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(54) **Modular electrical apparatus comprising coupling elements for coupling said apparatus to a further modular electrical apparatus**

(57) A modular electrical apparatus (10; 100) is described, comprising coupling elements (17, 18; 117, 118) for coupling said apparatus (10; 100) to a further modular electrical apparatus (31) such that said apparatuses (10; 100; 31), once they are coupled together, have two respective juxtaposed side walls (12, 34). The modular electrical apparatus (10; 100) comprises a generally box-shaped apparatus body (11) including a first coupling side wall (12) and a second side wall (13) opposite said first side wall (12). The coupling elements (17, 18; 117, 118) comprise at least one elastically flexible coupling tooth (17; 117) projecting from said first side wall (12), the coupling tooth (17; 117) being suitable to selectively take a coupling configuration, wherein said tooth (17; 117) is elastically uncharged, and an uncoupling configuration, wherein said tooth is deflected and elastically charged with respect to the coupling configuration. The modular electrical apparatus (10; 100) being characterized in that it comprises holding elements (21, 22; 121, 122) suitable to releasably hold said coupling tooth (17; 117) in the uncoupling configuration.

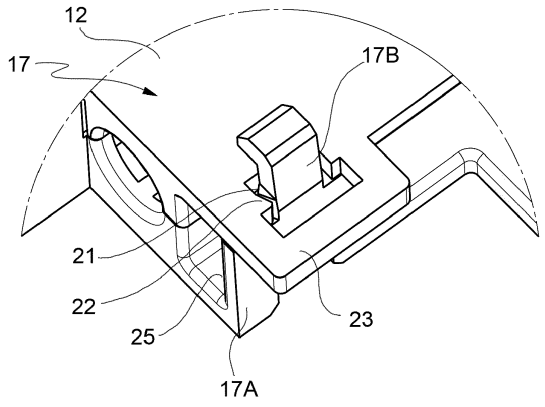

FIG. 2

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Description

[0001] The present invention relates to the technical field of the electrical apparatuses, and, more particularly, it relates to a modular electrical apparatus comprising coupling elements for coupling such apparatus to a further modular electrical apparatus, as defined in the preamble of claim 1.

[0002] As it is known, in the modern electrical systems, the use is widely spread of modular electrical apparatuses, each being designed to perform a specific function. By suitably combining such modular apparatuses together, relatively more complex groups can be obtained, which provide the sum of the several functions.

[0003] For example, a plurality of modular single-pole electrical circuit breakers that are identical to one another can be coupled to form a multipolar electrical circuit breaker, such as, for example a two-pole or three-pole circuit breaker.

[0004] Another example of a combination of modular electrical apparatuses is when the need arises, of associating an auxiliary function to a main apparatus, such as, for example, an automatic circuit breaker, mechanically coupling it to an ancillary apparatus, such as, for example, an auxiliary contact, a motor remote control module, a differential circuit breaker, a signalling device, etc., capable of providing the required ancillary function.

[0005] Among the prior art solutions that are typically used to mutually couple two modular electrical apparatuses, solutions are known, that are based on the use of rigid and/or flexible teeth projecting from one of the side walls of the body of one of the two modular electrical apparatuses to be coupled.

[0006] For example, it is known to provide a modular electrical apparatus with a pair of coupling teeth, which are intended to engage in respective coupling recesses provided on a further modular electrical apparatus so as to allow the coupling between the two apparatuses.

[0007] In this regard, it is known in particular to provide one of the electrical apparatuses with a substantially rigid tooth and with a substantially elastically flexible tooth. In this case, it is possible to mutually couple the electrical apparatuses by placing such apparatuses side by side along two respective side faces, inserting the rigid tooth in the respective coupling recess, and, finally, snap-coupling the flexible tooth in the respective coupling recess by a slight rotation of the electrical apparatus.

[0008] It is further known to provide one of the two modular electrical apparatuses with a pair of elastically flexible coupling teeth. In this case, it is possible to mutually couple two modular electrical apparatuses by placing such apparatuses side by side along two respective side faces and snap-coupling the flexible teeth in the respective coupling recesses bringing the side faces of the apparatuses near to one another, to be coupled by a translatory motion.

[0009] In order to uncouple the above-mentioned electrical apparatuses provided with coupling rigid and/or flexible teeth, once they are coupled together, it is typically needed to lever on the flexible coupling teeth with a tool, such as, for example, a screwdriver, such as to allow the disengagement of such teeth from the respective coupling recesses.

[0010] A drawback of the prior art solutions discussed above, which are based on the use of substantially fixed rigid and/or flexible coupling teeth projecting from a side wall of the apparatus, is due to the fact that the uncoupling of the electrical apparatuses, once they are coupled together, is relatively difficult.

[0011] The patent application published with number EP 2180495, on behalf of the Applicant, discloses an example of a modular electrical apparatus comprising coupling devices for coupling such apparatus with a further modular electrical apparatus. The apparatus disclosed in such patent application is provided with coupling devices that allow the sliding of two coupling hooks along a side wall of the apparatus. Each of such hooks is slidable between a coupling position and an uncoupling position such as to allow mutually coupling and uncoupling two modular electrical apparatuses in a relatively easy manner, without the need to use tools, while ensuring a strong and reliable coupling between the electrical apparatuses.

[0012] An object of the present invention is to provide a modular electrical apparatus comprising coupling elements for coupling such apparatus to further modular electrical apparatus, which is capable of solving or at least partially reducing the drawbacks discussed above with reference to the modular electrical apparatuses of the prior art, which are based on the use of rigid and/or flexible coupling teeth.

[0013] This and other objects are achieved by a modular electrical apparatus as defined and characterized in the appended claim 1 in the most general form thereof, and in the dependent claims in some particular implementation embodiments.

[0014] It is the object of the present invention also a group of parts as defined in claim 10.

[0015] The invention will be better understood from the following detailed description of embodiments thereof, given by way of example, hence being in no manner limiting, in relation to the appended drawings, in which:

- Fig. 1 shows a front plane view of a modular electrical apparatus according to a first embodiment;
- Fig. 2 is a partial perspective view of the modular electrical apparatus of Fig. 1, where, particularly, a coupling tooth of such apparatus is shown, such tooth being illustrated in a first operative configuration;
- Fig. 3 is a partial perspective view of the electrical apparatus of Fig. 1 similar to Fig. 2, wherein the coupling tooth is illustrated in a second operative configuration;
- Fig. 4 is a front plane view of a modular electrical apparatus in accordance with a second embodi-

ment;

- Fig. 5 is a partial perspective view of the apparatus of Fig. 4, where, particularly, a coupling tooth of such apparatus is illustrated in a first operative configuration;
- Fig. 6 is a perspective view in which a further modular electrical apparatus is shown, which is suitable to be coupled to one of the electrical apparatuses of the Figs. 1 or 4; and
- Fig. 7 is a perspective view in which a group of parts is shown, comprising the electrical apparatus of Fig. 1 and the apparatus of Fig. 6 that are coupled to each other.

[0016] To the aims of the present description, the phrases "right" and "left" as used to describe a part of a modular electrical apparatus will be employed only for sake of description simplicity; therefore, they will not to be construed in a limiting meaning.

[0017] In Fig. 1, a modular electrical apparatus according to a first embodiment is shown, which has been generally indicated with the reference 10. In the example, the apparatus 10 is an auxiliary contact 10, or an auxiliary contact device 10, associable to an electric circuit breaker. An auxiliary contact for an electric circuit breaker is widely known to those skilled in the art; therefore, the operation of such device will be not described herein in more detail. However, it shall be noticed that the teachings of the present description are not limited to an auxiliary contact for an electric circuit breaker, but the can be generally applied to any modular electrical apparatuses intended to be coupled to a further modular electrical apparatus. Particularly, in accordance with an embodiment, the apparatus 10 will be able to comprise for example, and without for this introducing any limitations, an electric circuit breaker, a motor remote control module, a differential circuit breaker, or a signalling device. Preferably, the apparatus 10 is a so-called DIN standard modular electrical apparatus.

[0018] Referring again to Fig. 1, the apparatus 10 comprises a generally box-shaped apparatus body 11. The apparatus body 11 comprises a first coupling side wall 12, or right wall 12, and a second side wall 13, or left wall 13, which is opposite the first coupling side wall 12. Furthermore, the apparatus body 11 preferably comprises a front wall 14 and an opposite rear wall (not shown), that are joined to the side walls 12, 13 and interposed between such walls 12, 13. Particularly, the front wall 14 is preferably provided with a maneuvering element 15, such as, for example, a maneuvering lever 15, and/or an indicating element 16 suitable to signal the electrical status of the apparatus 10 and/or of a further electrical apparatus coupled to the apparatus 10.

[0019] The apparatus 10 comprises coupling elements 17, 18 for coupling the apparatus 10 to a further modular electrical apparatus so that such apparatuses, once they are coupled together, have two respective juxtaposed side walls.

[0020] In accordance with a preferred embodiment, the coupling elements 17, 18 comprise a pair of elastically flexible coupling teeth 17, 18 that projects from the right wall 12. Preferably, the teeth 17, 18 are mutually aligned and spaced apart along the right wall 12 of the apparatus 10. However, it shall be noticed that it is not strictly needed for both teeth 17, 18 to be elastically flexible, but, generally, it is sufficient that at least one of the coupling teeth 17, 18 is an elastically flexible coupling tooth. For example, in accordance with an alternative embodiment that is less advantageous, since it makes the coupling and uncoupling between the modular electrical apparatuses less easy with respect to a solution with two coupling flexible teeth, the coupling elements 17, 18 may comprise an elastically flexible tooth and a rigid tooth. In this regard, it shall be noticed that by the term "rigid tooth" is meant a relatively rigid tooth with respect to an elastically flexible tooth.

[0021] Since the teeth 17, 18 have substantially identical structure and operation, for the sake of illustration brevity, the structure and operation of only one of the teeth 17, 18 will be described in detail herein below. Therefore, it is understood that what will be described herein below with reference to the tooth 17 will similarly apply to the tooth 18.

[0022] In this regard, with reference to Figs. 2 and 3, an enlarged portion of the apparatus 10 is shown, wherein the tooth 17 is visible. As it shall be noticed in such Figures, the tooth 17 is suitable to selectively take a first operative configuration, or coupling configuration (Fig. 2), and a second operative configuration, or uncoupling configuration (Fig. 3). In the coupling configuration (Figs. 1 and 2), the tooth 17 is elastically uncharged, or elastically substantially uncharged, and it preferably projects in a direction that is substantially orthogonal to the right wall. In the uncoupling configuration (Fig. 3), the tooth 17 is deflected and elastically charged with respect to the coupling configuration. It shall be noticed that the teeth 17, 18 are arranged so as to be bent to opposite directions when they take the respective uncoupling configurations. In other terms, when they take the respective uncoupling configuration, the teeth 17, 18 are relatively more spaced apart from one another compared to when such teeth take the respective coupling configuration.

[0023] Referring back to Fig. 1, in accordance with a preferred embodiment, the tooth 17 comprises a tooth end 17' that is joined to the left wall 13, an opposite tooth end 17" that projects from the right wall 12, and a tooth intermediate portion that is interposed between the above-mentioned tooth ends 17', 17".

[0024] Referring again to Fig. 1, in accordance with a preferred embodiment, the tooth 17 comprises a base portion 17A that extends between the right and left walls 12, 13 and a coupling portion 17B, or hook portion 17B, which is joined to the base portion and projects from the right wall 12. In accordance with an advantageous embodiment, the base portion 17A of the tooth 17 is substantially bridge-shaped. Such bridge-shaped configura-

tion is shown in Fig. 7, and it is substantially equal to the one of the base portion 117A of the coupling tooth 117 shown in Fig. 5. However, such figure relates to a second embodiment, which will be described in more detail herein below. It shall be noticed that the fact of providing a base portion of the coupling teeth 17, 18 that is bridge-shaped, advantageously allows both imparting a better elasticity to the teeth 17, 18, and defining a coupling seat suitable to cooperate with coupling elements provided on a modular electrical apparatus (not shown) intended to be coupled to the left wall 13 of the apparatus 10.

[0025] Referring back to the Figs. 2 and 3, the apparatus 10 advantageously comprises holding elements, or locking elements, that are suitable to releasably hold the coupling teeth 17, 18 in the respective uncoupling configurations. With reference to the Figs. 2 and 3, the holding elements 21, 22 of the tooth 17 in accordance with a preferred embodiment are shown. In the exemplified embodiment, holding elements that are structurally and functionally identical, or substantially identical, to the elements 21, 22 are provided on the coupling tooth 18.

[0026] In accordance with a preferred embodiment, the holding elements 21, 22 are operatively interposed between the right wall 12 and the coupling tooth 17. In accordance with a preferred embodiment, the holding elements 21, 22 comprise a pair of relief elements 21, 22 that are opposite each other and suitable to mutually mechanically interfere to lock the coupling tooth 17 in the uncoupling configuration. However, it shall be noticed that, generally, the number of pairs of relief elements 21, 22 is not limited only to one pair, but generally it is sufficient that at least one pair of relief elements 21, 22 is provided. For example, with reference to the Figs. 2 and 3, a further pair of relief elements 21, 22 could be provided on the opposite side of the tooth 17. In accordance with a preferred embodiment, the relief elements 21, 22 comprise a pair of cusps 21, 22. In accordance with a preferred embodiment, the cusps 21, 22 are provided respectively on the coupling tooth 17 and on the right wall 12. Preferably, the cusp 21 that is provided on the coupling tooth 17 projects from the above-mentioned intermediate portion of such tooth. As it shall be noticed in the example of Fig. 2, in the coupling configuration of the tooth 17, the cusps 21, 22 project in the transversal direction, and more preferably in a direction substantially orthogonal to the prevailing extension direction of the tooth 17.

[0027] Referring again to Fig. 1, in accordance with a preferred embodiment, the apparatus 10 comprises anti-yield elements 23, 24 suitable to reduce the flexure of the teeth 17, 18 when they pass from the coupling configuration to the uncoupling configuration. In accordance with a preferred embodiment, the anti-yield elements 23 comprise a pair of projecting portions 23, 24 of the right wall 12 that define eyelets 23, 24 through which the teeth 17, 18 are selectively movable. In Fig. 2, the eyelet 23 associated with the tooth 17 is particularly shown. In the example, the eyelet 24 is identical or substantially identical to the eyelet 23.

[0028] Referring back to Fig. 1, in accordance with a preferred embodiment, the apparatus 10 comprises a pair of release recesses 25, 26, each being associated to a respective tooth 17, 18. Through the release recesses 25, 26 a tool may be inserted, such as, for example, a screwdriver, which is suitable to cooperate with the teeth 17, 18 to make such teeth take the respective uncoupling configuration.

[0029] Referring now to Fig. 7, a group of parts is shown, generally indicated with 30, which comprises the apparatus 10 and a further modular electrical apparatus 31 that are coupled to each other. In the example, the apparatus 31 comprises in a non-limiting manner a multipolar electric circuit breaker 31. In Fig. 6, the circuit breaker 31 is shown uncoupled from the apparatus 10. Particularly, in such figure conjugated coupling elements 32, 33 are shown, preferably two coupling recesses 32, 33, which are provided on a side wall 34 of the circuit breaker 31 and which are suitable to cooperate with the teeth 17, 18 for removably coupling together the apparatus 10 and the circuit breaker 31.

[0030] Once the structure of the apparatus 10 has been described, an exemplary coupling and uncoupling mode between the apparatuses 10 and 31 is now described.

[0031] Assuming that the teeth 17, 18 of the apparatus 10 are in the coupling configuration, in order to couple the apparatus 10 and the circuit breaker 31 together, it is sufficient to carry out the following operations:

- arranging the right wall 12 of the apparatus 10 facing the wall 34 of the circuit breaker 31 such as to align the coupling teeth 17, 18 to the respective coupling recesses 32, 33;
- bringing the right wall 12 of the apparatus 10 and the wall 34 of the circuit breaker 31 nearer to one another by a translatory motion until when the coupling teeth 17, 18 snap-couple in the coupling recesses 32, 33 so as to stably couple the apparatus 10 and the circuit breaker 31 together.

[0032] It shall be noticed that, during the snap-coupling step of the teeth 17, 18, the latter deflect or partially bend, but without taking the uncoupling configuration. Alternatively, however, the coupling between the apparatuses 10 and 31 can be carried out also by making the teeth 17, 18 preliminarily take the uncoupling configuration, and by making the teeth 17, 18 subsequently take the coupling configuration, after these ones have been inserted through the coupling recesses 32, 33.

[0033] In order to uncouple from one another the apparatus 10 and the circuit breaker 31 once they are coupled together, it is sufficient to make the coupling teeth 17, 18 take the uncoupling configuration such as to uncouple or disengage the teeth 17, 18 from the coupling recesses 32, 33. This may be for example carried out by inserting a tool, such as, e.g., a screwdriver, through the release recesses 25, 26 and levering on the coupling

teeth 17, 18. Once the teeth 17, 18 have been locked in the uncoupling configuration by the above-mentioned cusps, the apparatus 10 can be simply uncoupled from the circuit breaker 31 by moving the walls 12 and 34 away from one another by a translatory motion.

[0034] Referring now to Fig. 4, a modular electrical apparatus 100 in accordance with a second preferred embodiment is shown. The apparatus 100 is substantially identical to the apparatus 10; therefore, it will be not described herein in more detail. Particularly, the apparatus 100 differs from the apparatus 10 substantially in the different arrangement of the holding elements that are provided to hold the coupling flexible teeth 117, 118 in the respective uncoupling configuration. Since the coupling teeth 117, 118 and the holding elements associated to such teeth are substantially identical to one another, for the sake of illustration brevity, only the tooth 117 and the corresponding holding elements 121, 122 will be described in more detail herein below. Therefore, it is understood that what will be described in relation to the tooth 117 will also apply, with the necessary changes, to the case of the coupling tooth 118.

[0035] Particularly, with reference to Fig. 5, in which the tooth 117 is shown in more detail, it can be noticed that, in accordance with a preferred embodiment, the holding elements 121, 122 comprise two pairs of relief elements 121, 122, or cusps 121, 122, that are opposite each other with respect to the center line of prevailing extension of the coupling tooth 117 when the tooth 117 takes the coupling configuration. Particularly, unlike the case of the apparatus 10 described above, it can be observed that, in the coupling configuration (Fig. 4 or 5) of the tooth 117, the cusps 121, 122 project in the prevailing extension direction of the coupling tooth. More particularly, in the example of Fig. 5, each pair of cusps 121, 122 comprises a cusp 121 that projects from the base portion 117A of the tooth 117, and a cusp 122 that projects from the anti-yield element 123 or eyelet 123. It shall be however noticed that it is not strictly needed that the relief elements 121, 122 comprise two pairs of cusps. For example, in accordance with an alternative embodiment, only one pair of cusps 121, 122 could be provided between the tooth 117 and the eyelet 123.

[0036] As regards the coupling and uncoupling modes of the apparatus 100 with a further modular electrical apparatus, such as, for example, the circuit breaker 31 described above (Fig. 6), such coupling and uncoupling modes are substantially identical to the ones described above with reference to the apparatus 10. Due to such reason, such coupling and uncoupling modes will be not repeated herein.

[0037] Therefore, based on what has been described above, it is possible to understand how a modular electrical apparatus according to the present disclosure is capable of achieving the objects mentioned above.

[0038] The principle of the invention being understood, the embodiments and the implementation details will be able to be widely changed with respect to what has been described and illustrated by way of non-limiting example only, without for this departing from the scope of the invention as defined in the appended claims.

Claims

1. A modular electrical apparatus (10; 100) comprising coupling elements (17, 18; 117, 118) for coupling said apparatus (10; 100) to a further modular electrical apparatus (31) such that said apparatuses (10; 100; 31), once they are coupled together, have two respective juxtaposed side walls (12, 34), wherein the modular electrical apparatus (10; 100) comprises a generally box-shaped apparatus body (11) including a first coupling side wall (13) and a second side wall opposite said first side wall (12), and wherein the coupling elements (17, 18; 117, 118) comprise at least one elastically flexible coupling tooth (17; 117) projecting from said first side wall (12), the coupling tooth (17; 117) being suitable to selectively take a coupling configuration, wherein said tooth (17; 117) is elastically uncharged, and an uncoupling configuration, in which said tooth is deflected and elastically charged with respect to the coupling configuration;
   the modular electrical apparatus (10; 100) being **characterized in that** it comprises holding elements (21, 22; 121, 122) that are suitable to releasably hold said coupling tooth (17; 117) in the uncoupling configuration.

2. The modular electrical apparatus (10; 100) according to claim 1, wherein the holding elements (21, 22; 121, 122) are operatively interposed between said first side wall (12) and said coupling tooth (17; 117).

3. The modular electrical apparatus according to claim 1 or 2, wherein the holding elements (21, 22; 121, 122) comprise at least one pair of relief elements (21, 22; 121, 122) that are opposite each other and suitable to mutually mechanically interfere to lock the coupling tooth (17; 117) in the uncoupling configuration, the relief elements (21, 22; 121, 122) of said pair being provided on the coupling tooth (17; 117) and on said first side wall (12), respectively.

4. The modular electrical apparatus (10; 100) according to claim 3, wherein said pair of relief elements (21, 22; 121, 122) comprises a pair of cusps (21, 22; 121, 122).

5. The modular electrical apparatus (10) according to claim 3 or 4, wherein, in the coupling configuration of the coupling tooth (17), the relief elements (21, 22) of said pair project in the transversal direction to the prevailing extension direction of the coupling tooth.

6. The modular electrical apparatus (100) according to claim 3 or 4, wherein, in the coupling configuration of the coupling tooth (117), the relief elements (121, 122) of said pair project in the prevailing extension direction of the coupling tooth (117).

7. The modular electrical apparatus (100) according to claim 6, wherein said at least one pair of relief elements comprises two pairs of relief elements (121, 122) that are opposite each other with respect to the center line of prevailing extension of the coupling tooth.

8. The modular electrical apparatus (10; 100) according to any of the claims 3 to 7, wherein said coupling tooth (17; 117) comprises a tooth end (17') that is joined to the second side wall (13), an opposite tooth end (17") that projects from the first coupling side wall (12), and a tooth intermediate portion that is interposed between the above-mentioned tooth ends (17', 17"), wherein the relief element (21; 121) of said pair that is provided on the coupling tooth projects from said tooth intermediate portion.

9. The modular electrical apparatus (10; 100) according to any of the preceding claims, wherein the coupling tooth (17; 117) comprises a base portion (17A) extending between said first and second side walls (12, 13) and a coupling portion (17B) that is joined to the base portion (17A) and projects from said first side wall (12), the base portion (17A) being substantially bridge-shaped.

10. A group of parts (30) comprising a modular electrical apparatus (10; 100) as defined in any of the preceding claims and a further modular electrical apparatus (31) that are coupled to each other.

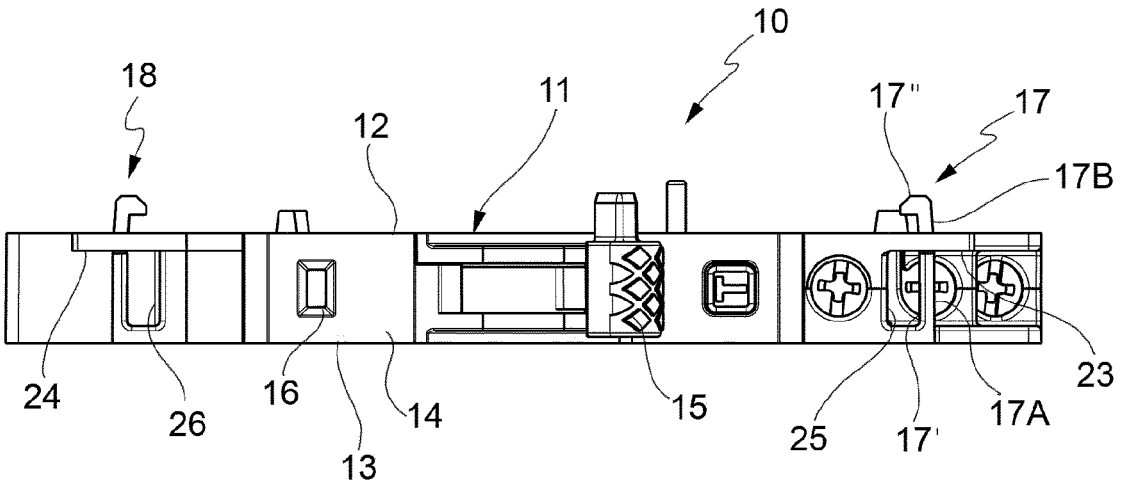
10
18
11
12
17''
17
17B
24
26
16
13
14
15
25
17'
17A
23

FIG. 1

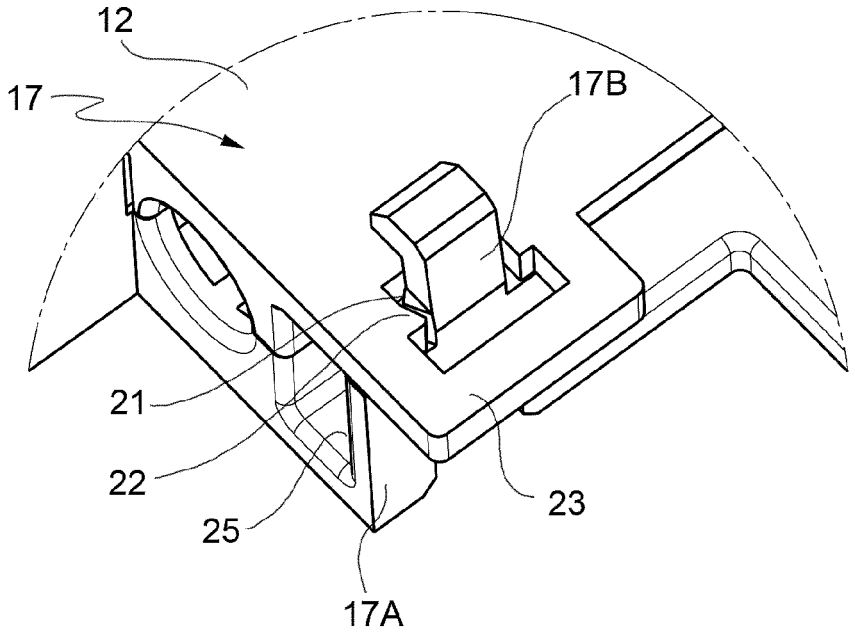
12
17
17B
21
22
25
23
17A

FIG. 2

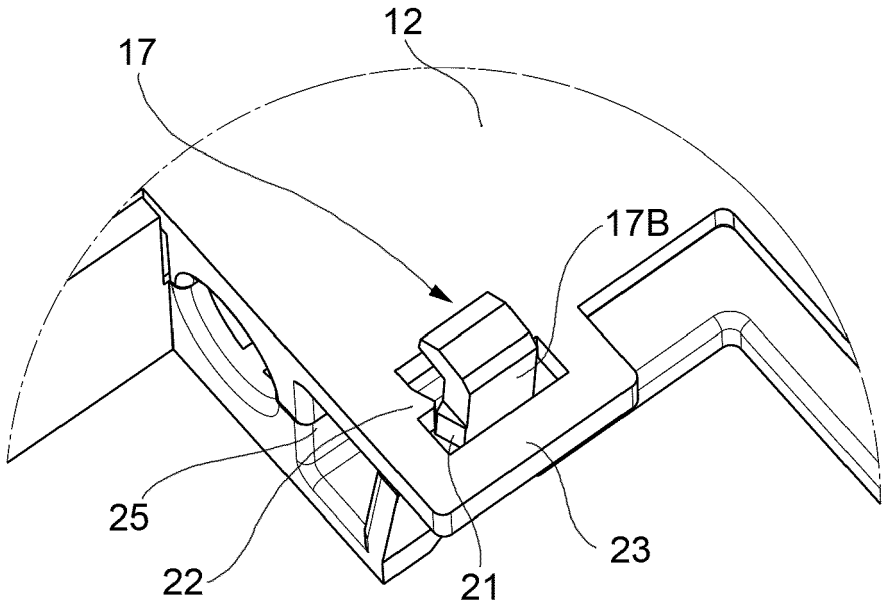

FIG. 3

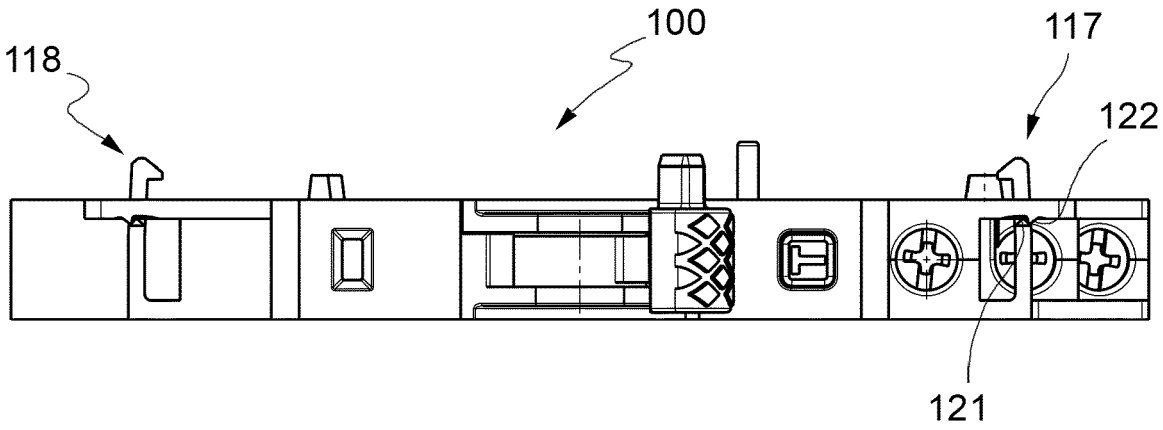

FIG. 4

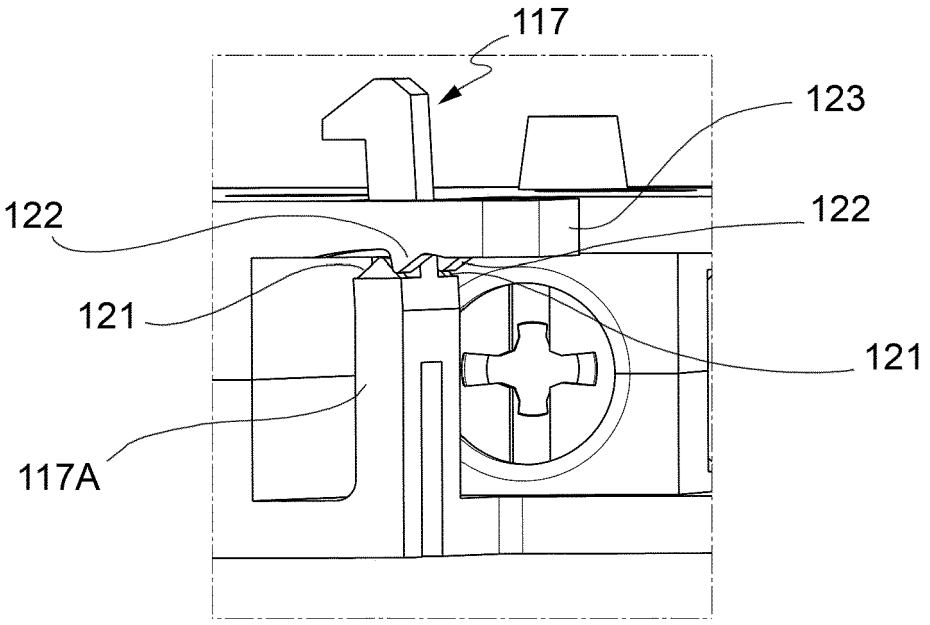

FIG. 5

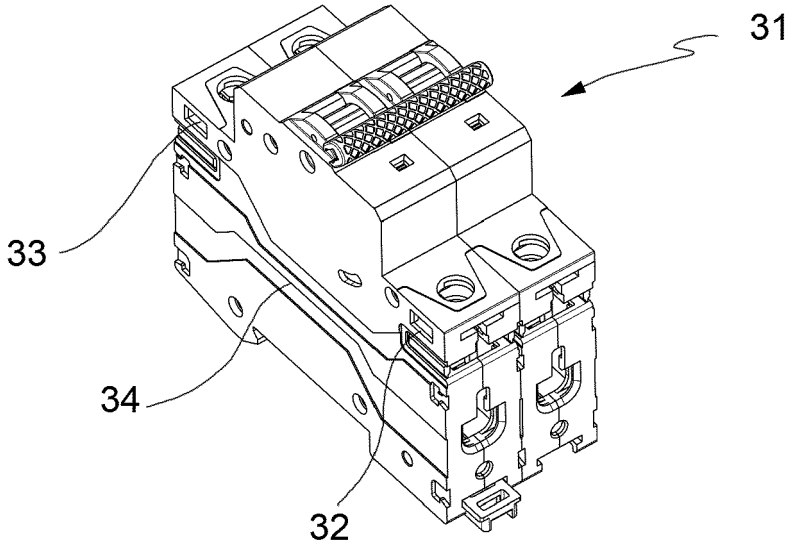

FIG. 6

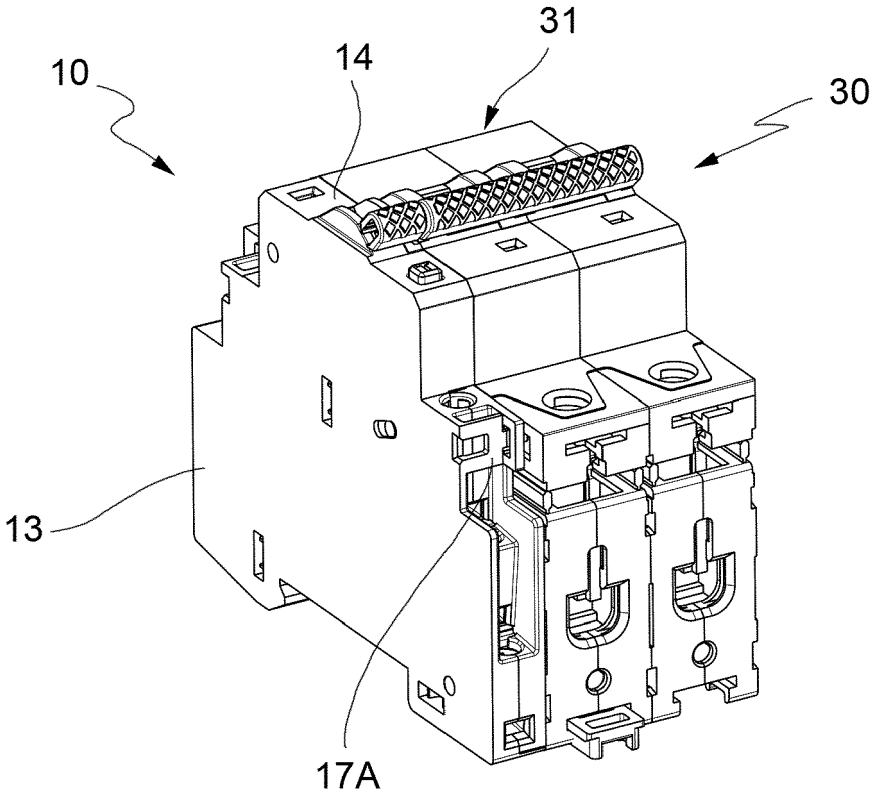

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 14 17 8024

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,D	EP 2 180 495 A1 (BTICINO SPA [IT]) 28 April 2010 (2010-04-28) * abstract; figure 1 * -----	1-10	INV. H01H71/02 H02B1/048
A	EP 1 662 533 A1 (ABB SCHWEIZ AG [CH]) 31 May 2006 (2006-05-31) * abstract; figure 3 * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

H01H
H02B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	19 September 2014	Simonini, Stefano

CATEGORY OF CITED DOCUMENTS

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