(19) Europäisches Patentamt
European Patent Office
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(11) **EP 4 335 998 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.03.2024 Bulletin 2024/11

(21) Application number: **23196019.6**

(22) Date of filing: **07.09.2023**

(51) International Patent Classification (IPC):
E05B 1/00 *(2006.01)* ***E05B 3/00*** *(2006.01)*
E05C 3/04 *(2006.01)* ***E05B 35/00*** *(2006.01)*
E05B 13/00 *(2006.01)* *E05B 65/00* *(2006.01)*

(52) Cooperative Patent Classification (CPC):
E05B 3/00; E05B 1/003; E05B 1/0053; E05B 13/002; E05B 35/008; E05C 3/042; E05B 65/006

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

(30) Priority: **09.09.2022 IT 202200018420**

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(54) **CLOSING SYSTEM FOR ELECTRICAL PANELS**

(57) A closing system (12) for an electrical panel comprises a knob (14) adapted to be arranged on a cover (16) of an electrical panel (18). The knob (14) is operatively connected to a locking tab (20) so that a rotation of the knob (14) around an axis (x) corresponds to a rotation of the tab (20). The closing system (12) further comprises an operating key (22) which may be coupled with the knob (14). The operating key (12) and the knob (14) are configured to couple according to a coupling direction (y) substantially radial to the rotation axis (x) of the knob (14). The operating key (22) and the knob (14) are arranged with respective coupling surfaces (24, 26; 28, 30) which allow the rotation of the knob (14) around the axis (x), acting with a corresponding rotation of the operating key (12).

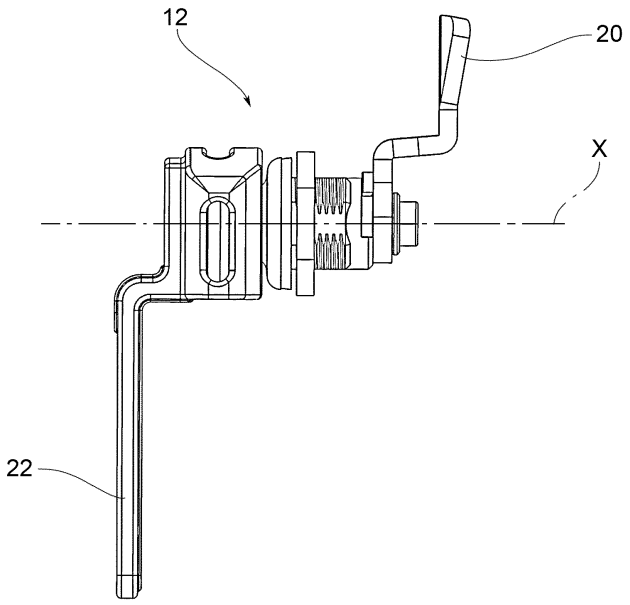

FIG.1

EP 4 335 998 A1

Description

FIELD OF APPLICATION

[0001] The present invention relates to a closing system for electrical panels. In particular, the present invention relates to a closing system for an electrical panel comprising a knob and an operating key.

PRIOR ART

[0002] As is well known, electrical panels comprise a case, a cover, and a closing system to selectively lock the cover to the case.

[0003] Closing systems generally comprise a tab on the inside of the cover that may be rotated from the outside to engage a striker set up inside the case to selectively lock the opening of the cover. Usually, engagement and disengagement of the striker is done by rotating the tab about 90°.

[0004] The tab may be moved by means of a lock comprising a shaped element integral in rotation with the tab, adapted to be engaged with a substantially tubular tool having a cross-section counter-shaped with respect to the shaped element.

[0005] In this way, the operator equipped with the key with the correct cross-section may open the lock by engaging the keyway and rotating it by 90°, for example. Conversely, an operator without the correct key may not easily open the electrical panel.

[0006] In this type of lock, the keyway to be engaged with the appropriate key is substantially flush with respect to the surface of the cover, or an outer portion of the lock itself. The very fact that it does not protrude outward from the cover makes it substantially unusable for detaching the cover from the case or rotating it on its hinges when they are provided.

[0007] An alternative solution that solves this problem is described in the international patent application WO 2022/153124 A1 in the name of the applicant, and involves the use of a knob protruding from the surface of the cover at the end of which a shaped element is arranged protruding from the surface of the knob. Such a solution is particularly advantageous because it allows a user to be able to move the cover with ease simply by using the knob, while still retaining the advantage of being able to open or close the cover with a counter-shaped key adapted to couple with the shaped element.

[0008] The prior art, while widely appreciated and used, is not without its drawbacks.

[0009] Although the technical solution involving the knob is entirely efficient in terms of opening the cover, the system that is used to rotate the knob and thus enable the cover to be opened or closed remains substantially similar to that of the prior art.

[0010] In fact, a user must have a substantially tubular tool available to engage the protruding shaped element in a direction substantially parallel to the rotation axis of the knob.

[0011] This operation, although very simple, is not straightforward because the tool's counter-shaped outline may not be oriented in concordance with the outline of the protruding element, which is why the user may be forced to search by trial and error for the correct orientation.

[0012] Moreover, in this type of application, the friction between the tab and the relevant striker surface is particularly high, so much so that the operator is forced to apply considerable axial force to the knob in order to not risk the tool suddenly disengaging the shaped element and spinning around.

DISCLOSURE OF THE INVENTION

[0013] The need to solve the drawbacks and limitations mentioned in reference to the prior art is thus felt.

[0014] Therefore, the need is felt to provide a closing system for an electrical panel that is ready to use, without the operator having to repeatedly try to find the correct orientation that allows the tool to couple with the protruding element.

[0015] Furthermore, the need is felt for a closing system that allows for both an easy mutual orientation between the tool and protruding element and an easy opening of the cover.

[0016] Also, the need is felt for a closing system that achieves effective closing of the electrical panel.

[0017] Moreover, the need is felt for a closing system that may be effective even when there is considerable friction between the closing tab and relevant striking surface.

[0018] These requirements are met at least partially by a closing system for an electrical panel in accordance with claim 1.

DESCRIPTION OF THE DRAWINGS

[0019] Further features and advantages of the invention will become more apparent from the following detailed description of preferred, non-limiting embodiments thereof, wherein:

- Fig. 1 is a schematic side view of a closing system according to a possible embodiment of the present invention;
- Fig. 2 is a schematic front view of a closing system according to a possible embodiment of the present invention;
- Fig. 3 is a schematic bottom view of a key of a closing system according to a possible embodiment of the present invention;
- Fig. 4 is a schematic side view of a key of a closing system according to a possible embodiment of the present invention;
- Fig. 5 is a schematic perspective view of a knob of a closing system according to a possible embodi-

ment of the present invention;

- Fig. 6 is a schematic perspective view of a key of a closing system according to a possible embodiment of the present invention;
- Fig. 7 is a schematic perspective view of an electrical panel according to a possible embodiment of the present invention;
- Fig. 8 is a schematic perspective view of an electrical panel according to a possible embodiment of the present invention in a first configuration of use; and
- Fig. 9 is a schematic perspective view of an electrical panel according to a possible embodiment of the present invention in a second configuration of use.

[0020] Elements or parts of elements common to the embodiments described hereinafter will be indicated with the same numerical references.

DETAILED DESCRIPTION

[0021] A closing system for an electrical panel according to the present invention is shown in Fig. 1, and is denoted with the general reference sign 12.

[0022] The closing system 12 for an electrical panel comprises a knob 14 adapted to be arranged on a cover 16 of an electrical panel 18 and an operating key 22 that may be coupled with the knob 14.

[0023] The knob 14 is operatively connected to a locking tab 20 in such a way that a rotation of the knob 14 around an axis x corresponds to a rotation of the tab 20.

[0024] The operating key 22 and the knob 14 are configured to couple according to a coupling direction y substantially radial to the rotation axis x of the knob 14. The operating key 22 and the knob 14 are arranged with respective coupling surfaces 24, 26; 28, 30 that allow the rotation of the knob 14 around the axis x, acting with a corresponding rotation of the operating key 22.

[0025] Unlike the prior art in which the coupling between the key/tool and the keyway on the knob occurs according to an axial direction (parallel to the rotation axis), in this case the coupling occurs according to a direction y that is substantially radial to the rotation axis x.

[0026] As seen in Fig. 5, the knob 14 may comprise a gripping portion 32 projecting in the radial direction with respect to the axis x and having a substantially discoidal shape. In accordance with alternative embodiments, the gripping portion 32 may also have different shapes, and have, for example, a hexagonal radial cross-section, etc., depending on specific requirements. In fact, in some embodiments it may be advantageous for a user to have a gripping portion with a particular cross-section, for example in order to grip it properly, or to be able to turn the knob with ease using only the hands.

[0027] According to a possible embodiment, the gripping portion 32 may be axially symmetrical with respect to the axis x.

[0028] The knob 14 may comprise an element 34 protruding in the axial direction, comprising knob coupling surfaces 28, 30 adapted to be engaged by respective operating key coupling surfaces 24, 26. Advantageously, the protruding element 34 may be substantially a parallelepiped with rounded edges 36, 38.

[0029] According to a possible embodiment, the knob coupling surfaces 28, 30 may be substantially parallel to each other.

[0030] In accordance with a possible alternative embodiment, the knob coupling surfaces 28, 30 may be inclined with each other to form a pyramid or a truncated pyramid, with the narrower end at the insertion zone between the key and the knob.

[0031] Regarding the dimensions of the protruding element 34, the latter may project with respect to the knob 14 with a height comprised between 2 and 10 mm, and preferably around 4 mm, and/or the knob coupling surfaces 28, 30 may have a transverse length with respect to the axis x which is comprised between 5 and 15 mm, and preferably around 10 mm. Advantageously, the protruding element 34 may comprise rounded portions between the knob coupling surfaces 28, 30 so as to facilitate the insertion between the key and knob.

[0032] In accordance with a possible embodiment, the gripping portion 32 may have a diameter comprised between 15 and 50 mm, and preferably around 28 mm.

[0033] The operating key 22 may comprise a substantially U-shaped body 40 with two arms 422, 424 and a connecting portion 426 which define an insertion opening 44 and an internal seat 42 adapted to at least partially accommodate the knob 14.

[0034] In particular, the internal seat 42 may be adapted to at least partially accommodate the gripping portion 32 of said knob 14.

[0035] The body 40 may comprise at least one key coupling surface 24, 26. In accordance with a possible embodiment, the at least one key coupling surface 24, 26 is arranged at the internal seat 42.

[0036] As seen in Fig. 3 and 4, in accordance with a possible embodiment, the at least one key coupling surface 24, 26 may be arranged between the two arms 422, 424. Advantageously, the at least one key coupling surface 24, 26 may have an extension direction substantially parallel to the direction y.

[0037] In accordance with a possible embodiment, the operating key 22 may comprise a longitudinal seat 52 protruding in the axial direction x from the body 40, arranged with the at least one key coupling surface 22, adapted to accommodate the protruding element 34 of the knob 14.

[0038] In the coupling condition between the operating key 22 and the knob 14, the internal seat 42 may be adapted to at least partially accommodate the gripping portion 32, and the protruding element 34 may be at least partially accommodated in the longitudinal seat 56.

[0039] The longitudinal seat 56 may be substantially counter-shaped with respect to the protruding element 34 of the knob 14.

[0040] Advantageously, the longitudinal seat 56 may

be arranged with an inlet area 58 for the protruding element 34, and in particular be arranged with rounded contours adapted to ensure easy insertion of the protruding element 34.

[0041] In accordance with a possible embodiment, the arms 422, 424, and the connecting portion 426 of the U-shaped internal seat 42 have at least partially a C-shaped cross-section with the opening facing towards the interior of the internal seat 42, so as to at least partially wrap the knob 14 in the coupling position.

[0042] In accordance with a possible alternative embodiment, the at least one knob coupling surface 28, 30 may be arranged at the radial gripping portion 32 of the knob 14. In particular, the gripping surface may have a cross-section, for example square or rectangular, adapted to couple directly with the key coupling surfaces 24, 26.

[0043] As described above, the coupling between the operating key 22 and the knob 14 is such that it occurs according to a radial direction with respect to the rotation axis x of the knob 14.

[0044] In accordance with a possible embodiment, this coupling may allow the key to remain in the coupled position without the aid of the user. The possibility of achieving a stable equilibrium condition may be achieved in various ways.

[0045] For example, according to one possible embodiment, the internal surfaces defining the internal seat 42 may be converging towards the connecting portion 426, such that a certain interference is determined between the knob 14 and the operating key 22. In other words, the coupling of the knob 14 within the internal seat 42 may be accomplished by substantially elastic deformation of the arms 422, 424, which expand to accommodate the knob 14.

[0046] Advantageously, the arms 422, 424 may be converging or diverging with respect to the connecting portion 426, with different particularities of the coupling depending on the case. For example, in the case where the arms are diverging, the knob 14 may easily fit within the internal seat 42, and the interference between the arms 422, 424 and the knob acts once the knob is already partially inserted within the internal seat 42. On the other hand, in the case where the arms 422, 424 are converging, the knob encounters some resistance to entry, which, due to the elasticity of the arms 422, 424, allows passage to the knob and at the same time prevents an easy exit.

[0047] In accordance with a possible alternative embodiment, the C-shaped cross-section of the arms 422, 424 and the connecting portion 426 may be such that an interference fit between the knob 14 and the internal seat 42 is possible. In other words, the coupling of the knob 14 within the internal seat 42 may be accomplished by a substantially elastic deformation of the C-shaped cross-section, with the ends 46, 48; 50, 52 expanding to accommodate the knob 14.

[0048] In Fig. 3 only the C-shaped cross-sections of the arms 422, 424 are shown explicitly; however, in a possible alternative embodiment, the connecting portion 426 may also be arranged with the C-shaped cross-section adapted to allow an interference fit between the knob 14 and the internal seat 42.

[0049] In particular, the ends 46, 48; 50, 52 of the C may be converging or diverging, with different particularities of the coupling depending on the case. For example, in the case where the ends 46, 48; 50, 52 are diverging, the knob 14 may easily fit within the internal seat 42, and the interference between the ends 46, 48; 50, 52 and the knob acts once the knob is already partially inserted within the internal seat 42. On the other hand, in the case where the ends 46, 48; 50, 52 are converging, the knob encounters some resistance to entry, which, due to the elasticity of the ends 46, 48; 50, 52422, 424, allows passage to the knob and at the same time prevents an easy exit.

[0050] As seen in Fig. 4, the operating key may be provided with a handle 54. The handle may be gripped by a user in such a way as to facilitate the engagement of the knob 14 with the operating key 22.

[0051] In accordance with a possible embodiment, the handle of the operating key may extend in a direction substantially parallel to the engagement direction of the knob 14.

[0052] Advantageously, the positioning of the handle 54 in the closing system according to the present invention is such that the engagement of the knob 14 is accomplished by moving the operating key from top to bottom, and the opening of the closing system 12 is accomplished by rotating the handle by an angle around 90°.

[0053] In accordance with a possible embodiment, the operating key 22 may be made of polymeric material, or metal, such as a Zamak® alloy. Advantageously, in the case of an operating key made of metal, a layer of paint may be envisaged.

[0054] In accordance with a possible embodiment, the operating key may comprise an inspection window 60 at the longitudinal seat 56. The inspection window 60 may have substantially the shape of the protruding element 34, so that the correct alignment of the key may be verified before, during and/or after the coupling between the knob 14 and the operating key 22.

[0055] The advantages that may be achieved with the closing system 12 according to the present invention are thus now apparent.

[0056] In particular, a closing system 12 has been made available that allows for a very simplified and easy coupling between the operating key 22 and the knob 14.

[0057] In fact, due to the U-shape of the internal seat of the operating key, the step of coupling the knob occurs intuitively, so that the user does not have to proceed by repeated attempts.

[0058] In addition, the coupling between the operating key and the knob may be maintained and interrupted if necessary due to the particular shape of the internal seat 42 and the knob 14.

[0059] Also, due to the particular shape of the coupling

between the operating key and the knob, it is possible to check the correct alignment of the key with the knob before inserting the knob inside the internal seat.

[0060] Furthermore, the operating key, precisely because it is coupled radially with respect to the knob, may be used to easily open the cover of the electrical panel. This advantage is even more evident when considering the handle 54 of the operating key.

[0061] Also, with the system of the present invention, it is not necessary to use the operating key to exert a force according to the axial direction toward the knob in order to overcome the friction between the tab and relevant striker. In fact, the coupling in the axial direction between the operating key and knob is ensured by the shape-coupling between the two components.

[0062] A person skilled in the art will be able to make modifications to the embodiments described above and/or substitute described elements with equivalent elements, in order to satisfy particular requirements, without departing from the scope of the accompanying claims.

Claims

1. Closing system (12) for electrical panels, comprising a knob (14) adapted to be arranged on a cover (16) of an electrical panel (18); said knob (14) being operatively connected to a locking tab (20) so that a rotation of said knob (14) around an axis (x) corresponds to a rotation of said tab (20); said closing system (12) further comprising an operating key (24) which may be coupled with said knob (14);

   characterized in that said operating key (12) and said knob (14) are configured to couple according to a coupling direction (y) which is substantially radial to said rotation axis (x) of said knob (14),
   and **in that** said operating key (24) and said knob (14) are arranged with respective coupling surfaces (24, 26; 28, 30) which allow the rotation of the knob (14) around the axis (x), acting with a corresponding rotation of the operating key (12).

2. Closing system (12) according to the preceding claim, **characterized in that** said knob (14) comprises a gripping portion (32) protruding in the radial direction with respect to the axis (x) and having a substantially discoidal shape, preferably said gripping portion (32) is axially symmetrical with respect to the x axis.

3. Closing system (12) according to any one of the preceding claims, **characterized in that** said knob (14) comprises a protruding element (34) protruding in an axial direction, comprising knob coupling surfaces (28, 30) adapted to be engaged by respective operating key coupling surfaces (26, 28).

4. Closing system (12) according to any one of the preceding claims, **characterized in that** said protruding element (34) is a parallelepiped with rounded edges (36, 38) .

5. Closing system (12) according to any one of the preceding claims, **characterized in that** said knob coupling surfaces (28, 30) are substantially parallel with each other, or said knob coupling surfaces (28, 30) are inclined with each other to form a pyramid or a truncated pyramid, with the narrower end at the insertion zone between the operating key and the knob.

6. Closing system (12) according to any one of claims 3-5, **characterized in that** said protruding element (34) protrudes with respect to the knob with a height comprised between 2 and 10 mm, and preferably around 4 mm, and/or said knob coupling surfaces (28, 30) have a transverse length with respect to said axis (x) which is comprised between 5 and 15 mm, and preferably around 10 mm, and/or said gripping portion (32) has a diameter comprised between 15 and 50 mm, preferably around 28 mm.

7. Closing system (12) according to any one of the preceding claims, **characterized in that** said operating key (22) comprises a substantially U-shaped body (40) with two arms (422, 424) and a connecting portion (426) which define an insertion opening (44) and an internal seat (42) adapted to at least partially accommodate said knob (14).

8. Closing system (12) according to claim 7, **characterized in that** said internal seat (42) is adapted to at least partially accommodate said gripping portion (32) of said knob (14).

9. Closing system (12) according to any one of claims 7-8, **characterized in that** said body (40) comprises at least one key coupling surface (24, 26) at the internal seat (42).

10. Closing system (12) according to any one of claims 7-9, **characterized in that** the at least one key coupling surface (24, 26) may be arranged between the two arms (422, 424), and have an extension direction substantially parallel to the coupling direction (y).

11. Closing system (12) according to any one of claims 2-10, **characterized in that** said operating key (22) may comprise a longitudinal seat (52) protruding in an axial direction (x) from the body (40), which seat is arranged with the at least one key coupling surface (22) and adapted to accommodate the protruding

element (34) of the knob (14).

12. Closing system (12) according to claim 15, **characterized in that** in the coupling condition between operating key (22) and knob (14), the internal seat (42) is adapted to at least partially accommodate the gripping portion (32), and the protruding element (34) is at least partially accommodated in the longitudinal seat (56).

13. Closing system (12) according to any one of claims 11-12, **characterized in that** the longitudinal seat (56) is substantially counter-shaped with respect to the protruding element (34) of the knob (14).

14. Closing system (12) according to any one of claims 11-13, **characterized in that** said operating key comprises an inspection window (60) at the longitudinal seat (56), said inspection window (60) substantially having the shape of the protruding element (34).

15. Closing system (12) according to any one of claims 7-14, **characterized in that** said U-shaped internal seat (42) comprises arms (422, 424) and a connecting portion (426) which, at least partially, have a C-shaped cross-section facing towards the interior of the internal seat (42), so as to at least partially wrap the knob (14) in the coupling position.

16. Closing system (12) according to any one of claims 7-15, **characterized in that** the arms (422, 424) are converging or diverging with respect to the connecting portion (426).

17. Closing system (12) according to any one of claims 7-16, **characterized in that** the C-shaped cross-section of the arms (422, 424) and of the connecting portion (426) may be such as to allow an interference coupling between the knob (14) and the internal seat (42).

18. Closing system (12) according to any one of the preceding claims, **characterized in that** the operating key is arranged with a handle (54) so as to facilitate the engagement of the knob (14) with the operating key (22).

19. Electrical panel (12) comprising a closing system (12) according to any one of the preceding claims.

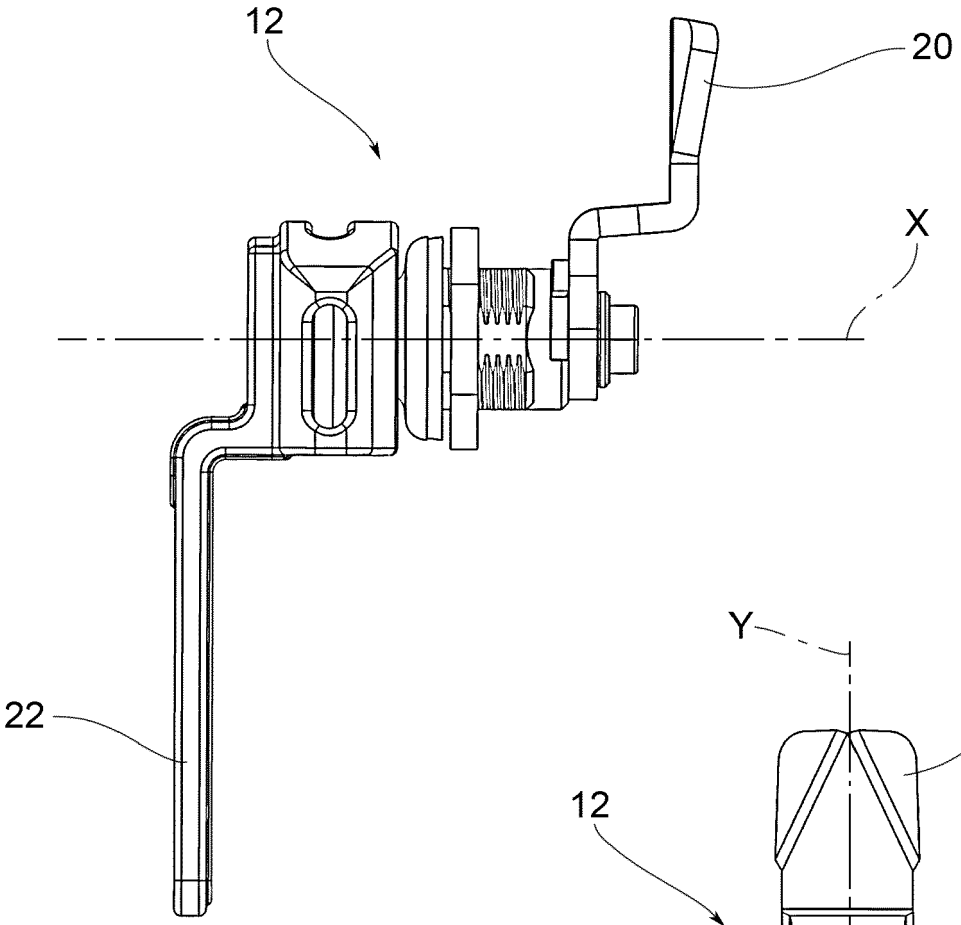

FIG.1

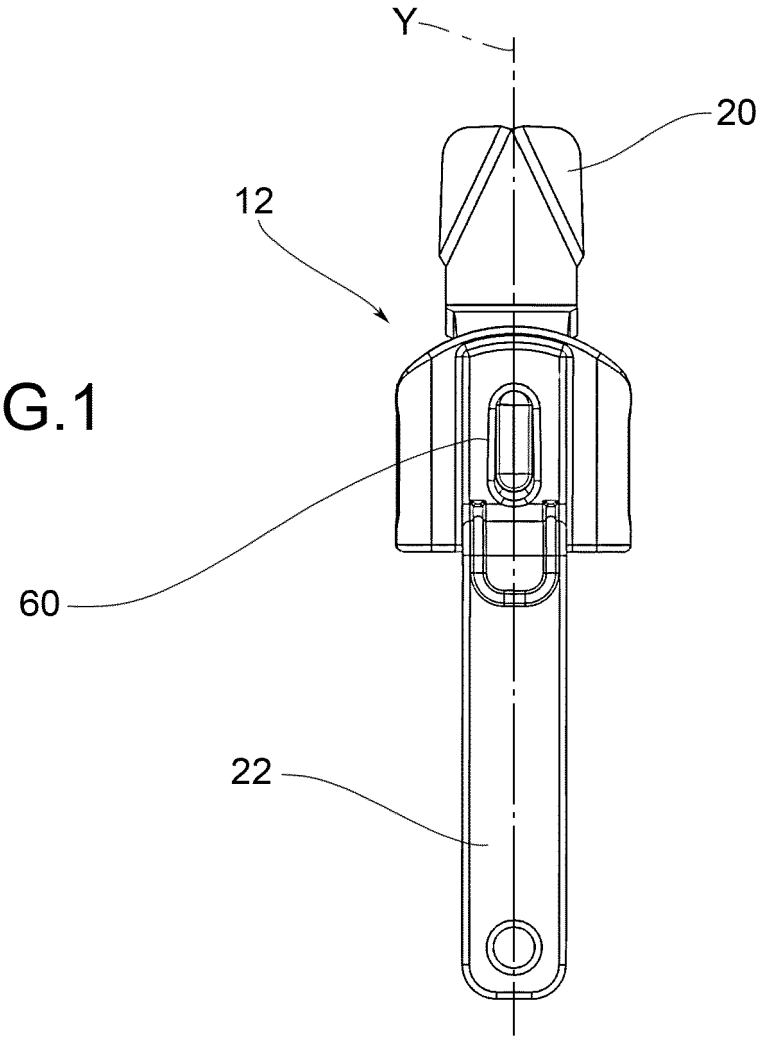

FIG.2

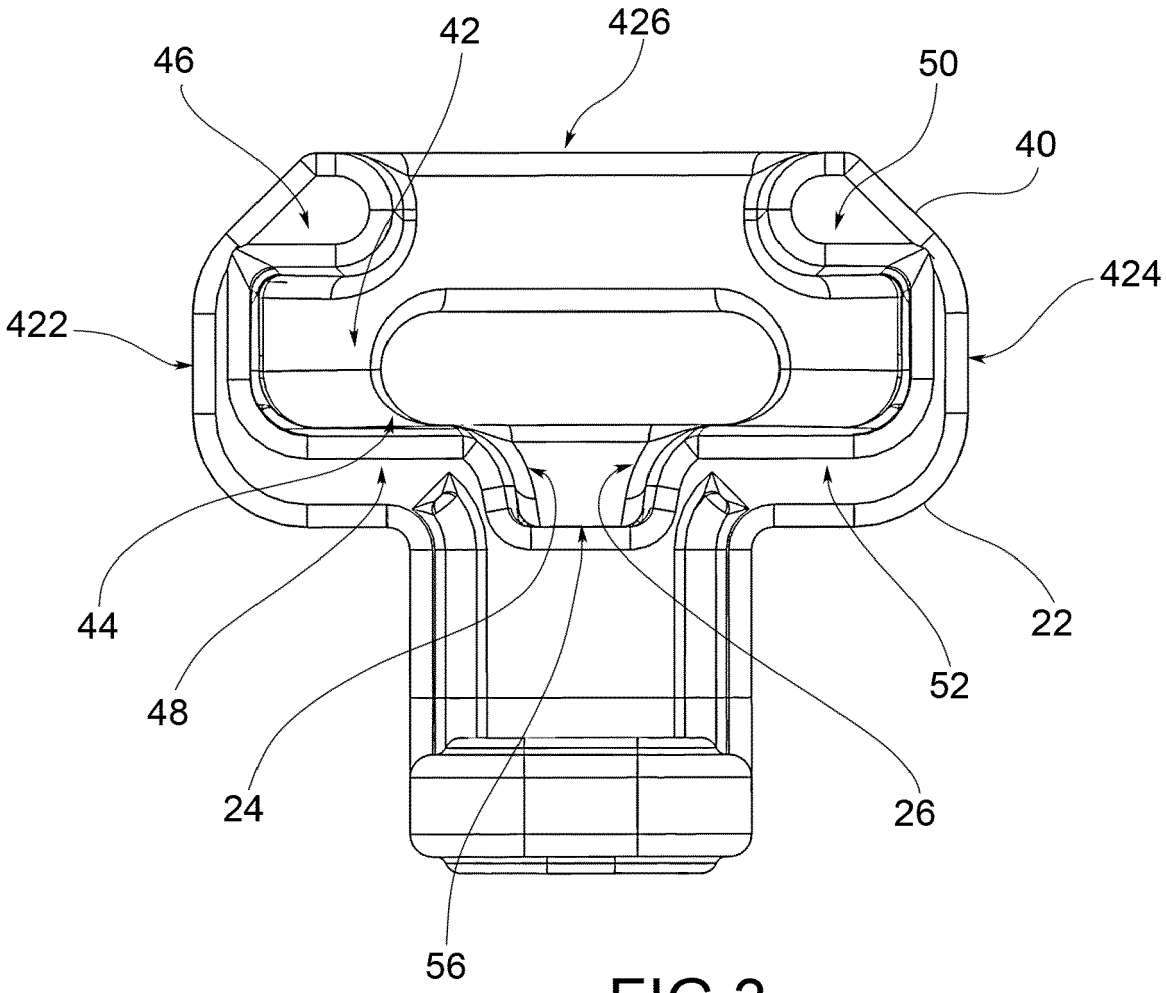

FIG.3

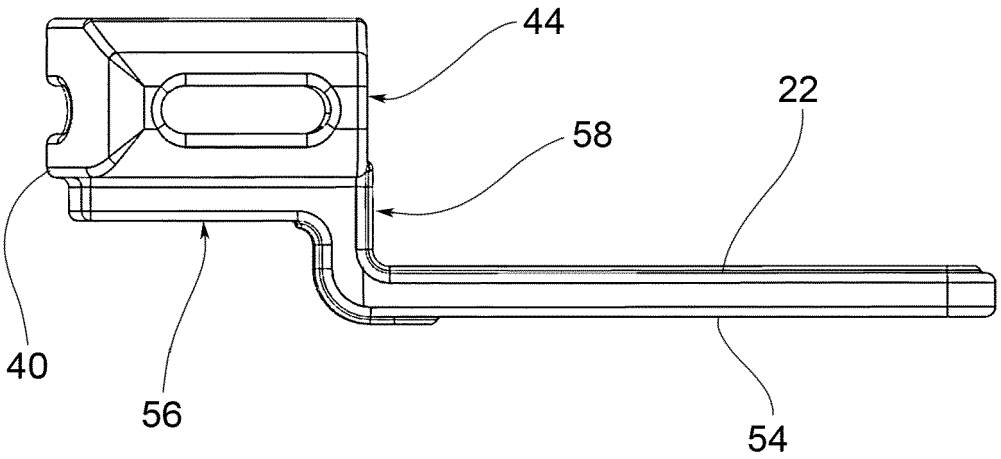

FIG.4

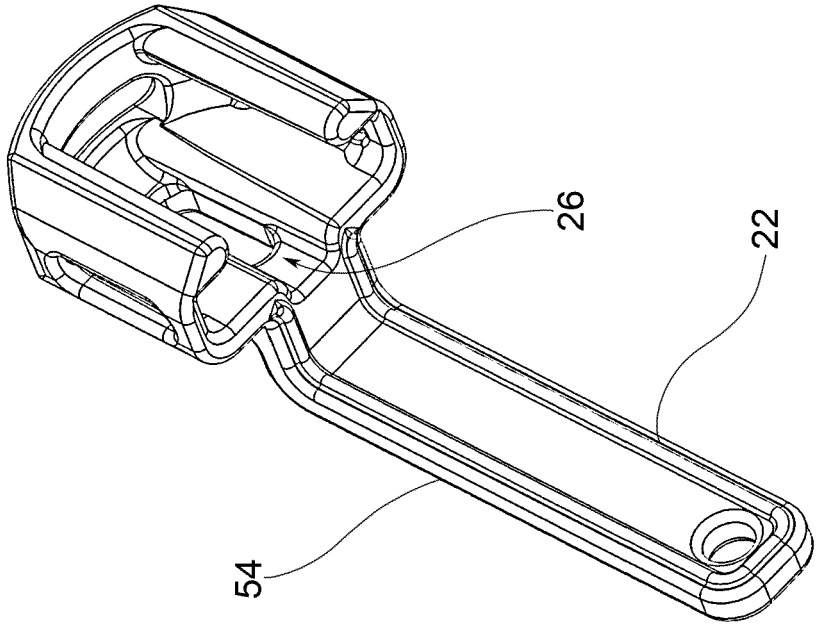

FIG.6

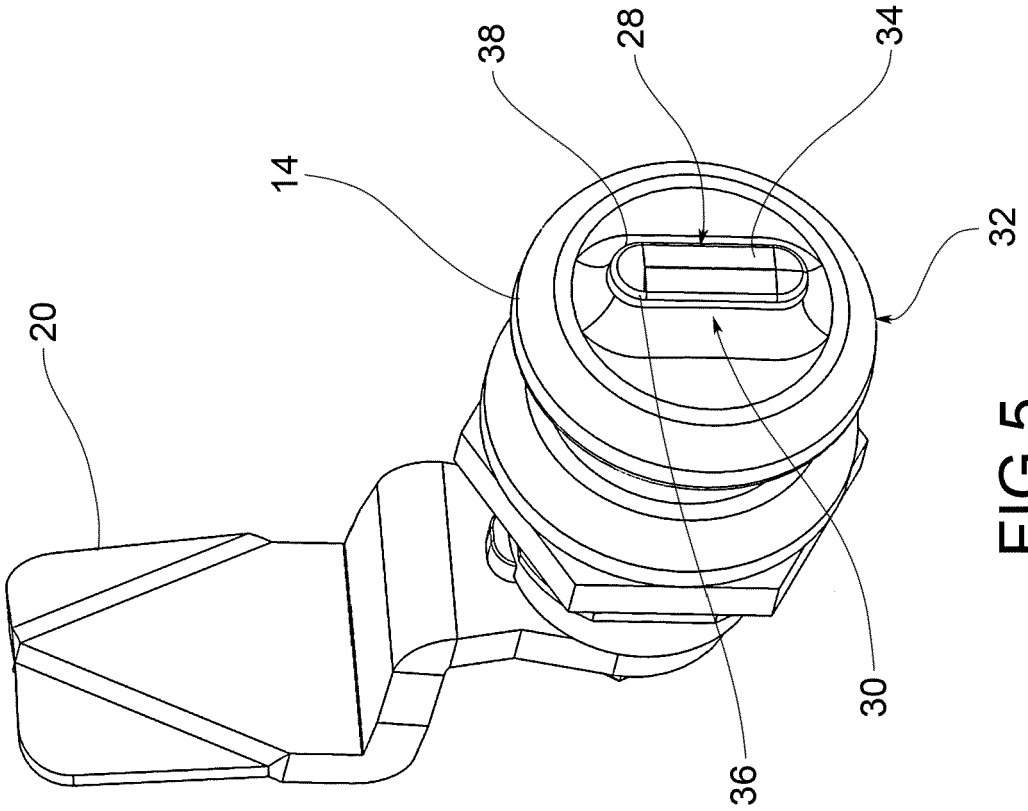

FIG.5

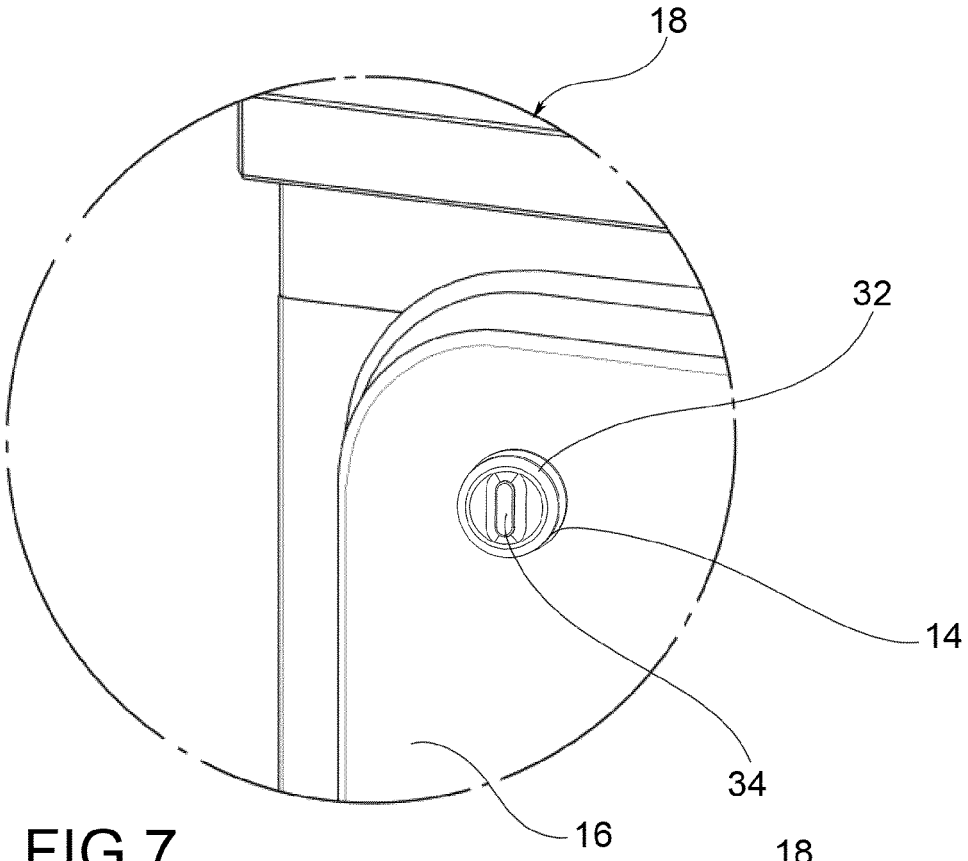

FIG.7

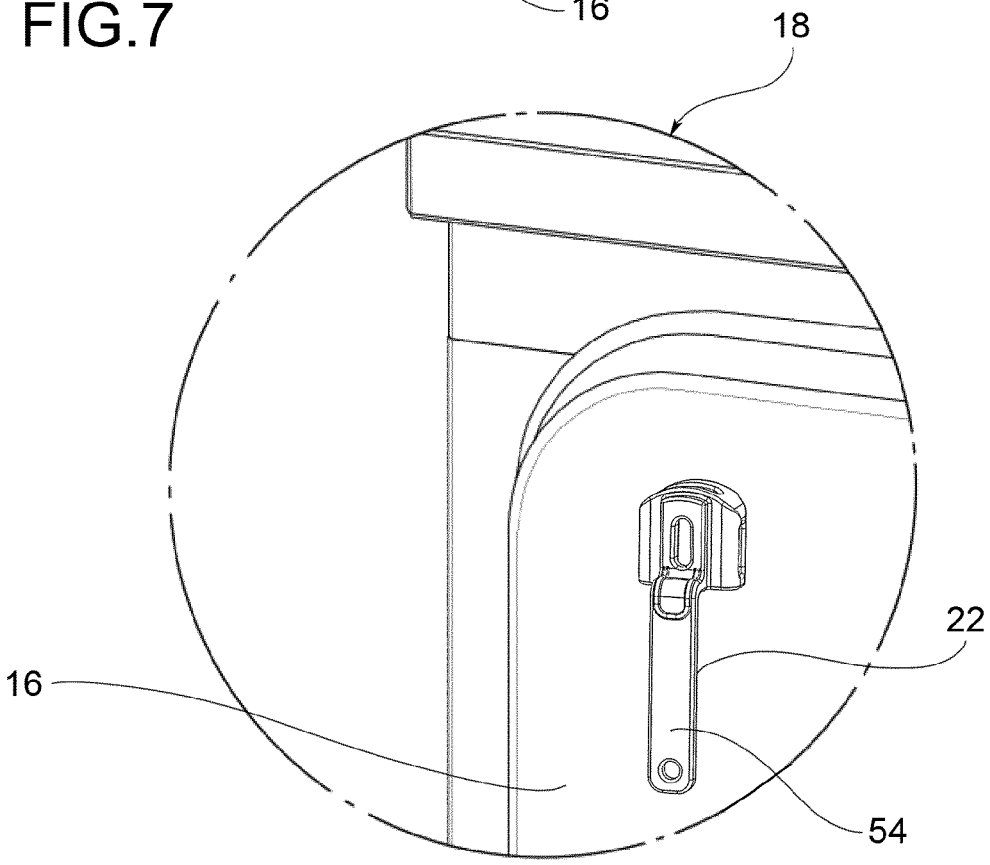

FIG.8

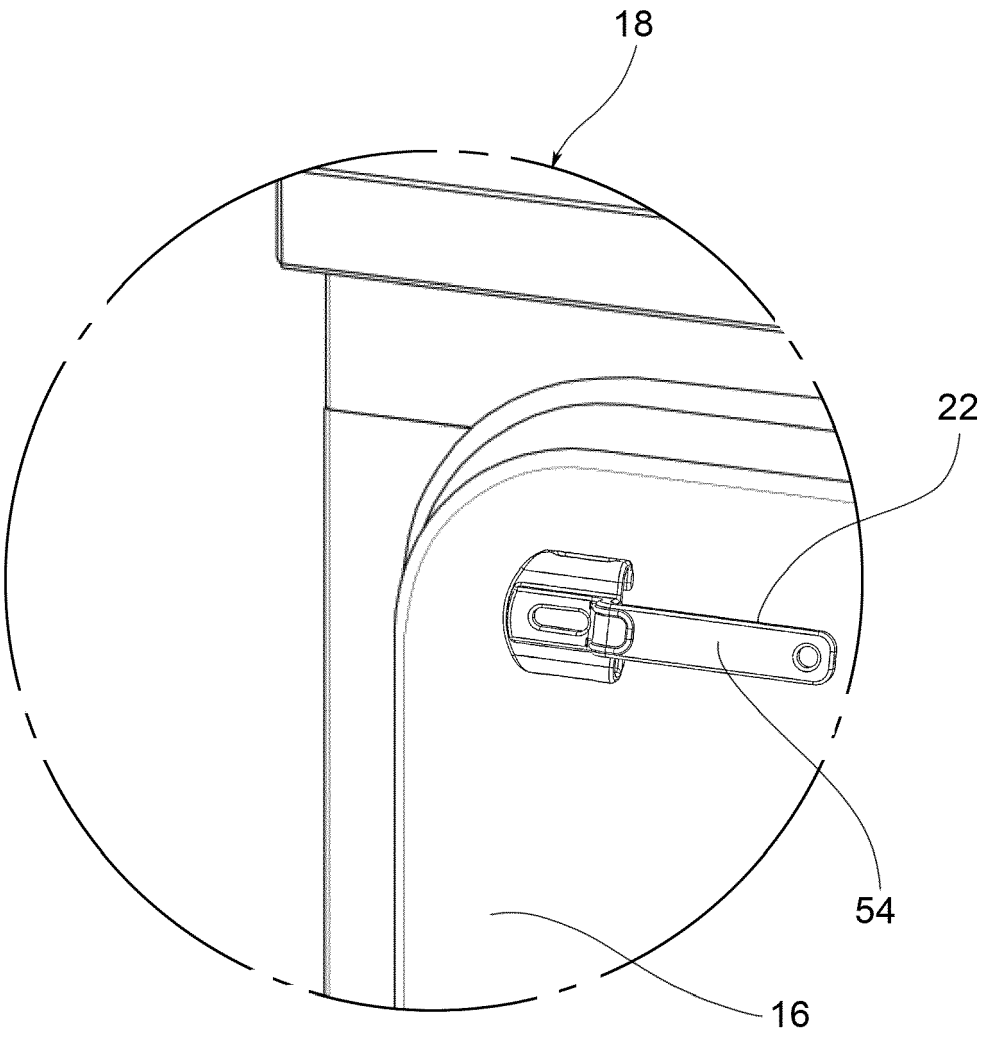

FIG.9

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EUROPEAN SEARCH REPORT

Application Number
EP 23 19 6019

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	US 6 676 176 B1 (QUANDT ROBERT H [US]) 13 January 2004 (2004-01-13)	1-3,5,6, 18,19	INV. E05B1/00
A	* the whole document *	7-17	E05B3/00 E05C3/04
A,D	WO 2022/153124 A1 (EURO INOX QUALITY S R L [IT]) 21 July 2022 (2022-07-21) * the whole document *	1-19	E05B35/00 E05B13/00 ADD. E05B65/00

TECHNICAL FIELDS SEARCHED (IPC)
E05B
E05C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	30 January 2024	Robelin, Fabrice

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 19 6019

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30-01-2024

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6676176 B1	13-01-2004	NONE	
WO 2022153124 A1	21-07-2022	EP 4278055 A1	22-11-2023
		WO 2022153124 A1	21-07-2022

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

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