14) is provided. The torsion preventing means is provided by a single torsion lock element (34), interacting with the housing (14) and the switching rod (22) in a form fit manner, wherein the torsion lock element (34) provides engaging means (54) to fix the torsion lock element (34) on the housing (14).

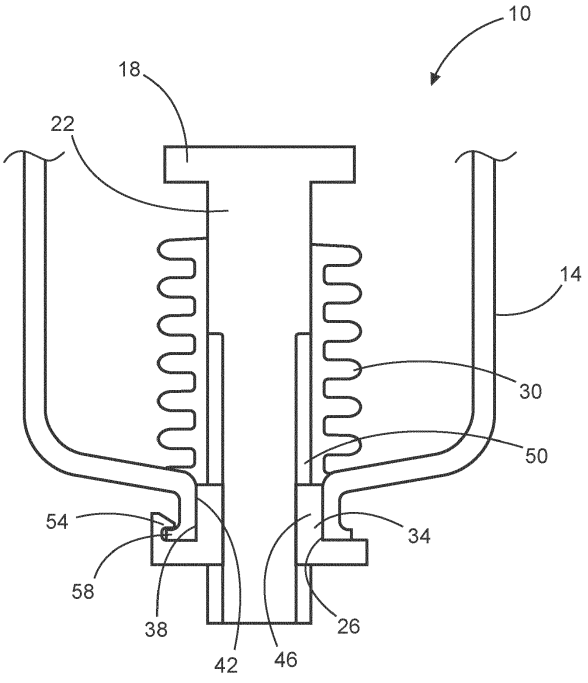

Figure 1

EP 4 421 838 A1

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 which is more economically to manufacture.

[0005] The problem is solved 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 with a housing is proposed. The housing has an opening for an axially movable switching rod, which is led out of the housing by means of a bellow arranged vacuum-tight to the housing, wherein a torsion preventing means for preventing a torsion of the switching rod with respect to the housing is provided. The torsion preventing means thereby is provided by a single torsion lock element, interacting with the housing and the switching rod in a form fit manner, wherein the torsion lock element provides engaging means to fix the torsion lock element on the housing.

[0007] The torsion lock element interact with the housing and the switching rod. Thereby, a torsion between the switching rod in relation to the housing cover is prevented. The bellow thereby is prevented by damage to ensure the vacuum in the vacuum interrupter. As the torsion preventing means is provided by a single part, which interacts with the housing no additional part is necessary to prevent torsion. The number of parts therewith is reduced. The torsion lock element further provides engaging means to fix the torsion lock element on the housing. Therefore, no further parts are necessary to fix the torsion lock element to the housing. The number of parts are therefore reduced. Thus, also the manufacturing costs can be decreased.

[0008] In a preferred embodiment of the invention, the housing and the torsion lock element interact with each other by a gearing connection. The torsion lock element and the housing are thereby provided with gears, which engage with each other to prevent a torsion. The gears thereby has the advantage, that the housing and the torsion lock element can be rotated so that both parts can be adjusted as required. Thereby it can be prevented that torque is acting on the bellow, so that the lifetime of the bellow is ensured.

[0009] In a further preferred embodiment, for the form fit connection the opening of the housing provides an internal gearing and the torsion lock element provides an external gearing. By providing in internal gearing to the opening of the housing the total size of the torsion lock element compared to an arrangement where the housing opening provides an external gearing can be minimized. Thereby it is possible to provide a vacuum interrupter having a reduced size.

[0010] Advantageously, each of the gearing connection comprises at least 180 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. Thereby it is possible to avoid a torque acting on the bellow.

[0011] Preferably, the engagement means is provided as a snap lock arrangement between the housing and the torsion lock element. A snap lock arrangement has the advantage that an easy mechanical connection between the housing 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] In a further advantageous development, the torsion lock element provides three snap parts interacting with the housing. By providing three snap parts the torsion lock element can be provided to the housing in a statically determined way. Thereby it is prevented, that the torsion lock element wiggle on the housing.

[0013] In an alternative embodiment, the torsion lock element provides more than three snap parts. The clamping force of the torsion lock element thereby will be increased, so that the torsion lock element will not fall of.

[0014] In a preferred embodiment, 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 in-

terrupter 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. In preferred embodiment, the plastic material is a PA 66 material. This material thereby has the advantage that it is temperature resistant.

[0015] A preferred embodiment specifies that the plastic material is reinforced by fiberglass material. The fiberglass material thereby is mixed in the plastic material so that the strength of the plastic material is increased. Accordingly, a torsion lock element can be provided having a high strength. Thus, the torsion lock element can be reduced in size while the same force can be transferred. The size of the vacuum interrupter and the weight can be reduced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The subject matter of the Invention will be explained in more details in the following description illustrated in the drawings, in which:

Figure 1 Cross-sectional view of an embodiment of a part of a vacuum interrupter according to the present invention, and

Figure 2 Perspective view of the torsion lock element according to an embodiment of the invention.

[0017] The figure 1 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. A switching rod 22 comprising the movable contact 18 at one axial end is led through an opening 26 of the cylindrical housing 14. The vacuum interrupter 10 further comprises a bellow 30, which at one end is fixed with the switching rod 22 and at another end is fixed with the cylindrical housing 14, so that an inside of the vacuum interrupter 10 is vacuum tight.

[0018] In the opening 26 of the housing 14 a torsion lock element 34 is arranged for preventing a torsion of the switching rod 22 with respect to the housing 14. The torsion lock element 34 comprises an external gearing 38 with interacts with an internal gearing 42 of the opening 26. The external and internal gearing 38, 42 are oriented in an axial direction of the housing 14. The torsion lock element 34 further comprises two tongue portions 46 extending to an internal direction of the torsion lock element 34. The tongue portions 46 interact with axial extending grooves 50 of the switching rod 22 to build a form fit arrangement.

[0019] The torsion lock element 34 further comprises engaging means, which are formed as snap hooks 54 interacting with a collar 58 of the opening 26 of the housing 14 to fix the torsion lock element 34 on the housing 14. The snap hook 54 together with the collar 58 form a snap lock arrangement so that no extra part is necessary to fix the torsion lock element 34 on the housing 14.

[0020] Figure 2 shows a perspective view of the torsion lock element 34 according to an embodiment of the invention. This figure clearly shows the external gearing 38 of the torsion lock element 34. Preferably, the external gearing 38 comprises at least 180 teeth 62, so that a fine adjustment of the switching rod 22 is possible and no moment acts onto the bellow 30. Figure 2 also shows that three snap hooks 54 are provided, which are equally distributed on an axial side of the torsion look element 34 extending in an axial direction.

List of reference numbers

[0021]

10	vacuum interrupter
14	housing
18	movable contact
22	switching rod
26	opening
30	bellow
34	torsion lock element
38	external gearing
42	internal gearing
46	tongue portion
50	groove
54	snap hook
58	collar
62	teeth

Claims

1. Vacuum interrupter (10) with a housing (14), which has an opening (26) for an axially movable switching rod (22), which is led out of the housing (14) by means of a bellow (30) arranged vacuum-tight to the housing (14), wherein a torsion preventing means for preventing a torsion of the switching rod (22) with respect to the housing (14) is provided,
characterized in that
the torsion preventing means is provided by a single torsion lock element (34), interacting with the housing (14) and the switching rod (22) in a form fit manner, wherein the torsion lock element (34) provides engaging means (54) to fix the torsion lock element (34) on the housing (14).

2. Vacuum interrupter (10) according to claim 1, **characterized in that** the housing (14) and the torsion lock element (34) interact with each other by a gearing connection (38, 42).

3. Vacuum interrupter (10) according to claim 1 or 2,

characterized in that for the form fit connection the opening (26) of the housing (14) provides an internal gearing (42) and the torsion lock element (34) provides an external gearing (38).

4. Vacuum interrupter (10) according to claim 2 or 3, **characterized in that** each of the gearing connection (38, 42) comprises at least 180 teeth (62).

5. Vacuum interrupter (10) according to one of the preceding claims, **characterized in that** the engagement means (54) is provided as a snap lock arrangement between housing (14) and the torsion lock element (34).

6. Vacuum interrupter (10) according to one of the preceding claims, **characterized in that** the torsion lock element (34) provides three snap hook (54) parts interacting with the housing (14).

7. Vacuum interrupter (10) according to one of the preceding claims, **characterized in that** the torsion lock element (34) is made of a plastic material.

8. Vacuum interrupter (10) according to one of the preceding claims, **characterized in that** the plastic material is reinforced by fiberglass material.

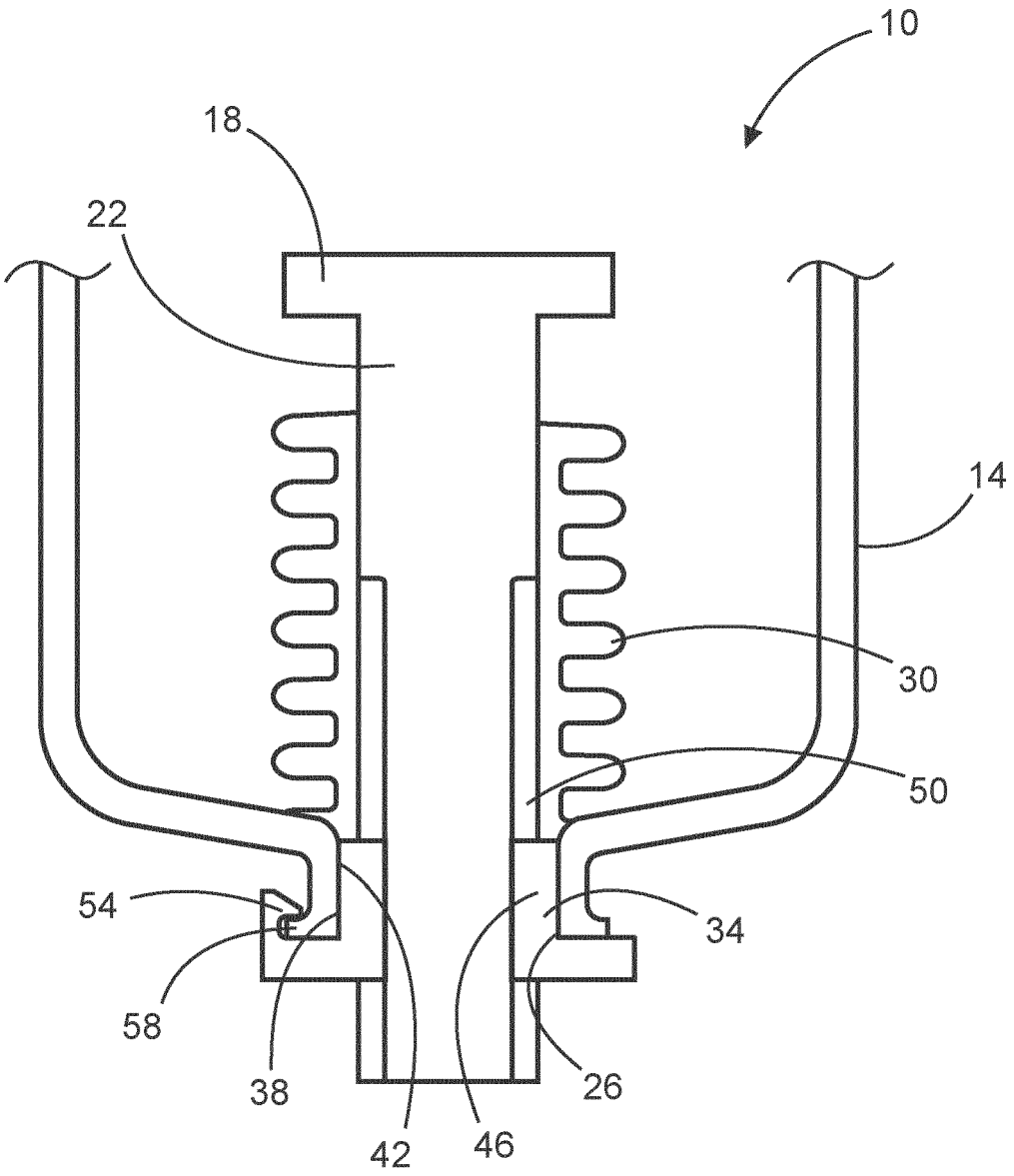

Figure 1

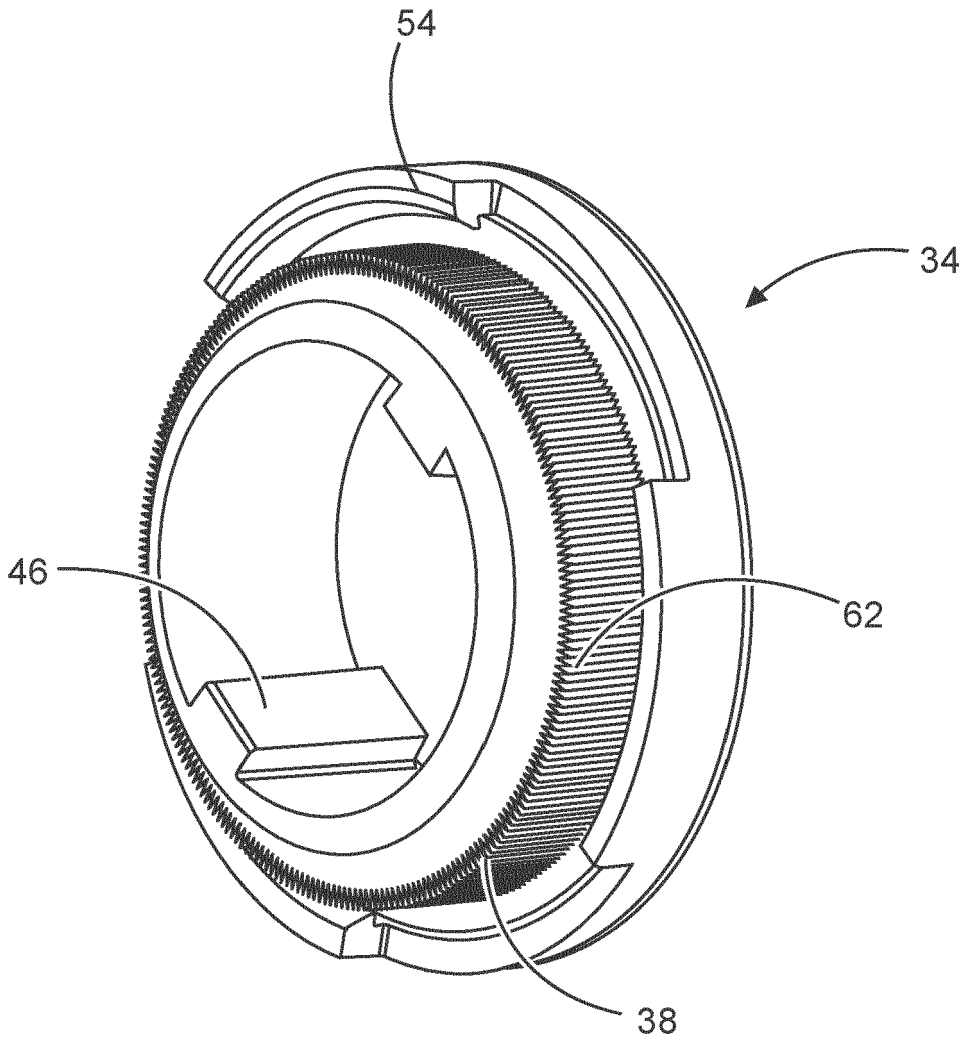

Figure 2

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EUROPEAN SEARCH REPORT

Application Number
EP 23 15 8858

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 196 29 204 A1 (ABB PATENT GMBH [DE]) 22 January 1998 (1998-01-22)	1-8	INV. H01H33/662
Y	* column 3, line 1 - column 4, line 17; figures 1-7 * * column 2, line 37 - line 47 *	8	
X	EP 1 120 803 A1 (ALSTOM [FR]) 1 August 2001 (2001-08-01)	1-3,5-8	
Y	* paragraph [0013] - paragraph [0015]; figures 1-3 *	8	
A		4	
X	DE 10 2008 018531 B3 (SIEMENS AG [DE]) 17 September 2009 (2009-09-17)	1-3,5-8	
Y	* paragraph [0021] - paragraph [0024]; figures 1-4 *	7,8	
A		4	
Y	DE 24 40 829 A1 (SIEMENS AG) 11 March 1976 (1976-03-11)	7,8	
A	* page 2, paragraph 3rd paragraph *	1-6	
			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	11 July 2023	Ernst, Uwe

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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REFERENCES CITED IN THE DESCRIPTION

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