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(54) **Residual-current circuit breaker**

(57) A residual-current circuit breaker, characterized in that it includes at least one movable contact that acts on a fixed contact; the movable contact is connected to a first terminal and the fixed contact is connected to a second terminal; a test circuit has a contoured blade that is connected to the second terminal, a button acting on a spring, said button being accessed from the outside; when the button is pressed, the spring closes the test circuit, making contact with the contoured blade; the test circuit also has a test contact elastic plate and a resistor; the test contact elastic plate is coupled to the resistor and is in contact with the spring; the elastic plate is in contact with the movable contact when the movable contact is in the closed position, in contact with the fixed contact.

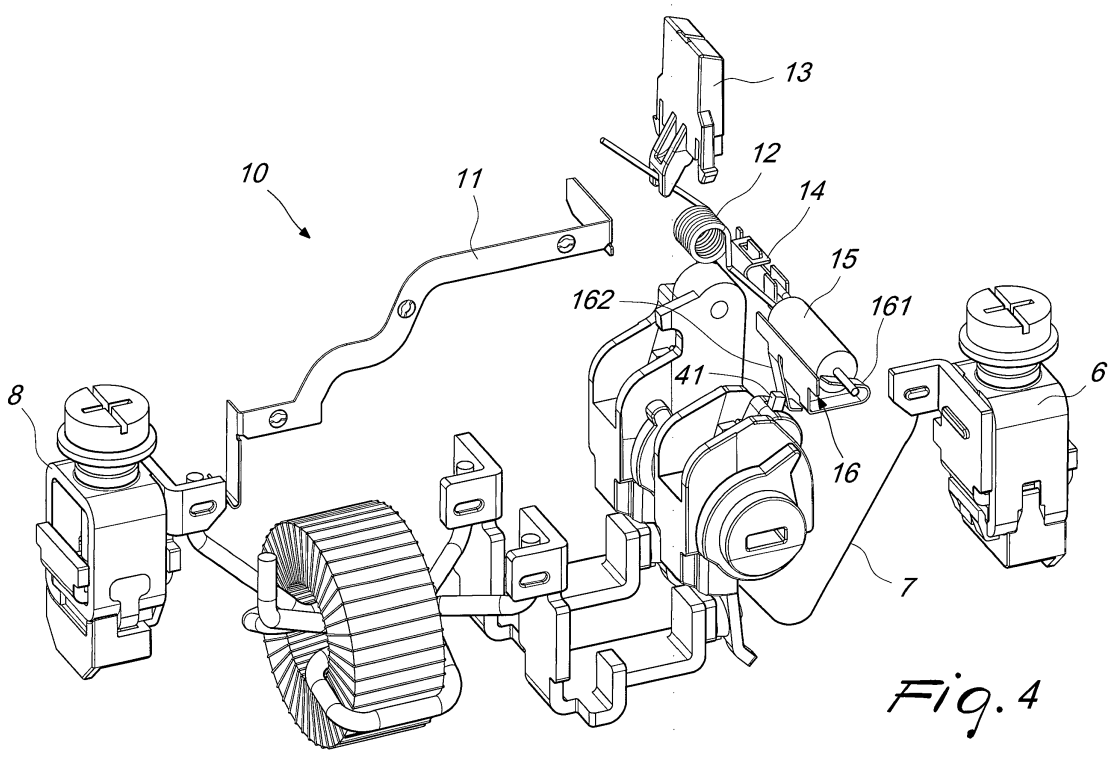

Fig. 4

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Description

[0001] The present invention relates to a residual-current circuit breaker.

[0002] As is known, residual-current circuit breakers are normally provided in domestic and industrial systems in order to prevent a fault current from causing danger for users and for loads connected to the electrical line.

[0003] Essentially, the residual-current circuit breaker, upon detecting the presence of the fault current, releases the line, thus interrupting the power supply to the load or loads arranged downstream.

[0004] After the release of the residual-current circuit breaker, and once the correct operating conditions for the system have been restored, the residual-current circuit breaker has to be reset.

[0005] Residual-current circuit breakers are generally provided with a test button, by means of which it is possible to release the circuit breaker, simulating a fault, in order to check the correct operation of the release system.

[0006] The test button is part of a test circuit that is installed inside the residual-current circuit breaker.

[0007] EP1916692 discloses a residual-current circuit breaker provided with a test circuit which, as in other conventional types of circuit breaker, is assembled by means of soldering operations. Also, the test circuit is functionally connected to the operating components of the circuit breaker by means of wires.

[0008] EP1562212 discloses a test device with an electrical resistance with which first and second current paths are electrically connected. The test device has an electrical connecting line with one end configured as a spring contact element so that the electrical connection between the first current path and the second current path can be made by overcoming the corresponding spring force.

[0009] A problem that is always felt in the design and manufacture of residual-current circuit breakers is to provide a structure that has a small number of components and is simple to assemble, in order to reduce production costs, at the same time ensuring maximum reliability and safety of the apparatus.

[0010] The aim of the present invention is to provide a residual-current circuit breaker with a test circuit that is constructively simpler to provide than the test circuits traditionally applied to this type of circuit breaker.

[0011] Within the scope of this aim, an object of the invention is to provide a residual-current circuit breaker that allows the assembly of a test circuit without any soldering operation and without wires.

[0012] Another object of the present invention is to provide a circuit breaker which, by virtue of its particular constructive characteristics, is capable of giving the greatest assurances of reliability and safety in use.

[0013] This aim and these and other objects that will become better apparent hereinafter are achieved by a residual-current circuit breaker characterized in that it comprises at least one movable contact that acts on a fixed contact; said movable contact being connected to a first terminal and said fixed contact being connected to a second terminal; said circuit breaker being characterized in that it comprises a test circuit, which comprises a contoured blade that is connected to said second terminal; a button acting on a spring, said button being accessed from the outside; when said button is pressed, said spring closing said test circuit, making contact with said contoured blade; said test circuit further comprising a test contact elastic plate and a resistor; said test contact elastic plate being coupled to said resistor and being in contact with said spring; said elastic plate being in contact with said movable contact when said movable contact is in said closed position, in contact with said fixed contact.

[0014] Further characteristics and advantages will become better apparent from the description of preferred but not exclusive embodiments of the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a side view of the internal components of a residual-current circuit breaker, provided with a test circuit according to the present invention and shown in the condition in which the contacts are closed;

Figure 2 is a partial side view of the opposite side, with respect to the preceding figure, showing the breaker in the condition in which the contacts are closed;

Figure 3 is a side view of the internal components of a residual-current circuit breaker, shown in the condition in which the contacts are open;

Figure 4 is an exploded perspective view of the test circuit;

Figure 5 is another perspective view of the test circuit;

Figure 6 is a perspective view of the spring, of the elastic contact plates, of the resistor and of the test contact;

Figure 7 is a perspective view of the residual-current circuit breaker, shown with its enclosure, in the act of applying a wire to the test contact elastic plate;

Figure 8 is an enlarged-scale perspective view of the region of the test contact elastic plate;

Figure 9 is a view, similar to the preceding one, showing the step of insertion of the tip of a screwdriver at the test contact elastic plate;

Figure 10 is a view, similar to the preceding one, showing the step of insertion of the wire in the test contact elastic plate;

Figure 11 is a view, similar to the preceding one, showing the wire in the inserted position.

[0015] With reference to the cited figures, the residual-current circuit breaker according to the invention, generally designated by the reference numeral 1, includes a supporting structure 2, on which an actuation handle 3 is mounted for controlling a contact actuation mechanism.

[0016] The contacts have at least one main movable contact 4 that acts on a main fixed contact 5.

[0017] The movable contact 4 is connected to a first terminal 6 by means of a wire 7. The fixed contact 5 is connected to a second terminal 8.

[0018] According to the present invention, the circuit breaker 1 has a test circuit, generally designated by the reference numeral 10, which includes a contoured blade 11 mounted on the supporting structure 2.

[0019] The contoured blade 11 is preferably made of stainless steel.

[0020] The contoured blade 11 is connected to the second terminal 8 by a protrusion that makes contact with the end of the external cable associated with the terminal 8.

[0021] The test circuit also has a spring 12 on which a button 13 that can be accessed from the outside acts.

[0022] The spring 12 is capable of closing the circuit when it touches the contoured blade 11 by virtue of the action of the button 13.

[0023] The test circuit 10 also has a test contact elastic plate 14 that is coupled to a resistor 15 and is in contact with the spring 12.

[0024] The test contact elastic plate 14 is configured to engage the end of an electrical wire 18 by means of a tool such as a screwdriver 17.

[0025] Figures 7-11 are schematic views of the sequence of operations for engaging the end of the wire 18 with the plate 14.

[0026] The resistor 15 adjusts the ampere turns of the test circuit as a function of the nominal characteristics of the residual-current circuit breaker. The current generated during the test must be in fact a certain multiple of the residual current of the device.

[0027] A second plate 16 has two elastic tabs: a first elastic tab 161 makes contact with the lead of the resistor 15, while a second elastic tab 162 makes contact with a protrusion 41 of the movable contact 4, when the movable contact 4 is in the closed position, as shown more clearly in Figures 4 and 5.

[0028] The test circuit has two situations for the opening of the movable contact.

[0029] During the normal operation of the breaker, when the movable contact 4 is closed on the fixed contact 5, the spring 12 is spaced from the blade 11 and therefore the test circuit is normally open.

[0030] By acting on the button 13, the spring 12 is moved into contact with the blade 11, closing the test circuit and causing the automatic opening of the residual-current circuit breaker, in the case of correct operation.

[0031] A second situation for opening the movable contact 4 is caused when the button 13 is pressed for a time that is longer than the residual-current circuit breaker tripping time.

[0032] Normally, with the movable contact 4 in the closed position, the protrusion 41 of the movable contact 4 interferes with the second elastic tab 162 of the second plate 16.

[0033] By keeping the test button 13 pressed beyond the residual-current circuit breaker tripping time, the automatic opening of the movable contact 4 causes the opening of the test circuit, moving away the movable contact from the second plate, thus avoiding the persistence of the current in the circuit and therefore avoiding the failure of the resistor 15.

[0034] In practice it has been found that the invention achieves the intended aim and objects, a residual-current circuit breaker having been provided which has a test circuit that is constructively simpler to manufacture with respect to test circuits traditionally applied to this type of breaker.

[0035] An important advantage of the present invention resides in that the test circuit can be installed in the residual-current circuit breaker without any soldering operation and without using wires.

Claims

1. A residual-current circuit breaker **characterized in that** it comprises at least one movable contact that acts on a fixed contact; said movable contact being connected to a first terminal and said fixed contact being connected to a second terminal; said circuit breaker being **characterized in that** it comprises a test circuit, which comprises a contoured blade that is connected to said second terminal; a button acting on a spring, said button being accessed from the outside; when said button is pressed, said spring closing said test circuit, making contact with said contoured blade; said test circuit further comprising a test contact elastic plate and a resistor; said test contact elastic plate being coupled to said resistor and being in contact with said spring; said elastic plate being in contact with said movable contact when said movable contact is in said closed position, in contact with said fixed contact.

2. The circuit breaker according to claim 1, **characterized in that** said contoured blade is mounted on said supporting structure.

3. The circuit breaker according to claim 1, **characterized in that** said contoured blade is connected to said second terminal by means of a protrusion that makes contact with the end of an external cable associated with said second terminal.

4. The circuit breaker according to one or more of the preceding claims, **characterized in that** said test contact elastic plate engages the end of an electrical wire by means of a tool such as a screwdriver.

5. The circuit breaker according to one or more of the preceding claims, **characterized in that** said resistor adjusts the ampere turns of the test circuit.

6. The circuit breaker according to one or more of the preceding claims, **characterized in that** said second plate comprises two elastic tabs: a first elastic tab, which makes contact with the lead of said resistor, and a second elastic tab, which makes contact with a protrusion of said movable contact, when said movable contact is in the position in contact with said fixed contact.

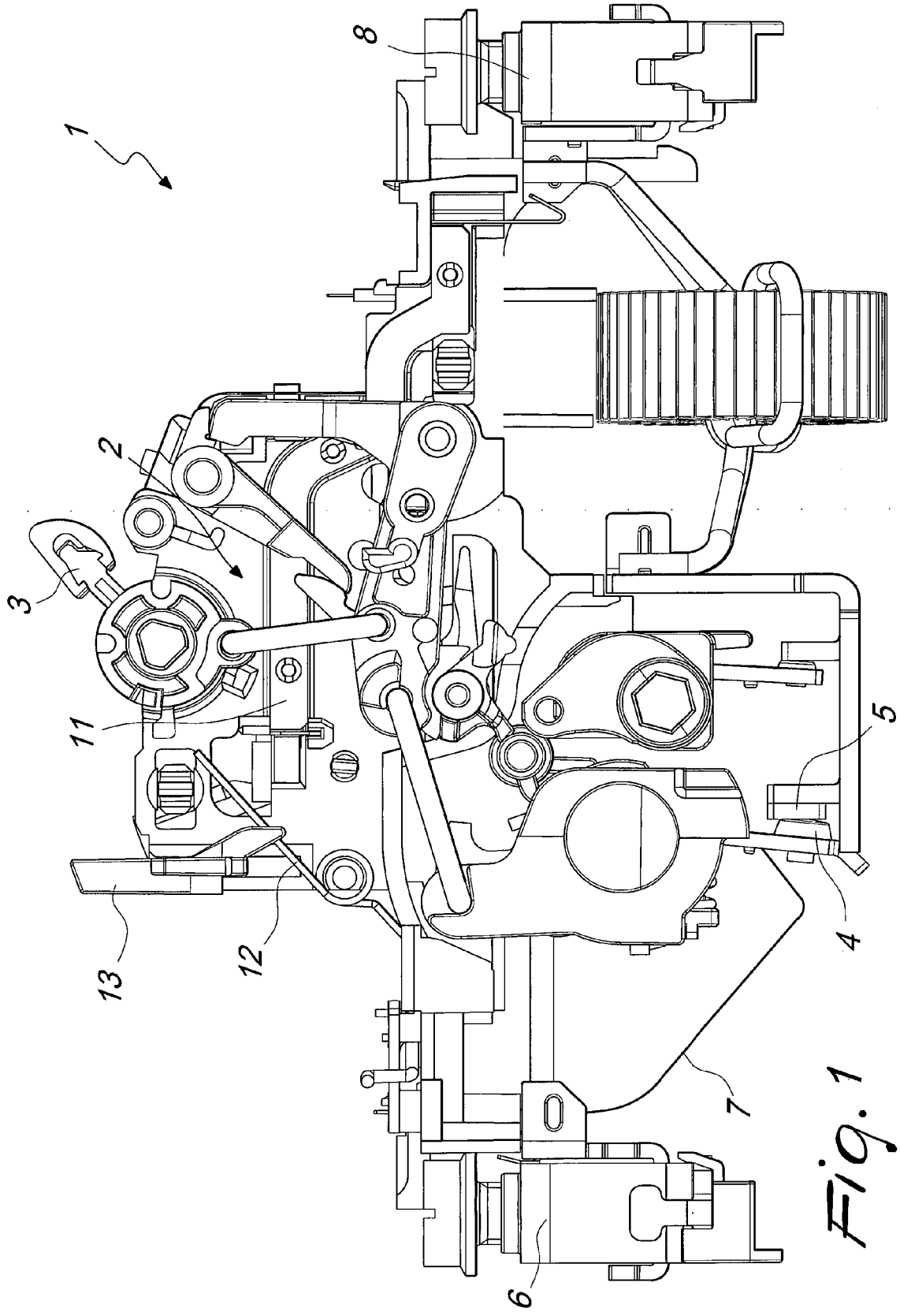

Fig. 1

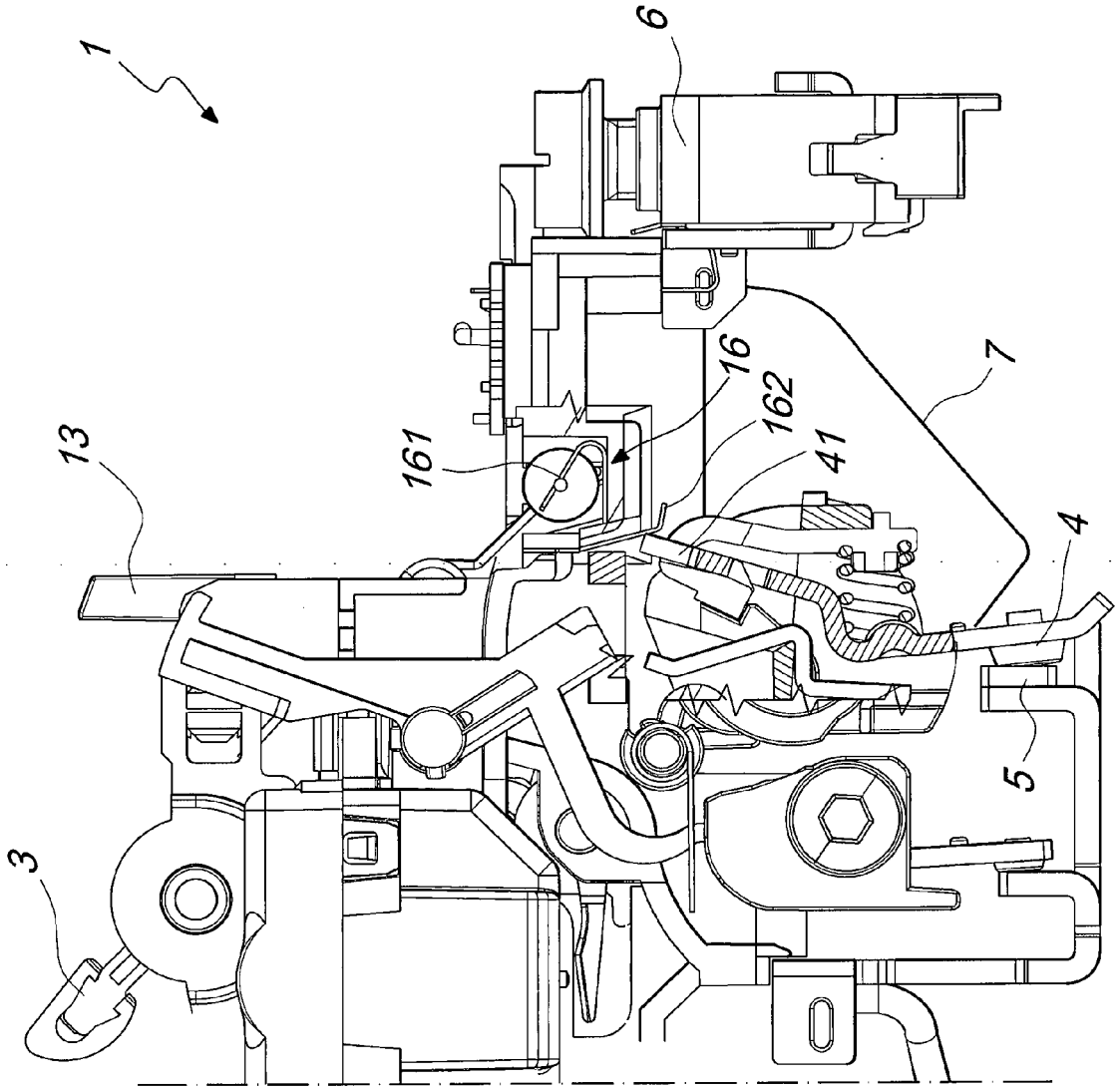

Fig. 2

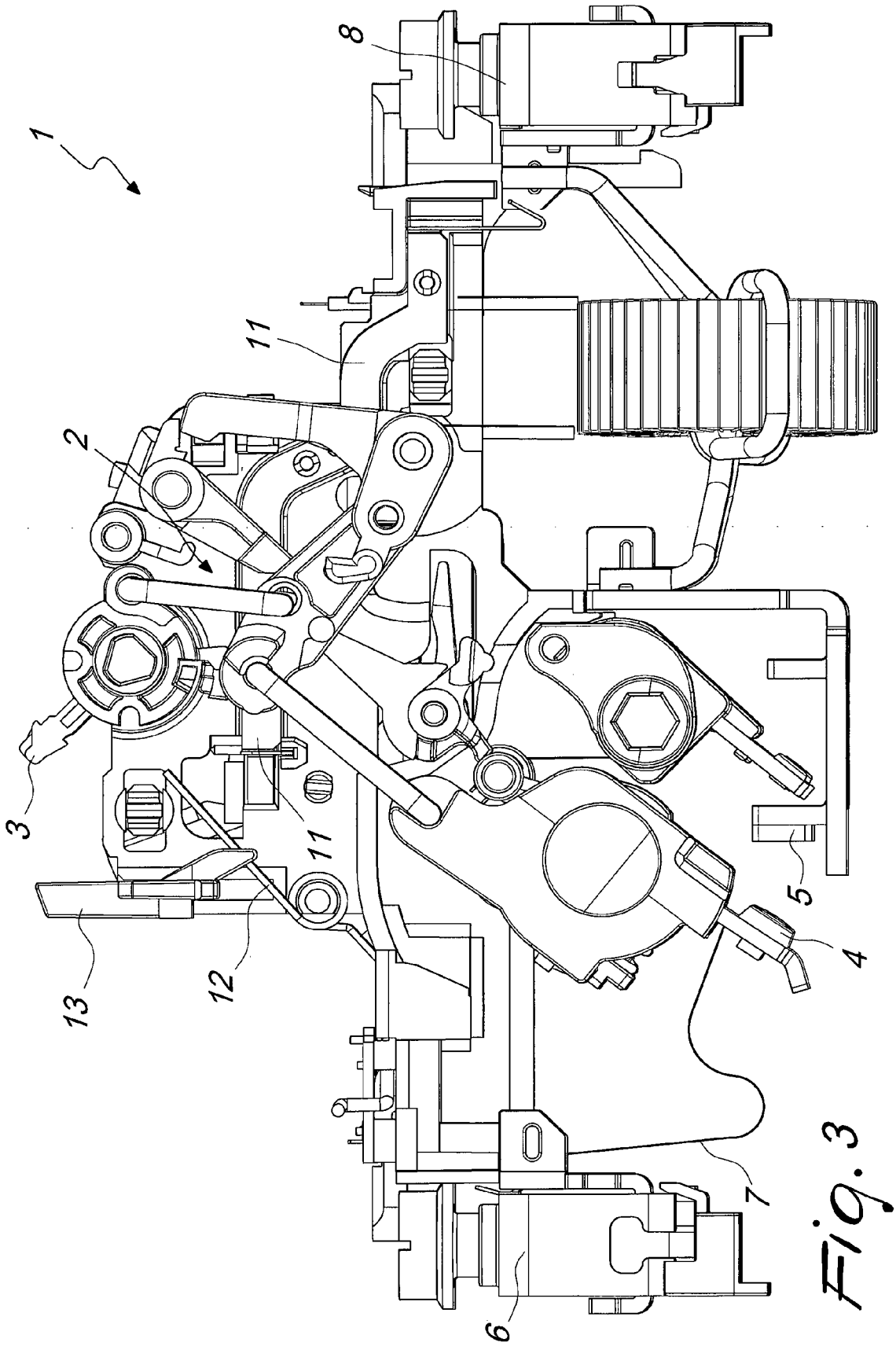

Fig. 3

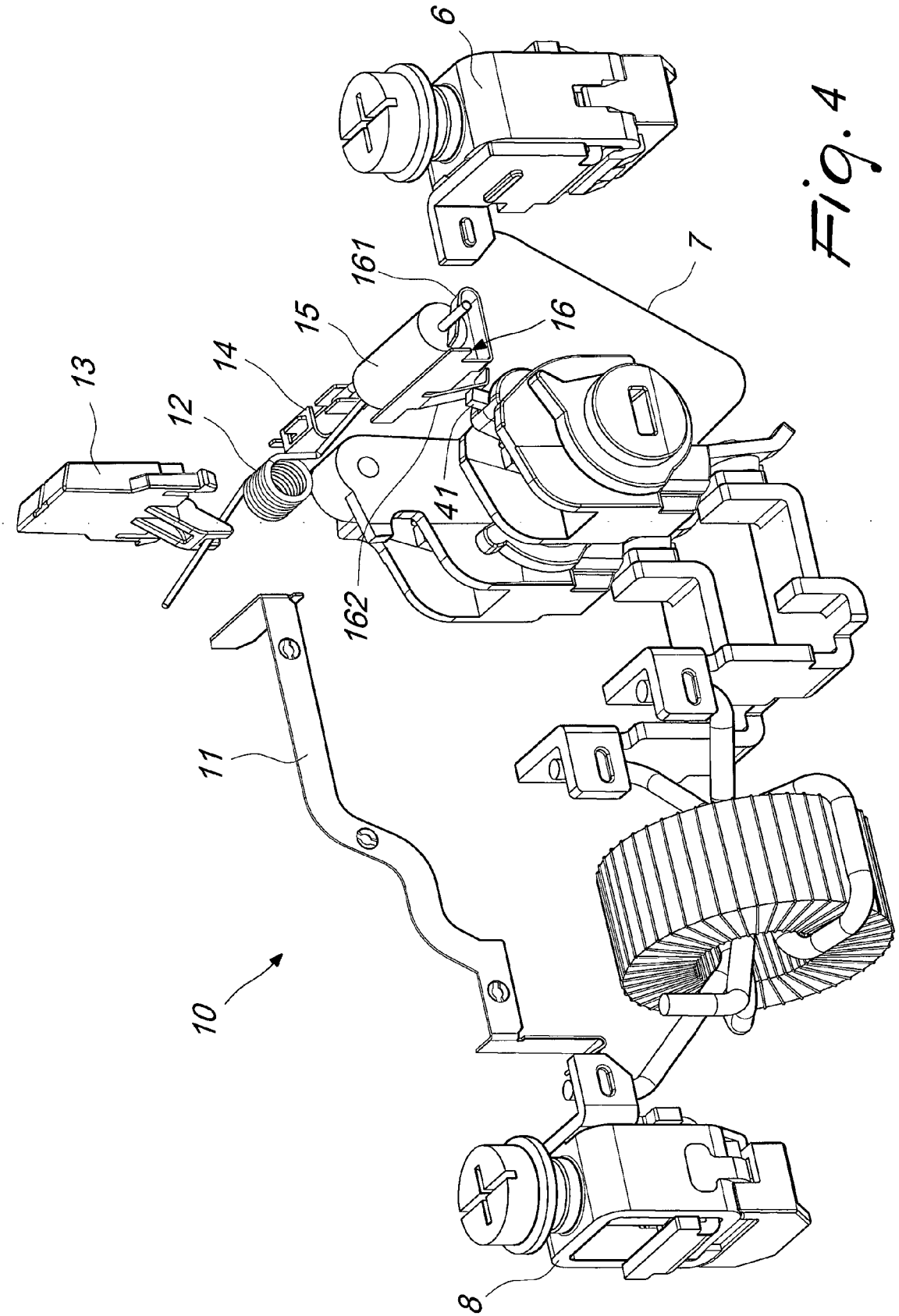

Fig. 4

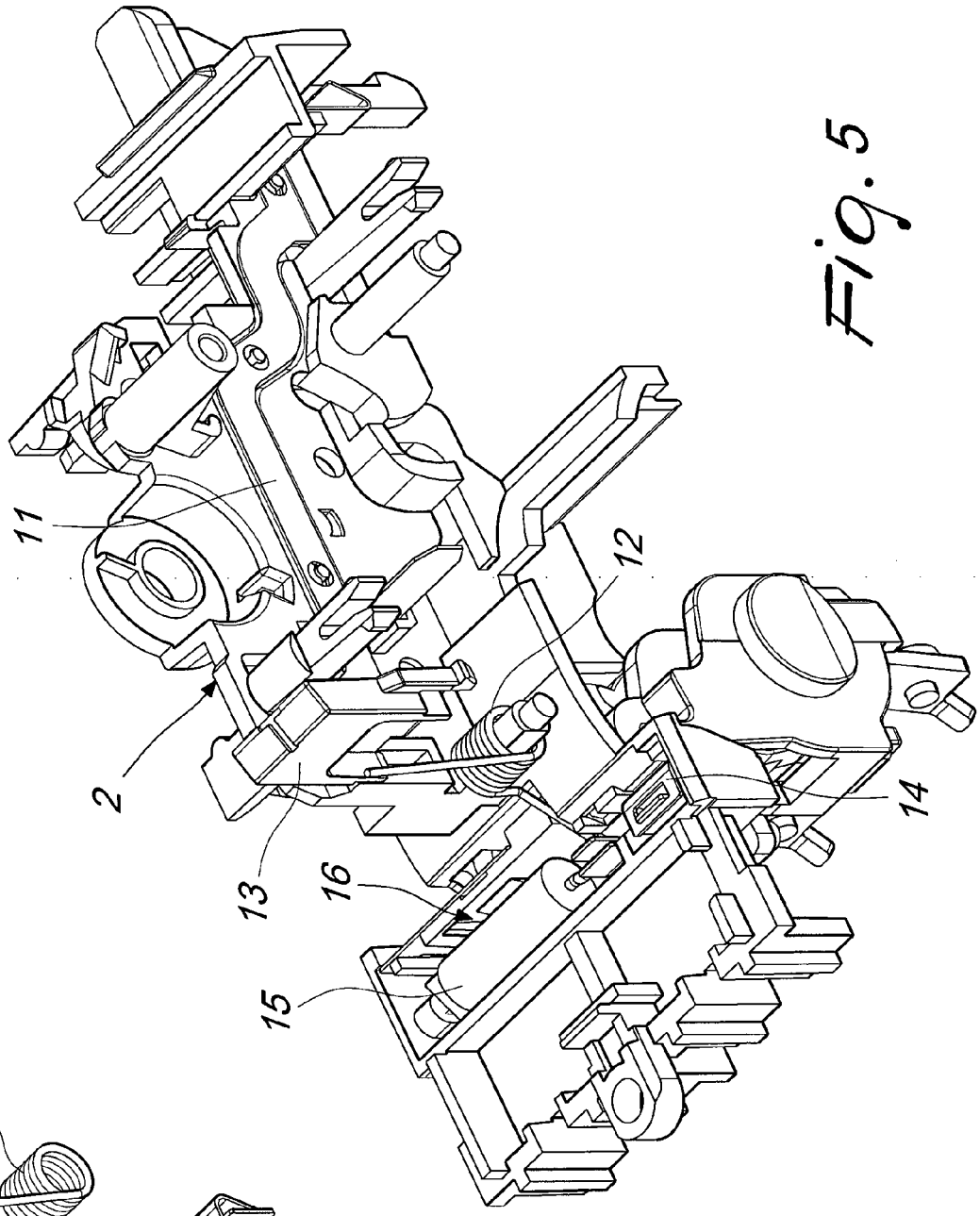

Fig. 5

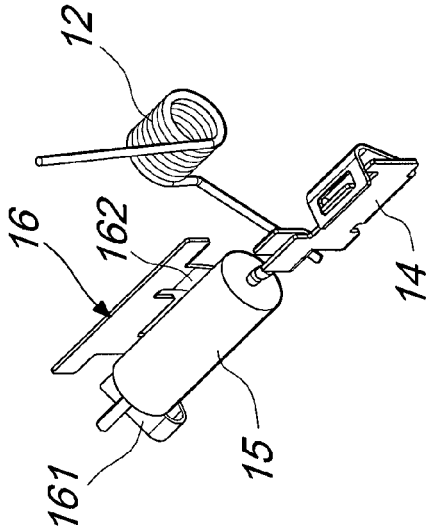

Fig. 6

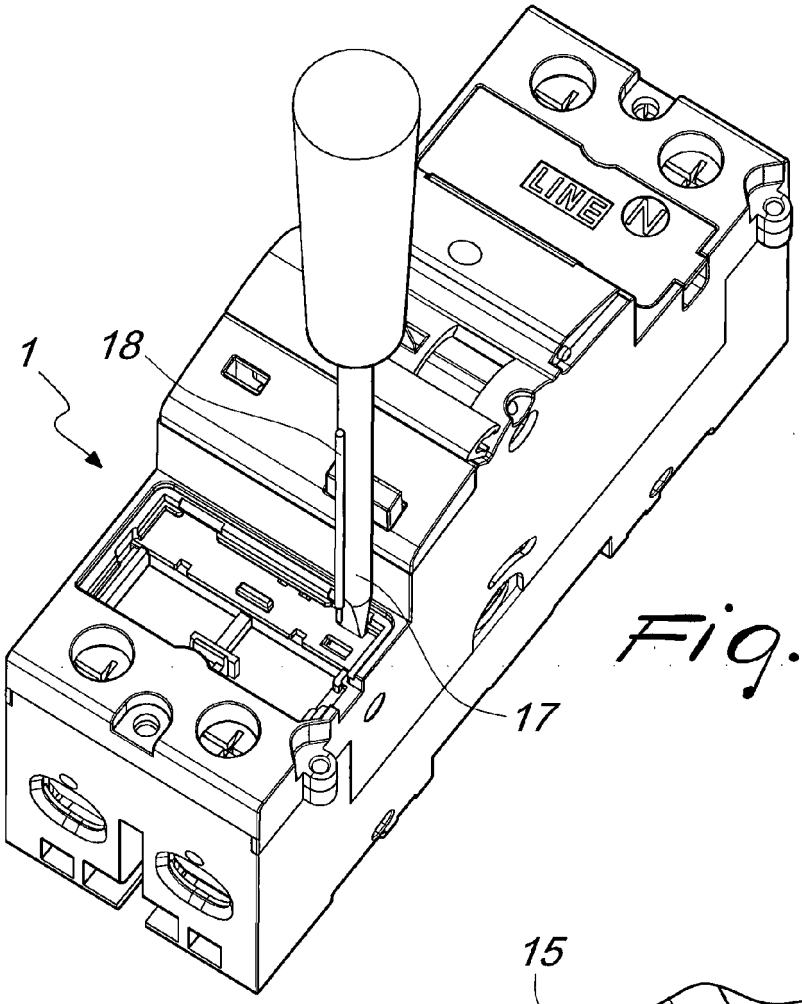

Fig. 7

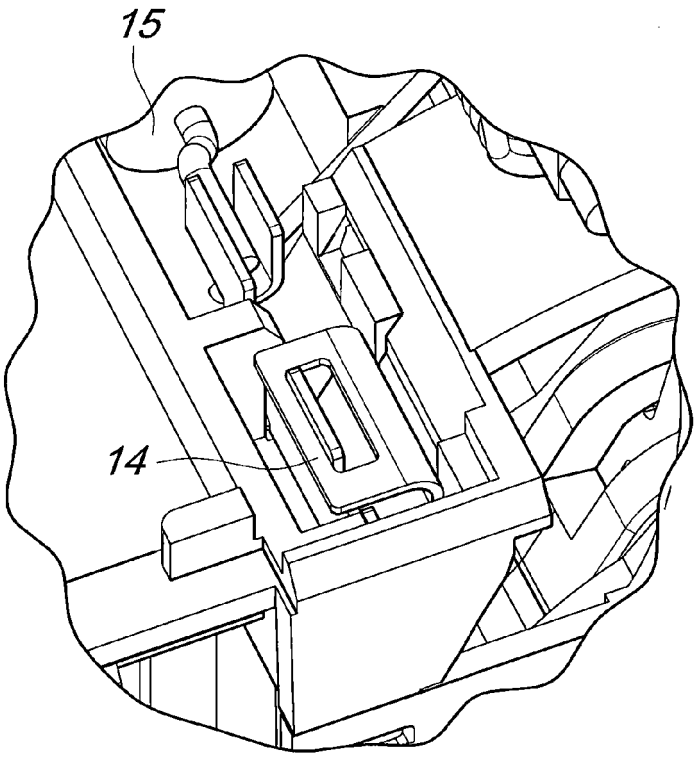

Fig. 8

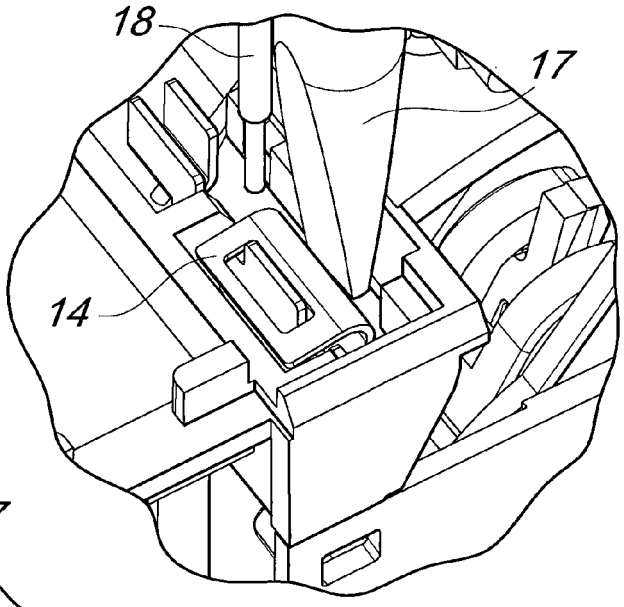

Fig. 9

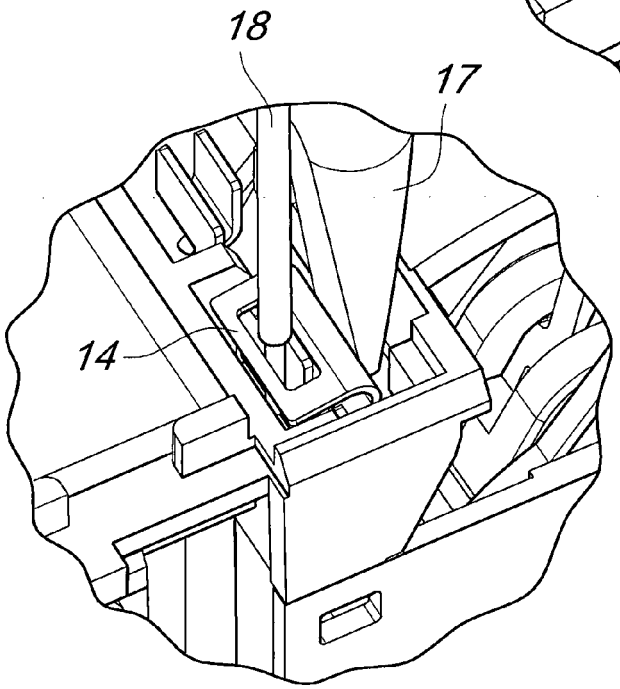

Fig. 10

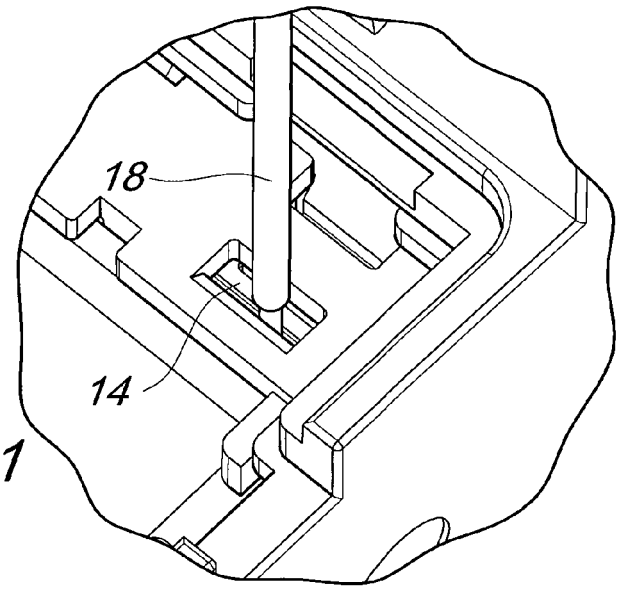

Fig. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 14 00 2119

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A	FR 2 489 587 A1 (LICENTIA GMBH [DE]) 5 March 1982 (1982-03-05) * page 2, line 21 - page 4, line 27; figures 1-3 *	1	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	22 October 2014	Nieto, José Miguel

CATEGORY OF CITED DOCUMENTS

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