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(54) **A LOADING ASSEMBLY OF A SWITCH OF AN ELECTRICAL SWITCHBOARD**

(57) A loading assembly of a switch of an electrical switchboard, the assembly comprising a loading spring for loading the switch; an operating lever is movable from a first position to a second position to perform loading strokes of the spring; a transmission on one side coupled to the operating lever and on the other side to the loading spring; wherein the coupling between the operating lever and the transmission is configured in such a way that during the loading strokes the lever actuates the transmission only after passing an intermediate position between the first and second position.

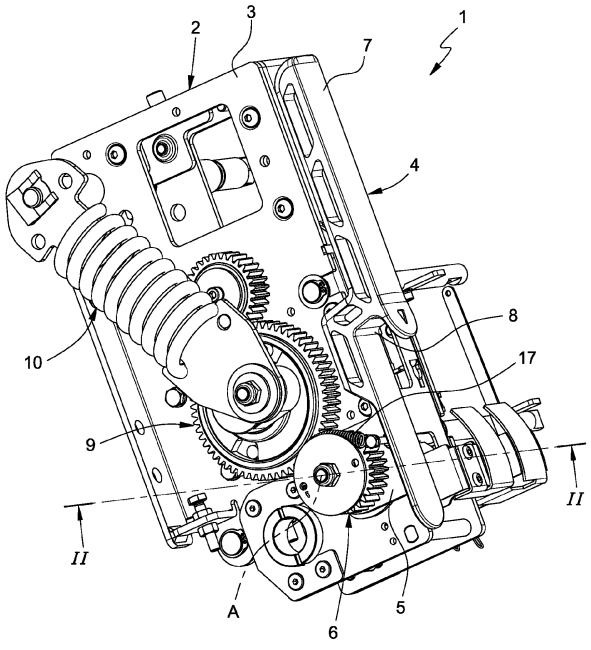

FIG. 1

EP 4 254 455 A1

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 102022000006536 filed on April 1st, 2022, the entire disclosure of which is incorporated herein by reference.

Technical field

[0002] The technical field of reference of the present invention refers to electrical switchboards or electrical cabinets, in particular of high/medium voltage, which receive voltage from specially provided voltage bars and supply current through lines directed towards downstream users. In particular, the technical field of the present invention refers to a loading assembly of the switch for electrical cabinets, i.e. to the assembly which is actuated by the operator for reaching the conditions suitable for switching on the switchboard by means of the switch. In such context, the present invention will deal with the problem of how to offer a loading assembly of the switch having reduced size and in which many functionalities are concentrated in an innovative manner in a specific position of the assembly.

State of the art

[0003] As indicated in the previous chapter, the present invention refers to a loading assembly of a switch for an electrical cabinet or an electrical switchboard. In general, a person skilled in the art operating in this sector is familiar with what a switch assembly for an electrical switchboard is, what the relative loading assembly is and which are the devices composing such assemblies and the functionalities thereof. By way of example, it is possible to mention prior patents EP1538650 and EP1226596 as evidence of the reputation of the switch-disconnector assemblies and of the knowledge of the person skilled in the art in this sector.

[0004] Very briefly, a loading assembly of a switch comprises a loading spring which is loaded by means of a specially provided lever. The complete loading necessary for creating the conditions for switching on the switchboard provides for a plurality of loading cycles of the spring and the operator is thus required to handle the operating lever several times between a first dead centre (rest position) and a second dead centre (second position). Between the operating lever and the loading spring, a specially provided transmission is present which is usually made in the form of a series of gear wheels. A first gear wheel is coupled to an end of the lever in the sense that both of these elements are rotatable about the same axis centred in the pin of the first gear wheel. In this manner, by acting in rotation on the opposite free end of the lever, the rotation of the first gear wheel is driven and the latter, in turn, drives in rotation the remaining wheels acting on the loading spring.

[0005] In such context, it is known to provide for a first "idle" section of movement of the lever starting from the rest position. In this first section, the motion is thus not transmitted to the transmission and facilitates the operator in the first loading phases. It is further known to provide for end-of-strokes of the movement of the lever (both at the rest position and at that of maximum excursion), and return springs are also provided for returning the lever in the rest position.

[0006] Thus, according to the prior art, the devices provided for the aforementioned three functions (lever-gear decoupling in the first movement, end-of-stroke and lever return in rest position) are arranged in the assembly in different positions and involve, each time, different elements making the assembly complex and bulky.

US5850909 describes an electrical switching mechanism for the quick connection and release, in particular for electric vehicles.

US5896258A describes an assembly for opening a power supply circuit which in anomalous conditions automatically closes after a short time interval.

Description of the invention

[0007] Starting from such prior art, an object of the present invention is to provide an innovative loading assembly of a switch, in particular a switch for electrical cabinets, capable of offering an innovative and alternative solution to the loading assemblies currently known.

[0008] In particular, the main object of the present invention is to offer a loading assembly of a switch for electrical cabinets in which the "idle" functions of the operating lever in the first movement, the end-of-strokes of the motion of the lever and the lever return in rest position are integrated in the assembly in a single position making the assembly compact and more efficient.

[0009] In accordance with such objects, the implementation of the present invention requires the presence of a loading assembly of a switch of an electrical switchboard in which the loading assembly comprises:

- a loading spring for loading the switch (which can be defined as main spring);
- an driving lever cyclically movable from a first (rest) position to a second (maximum excursion) position to perform loading strokes of the spring;
- a transmission on one side coupled to the operating lever and on the other side to the loading spring.

[0010] The motion of the lever is rotatory about a first end coupled to a frame which supports the transmission. In use, in the first position the lever is substantially vertical and the operator has to hold it at its free end so as to manually actuate the rotation thereof.

[0011] As previously mentioned, it is known to provide for the first motion phases of the lever not to determine

a loading of the main spring. According to the present invention, such effect is directly integrated in the coupling between the operating lever and the transmission (i.e. in the coupling between the first end of the lever and the transmission) in such a way that during the loading strokes the lever actuates the transmission only after passing an intermediate position between the first and second position.

[0012] According to the invention, the transmission comprises at least one first gear and thus the first end of the operating lever is coupled to such first gear. The first gear is made in the form of a rotatable gear wheel in rotation about a pin with an axis A. In such example, also the first end of the lever is rotatable about the same axis A. The gear wheel comprises a sleeve fitted on the pin which supports in an upper portion thereof a gear ring. The first end of the lever and a lower portion of the aforementioned sleeve comprise shaped coupling portions so as to make a coupling in which only after passing the intermediate position the motion of the lever drives in rotation the sleeve. The sleeve and the gear ring are, in turn, coupled in such a way that only during the loading stroke of the lever the sleeve drives the gear ring. In the stroke of the lever from the second to the first position the lever drives back only the sleeve without thus handling the gear ring which otherwise would unload the main spring.

[0013] As previously mentioned, the assembly of the present invention also comprises end-of-strokes so as to limit the rotation of the lever. According to the present invention also such functionality is obtained at the coupling of the lever to the first gear wheel gear. According to an embodiment, the aforementioned end-of-stroke device comprises a fixed pin protruding from a plate and is housed in a slotted seat formed in an object or body connected to the previously mentioned lower portion of the sleeve of the gear wheel. Such object, unlike the gear ring, is integral with the sleeve so as to be handled in both strokes of the lever and be able to cyclically go back to the start positions in which it locks the maximum excursions of the lever. Therefore, during the loading stroke of the lever, once driven in rotation the sleeve, this carries the end-of-stroke body and the gear wheel with it. The lever moves until the fixed pin is at the opposite end of the slotted seat relative to the rest position.

[0014] A return spring of the lever is preferably present configured to force the lever from the second to the first position, and is arranged at the coupling of the lever to the first gear wheel gear. As described above, the coupling between lever and gear wheel is such that, in the unloading stroke of the lever between second and first position, the gear ring is not moved so that the main spring does not lose the loading acquired in the previous cycle. Only the sleeve and the end-of-stroke body are driven back by the lever after a small idle movement from the second to the first position.

[0015] According to an embodiment, the return spring comprises a first end constrained to the first end of the lever and a second end directly or indirectly constrained to a fixed part of the structure, preferably to a fixed portion of the first gear wheel gear. The return spring in any case produces the complete return of the lever in the original rest position.

List of the figures

[0016] Further characteristics and advantages of the present invention will be apparent from the following description of a non-limiting example embodiment thereof, with reference to the accompanying drawings, wherein:

- Figure 1 shows a schematic view of an example of a loading assembly of a switch for electrical cabinets according to the present invention;
- Figure 2 shows a schematic section view of a portion of the assembly of Figure 1 along reference II indicated in Figure 1;
- Figures 3, 4 and 6 show schematic section views of a portion of the assembly of Figure 2 along reference III indicated in Figure 2 in different configurations of use of the assembly;
- Figures 5 and 7 show schematic section views of a portion of the assembly of Figure 2 along reference IV indicated in Figure 2 in the configurations of use of the assembly of Figures 4 and 6.

Description of an embodiment of the invention

[0017] With reference to the accompanying figures, Figure 1 shows a schematic view of an example of a loading assembly of a switch for electrical switchboards according to the present invention. In such figure, the loading assembly is indicated, as a whole, by reference numeral 1. According to the (non-limiting) example shown in Figure 1, the assembly 1 comprises a frame 2 in the form of at least one wall or plate 3. The plate 3 is flat and thus substantially defines a plane. The assembly 1 comprises an operating lever 4 at an edge of the plate 3. Such lever 4 comprises a first end 5 coupled in a rotatable manner to the plate about an axis A orthogonal to the plate 3. As it will be evident in the following, such axis A is the same axis of rotation of the gear wheel indicated by reference numeral 6 in Figure 1. The lever 4 further has an opposite free end 7 configured to be handled and moved by the operator as well as a hooked intermediate portion 8. The function of the hooked portion 8 is to form a small gripping portion (of the type capable of housing the finger of a hand) which is utilized in the first movement of the lever. In fact, in the rest position, the lever 4 is so flush with the plate that the operator cannot insert his/her hand between the plate 3 and the end 7. The fact that the portion 8 is small and capable of housing only one finger does not constitute a problem because, as it will be described in the following, the first movement of the lever does not drive in motion other components of the assembly.

[0018] These, in fact, will be driven only after a given angle of inclination of the lever 4 in which the end 7 can be entirely grabbed and handled with the necessary force. As mentioned, the first end 5 of the lever 4 is rotatable about an axis A which is also the axis of rotation of a first gear wheel 6. As is visible in this example, a second wheel 9 is also present coupled to the first wheel 6 which acts on the loading spring 10. The operation of the assembly of Figure 1 is thus the following. Starting from the position represented in Figure 1, the operator handles the lever 4 acting in the small portion 8 making the lever 4 make a rotation about the axis A which takes it from the first rest position to a first intermediate position. In such excursion, the end 5 of the lever 4 does not actuate the transmission. Only after passing such first intermediate position, i.e. continuing in the rotation of the lever 4 about the axis A, the end 5 of the lever 4 drives in rotation the gear wheel 6. The latter drives the second gear wheel 9 which, in turn, actuates the loading spring 10. Therefore, in such example, as in general according to the present invention, it is the coupling between the end 5 of the lever 4 and first gear wheel 6 to be configured to allow the first "idle" section of movement of the lever 4.

[0019] Figure 2 shows a schematic section view of a portion of the assembly of Figure 1 along reference II indicated in Figure 1. In such figure, it is visible that the gear wheel comprises a pin 11 along the axis A which supports in rotation a sleeve 20 which, in turn, supports a gear ring 21. The sleeve 20 comprises an upper portion (along the axis A) which supports the gear ring 21. The coupling between these elements is unidirectional, i.e. the sleeve drives the gear ring 21 only along the motion of the lever between the first and second position; in the opposite stroke, only the sleeve 20 is driven by the lever 4 with gear ring 21 stopped. The coupling between the end 5 of the lever 4 and sleeve 20 occurs at a lower portion 12 in the sleeve 20 in the proximity of the plate 3. Figure 3 shows a section view of the portion of Figure 2 along plane III and allows seeing how the lower portion 12 of the sleeve 20 and the end 5 of the lever 4 are shaped respectively in this example. As is visible, the lower portion 12 of the sleeve 20 of the wheel 6 has a section parallel to the plate 3 having a substantially square shape. The end 5 of the lever 4 comprises a seat 13 in which the lower portion 12 is inserted. According to this example, the seat 13 has a square shape but with V-shaped sides, hence a first rotation of the lever 4 about the axis A from the first to the second position does not engage the portion 12 and does not drive in rotation the sleeve 20 (and thus not even the gear ring 21). Only after such first movement, a different configuration is reached between seat 13 and lower portion 12 (visible in Figure 4) in which all further rotations of the lever 4 about the axis A from the first to the second position drive in rotation the sleeve 20 and with it in a unidirectional manner also the ring 21. Figure 6 shows the final position of the lever 4 in which its rotation from the initial position drove in rotation the wheel 6. By effect of the geometry of the seat 13 and of the portion 12 also starting from the position of Figure 6 for going back to the first position there is a first "idle" section of rotation of the lever 4 in which the sleeve 20 is not driven in rotation. Beyond such first idle section, the lever 4 drives the sleeve 20 whereas the ring 21 remains stopped.

[0020] According to the present invention, the first and second position of the lever 4 beyond which it is not possible to go are defined by the presence of an end-of-stroke device it too integrated at the lever 4 - wheel 6 coupling zone. Figure 7 shows to such purpose a body 14 coupled to the lower portion 12 of the sleeve 20 and interposed between the wall 3 and the portion 5 of the lever 4. Such body 14, which in Figure 2 is at the height of the section indicated by IV and which can be of one piece or simply integral with the sleeve, is indicated in Figure 7 and is also visible in minimum part in Figure 6. As is visible, such body 14 comprises a C-shaped slotted seat 16 which houses a protruding fixed pin 15 of the plate 3. The body 14 is always integral in both directions with the sleeve 20. In the position of initial drive of the sleeve 20, the pin 15 is at a first end of the seat 16 (Figure 5) and once in contact with the opposite end (Figure 7) it inhibits all further rotations of the sleeve 20 and thus of the lever 4.

[0021] Finally, Figure 2 allows noting how also the return spring 17 which forces the lever 4 towards the rest position is integrated in the coupling zone between lever 4 and gear 6. In this example, the spring 17 comprises an end coupled to a pin 18 protruding from the end 5 of the lever 4 and an opposite end coupled to an upper plate 19 of the supporting wheel 6 of the pin 11. Since the plate 19 remains stopped relative to the plate 3, the return of the spring 17 acts from the first movements of the lever 4 and allows recovering also the first phase of the rotation in which the wheel 6 is not moved by the lever 4.

[0022] The return stroke of the lever 4 from the second towards the first position ends when the end-of-stroke pin goes back in the opposite position of the seat. As already mentioned, the coupling between the sleeve 20 and the gear ring 21 is configured in such a way that during the return stroke the sleeve 20 does not drive back the gear ring 21 but only the body 14 with the end-of-stroke slot. Therefore, the lever 4 in the return stroke first accomplishes a small idle section and then drives back only the sleeve 20 and the end-of stroke 14 (not the gear wheel 21).

[0023] It is evident that modifications and variations can be made to the invention described herein relative to the example shown in the figures. The main aspect, in fact, of the present invention lies in the particular and common location inside the assembly of the functions of "idle" of the first section of the lever, of end-of-stroke of the lever and of return of the lever in the rest condition.

Claims

1. A loading assembly of a switch of an electrical switchboard, the assembly (1) comprising:

   - a loading spring (10) for loading the switch;
   - an operating lever (4) movable from a first position to a second position to perform loading strokes of the spring (10);
   - a transmission (9) on one side coupled to the operating lever (4) and on the other side to the loading spring (10); wherein the coupling between the operating lever (4) and the transmission (9) is configured in such a way that during the loading strokes the lever (4) actuates the transmission (9) only after passing an intermediate position between the first and second position;

   wherein the transmission (9) comprises at least one gear (6), the operating lever (4) comprising a first end (5) coupled to the gear (6);
   wherein the gear wheel comprises a sleeve (20) fitted rotatable in both directions on the pin (11) and a gear ring (21) fitted on an outer portion of the sleeve (20); the lower portion of the sleeve (20) being a shaped portion configured to couple to the first end (5) of the lever (4);
   wherein the coupling between sleeve (20) and gear ring (21) is such that the sleeve (20) drives in rotation the gear ring (21) only during the loading stroke of the lever (4) from the first to the second position; from the second to the first position the lever (4) drives in rotation the sleeve (20) with gear ring (21) stopped so as not to lose the loading made on the main spring (10).

2. Assembly as claimed in claim 1, wherein the assembly comprises a supporting wall (3), the gear (6) coupled to the lever (4) being made in the form of a gear wheel (6) supported in rotation relative to the wall (3) by a pin (11) having an axis A; also the first end (5) of the lever (4) being rotatable about the axis A.

3. Assembly as claimed in claim 1, wherein the coupling between the operating lever (4) and the sleeve (20) is configured such that also during the motion of the lever (4) from the second to the first position the sleeve (20) is driven only after passing a second intermediate position between the second and the first position.

4. Assembly as claimed in claim 1 or 3, wherein an end-of-stroke device is provided to limit the rotation of the lever (4).

5. Assembly as claimed in claim 4, wherein the end-of-stroke device comprises a fixed pin (15) protruding from the plate (3) housed in a slotted seat (16) formed in a body (14) integral in both directions of rotation with the lower portion (12) of the sleeve (20) of the gear wheel (6).

6. Assembly as claimed in any one of the preceding claims, wherein a return spring (17) is provided configured to force the lever (4) from the second to the first position.

7. Assembly as claimed in claim 6, wherein the return spring (17) comprises a first end constrained to the lever (4) and a second end constrained to a fixed portion (19) of the assembly.

8. Assembly as claimed in claim 6, wherein a fixed portion (19) of the assembly is a fixed portion of the gear wheel (6).

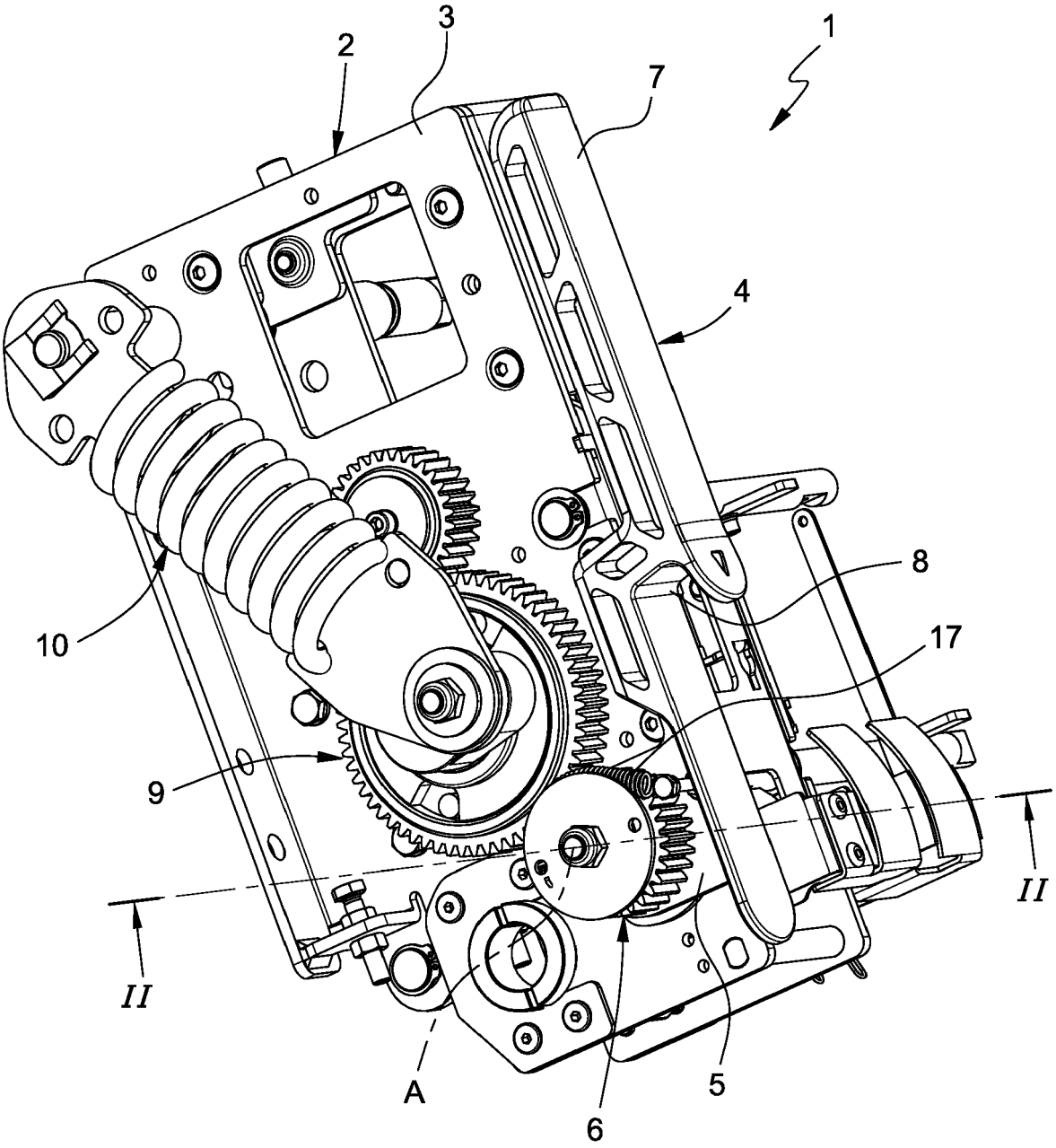

FIG. 1

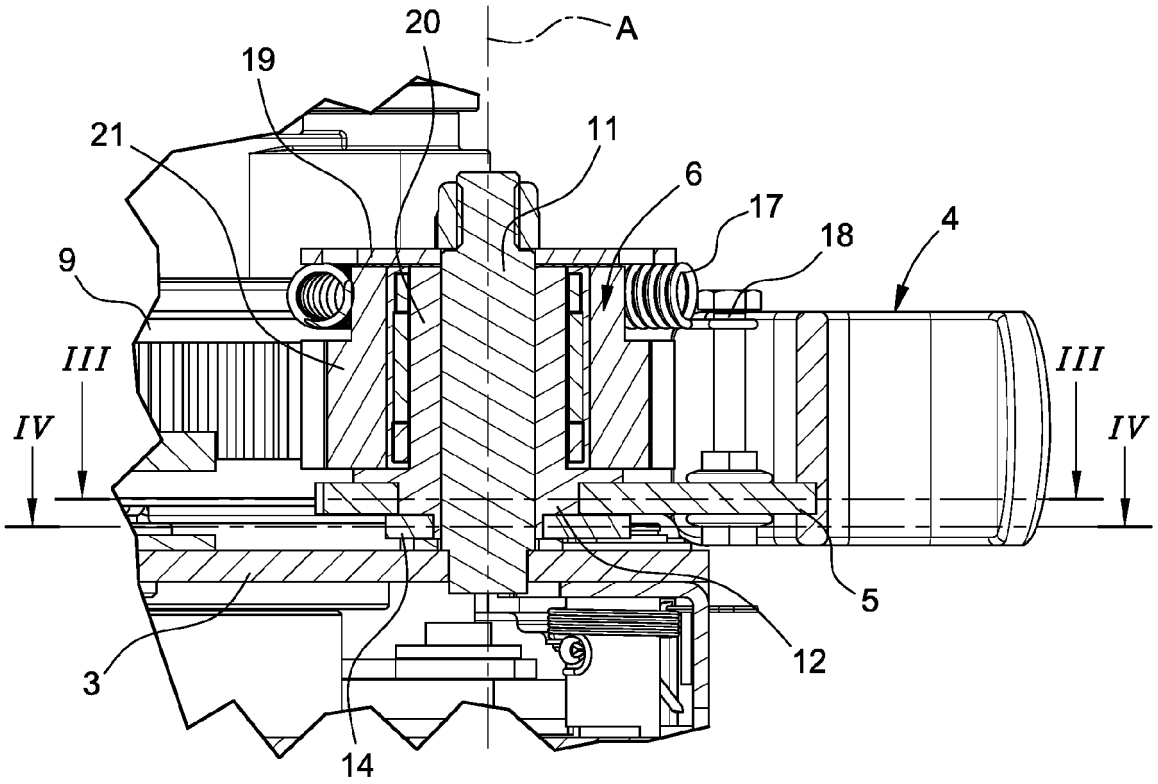

FIG. 2

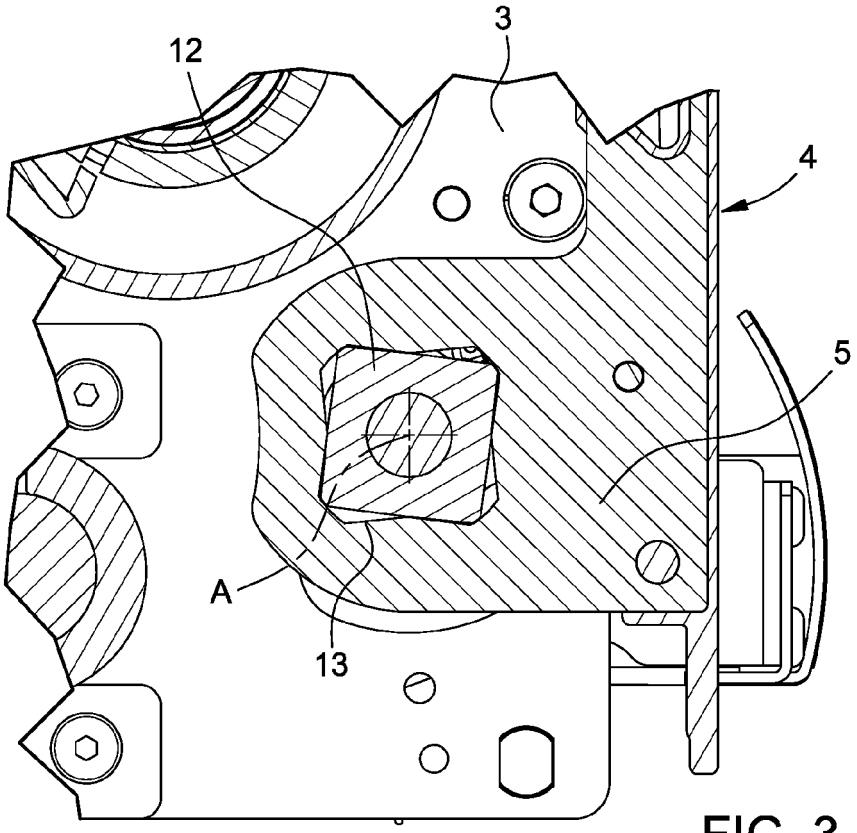

FIG. 3

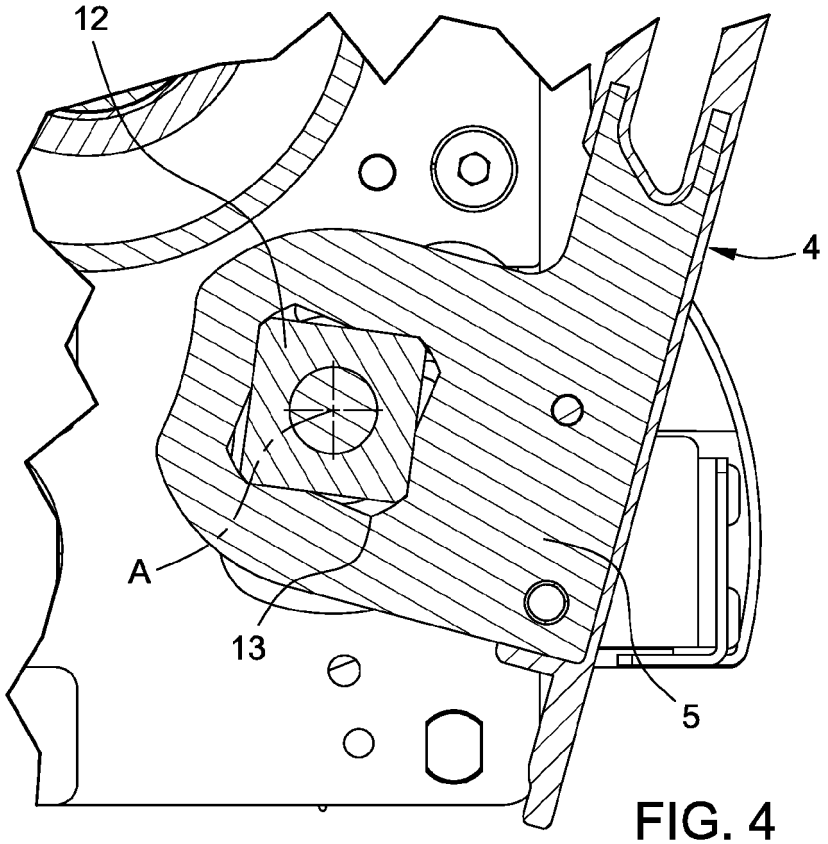

FIG. 4

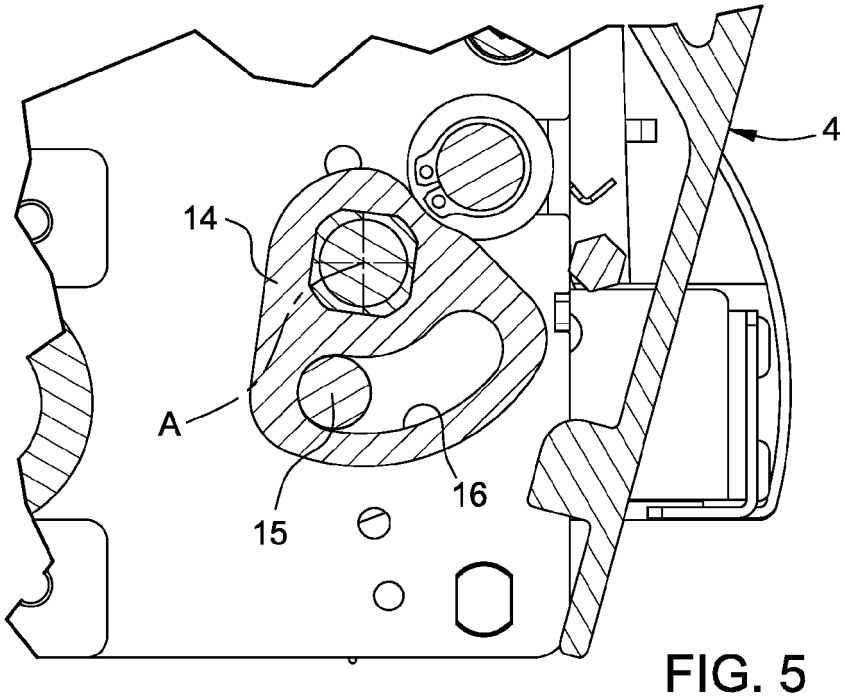

FIG. 5

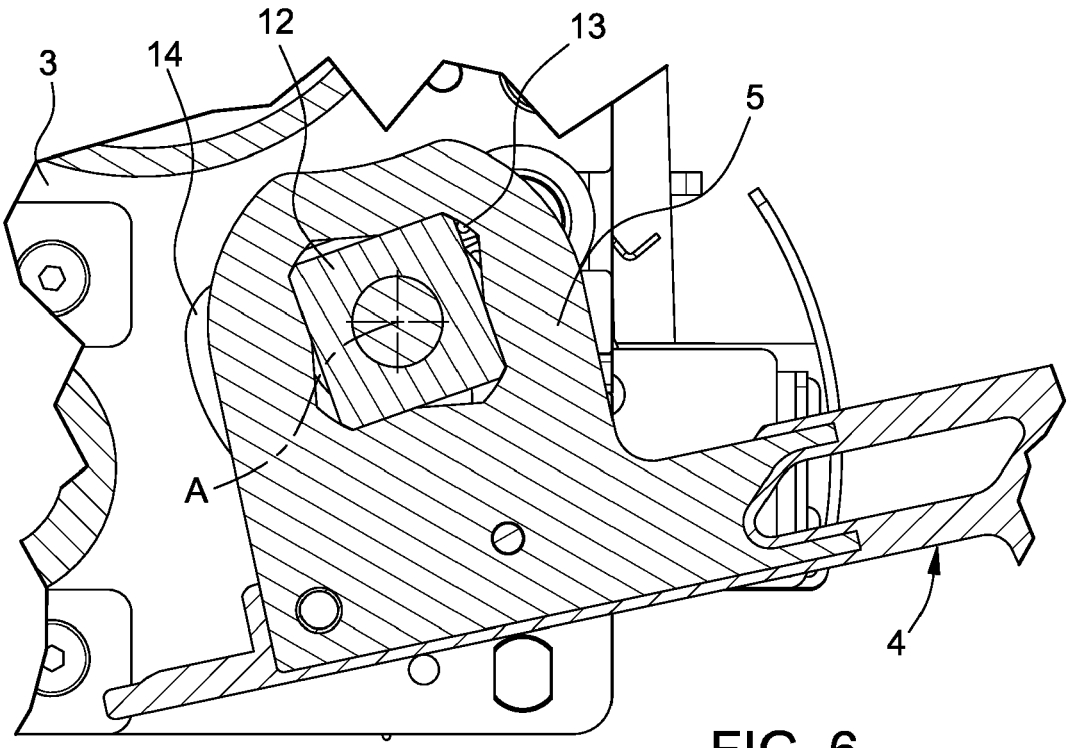

FIG. 6

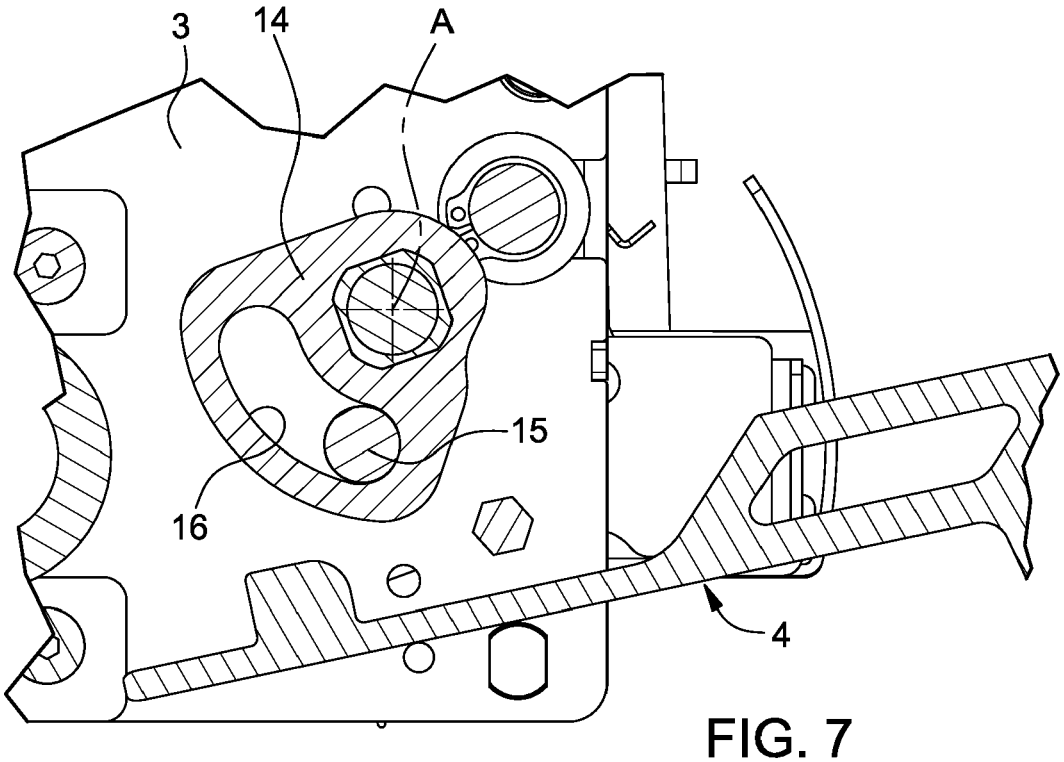

FIG. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 23 16 5893

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	US 5 850 909 A (WAGNER BRIAN L [US]) 22 December 1998 (1998-12-22) * column 3, line 48 - column 9, line 51 * * figures 1-13 *	1-8	INV. H01H21/38 H01H3/48
A	US 5 896 258 A (COTTON ROSS ALEXANDER [CA] ET AL) 20 April 1999 (1999-04-20) * column 2, line 43 - column 4, line 62 * * figures 1-6 *	1-8	

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	14 August 2023	Ledoux, Serge

CATEGORY OF CITED DOCUMENTS

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14-08-2023

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5850909 A	22-12-1998	NONE	
US 5896258 A	20-04-1999	CA 2191140 A1	25-05-1998
		US 5896258 A	20-04-1999

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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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Patent documents cited in the description

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- EP 1538650 A **[0003]**
- EP 1226596 A **[0003]**
- US 5850909 A **[0006]**
- US 5896258 A **[0006]**