(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 507 275 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
02.02.2011 Bulletin 2011/05

(21) Application number: **02728105.4**

(22) Date of filing: **22.05.2002**

(51) Int Cl.:
H01H 73/08 *(2006.01)* ***H01H 73/00*** *(2006.01)*

(86) International application number:
PCT/JP2002/004943

(87) International publication number:
WO 2003/098652 (27.11.2003 Gazette 2003/48)

(54) **INSERTION TYPE CIRCUIT BREAKER**

UNTERBRECHERSCHALTUNG DES EINFÜGETYPS

DISJONCTEUR A INSERTION

(84) Designated Contracting States:
DE

(43) Date of publication of application:
16.02.2005 Bulletin 2005/07

(73) Proprietor: **MITSUBISHI DENKI KABUSHIKI KAISHA**
Chiyoda-ku
Tokyo 100-8310 (JP)

(72) Inventors:
- **KAWAKAMI, Kanehiro,**
  c/o Mitsubishi Denki K.K.
  Chiyoda-ku,
  Tokyo 100-8310 (JP)
- **ISHIKAWA, Akira,**
  c/o Mitsubishi Denki K.K.
  Chiyoda-ku,
  Tokyo 100-8310 (JP)

(74) Representative: **HOFFMANN EITLE**
Patent- und Rechtsanwälte
Arabellastraße 4
81925 München (DE)

(56) References cited:
EP-A1- 0 567 415
EP-A1- 1 148 530
JP-A- 8 185 782
JP-A- 11 096 861
JP-B2- 2 504 683
US-A- 5 719 363

EP 1 507 275 B1

Description

Technical Field

[0001] The present invention relates to a Plug-In Circuit Breaker in which a circuit breaker body is detachable with respect to a mounting base and, more specifically, a Plug-In Circuit Breaker including a safety trip apparatus that brings a switch contact into an open circuit to interrupt a load current when inserting and pulling out the circuit breaker body.

Background Art

[0002] Fig. 8 is a longitudinal cross sectional view of essential part in the state of having inserted base a circuit breaker body of the conventional Plug-In Circuit Breaker into a mounting, which is disclosed in the European Patent Publication No. WO 01/27959.

[0003] Figs. 9 are enlarged cross sectional views when releasing engagement with a trip mechanism of a safety trip apparatus constituting the Plug-In Circuit Breaker of Fig. 8. Fig. 9(a) is an enlarged side cross-sectional view, Fig. 9(b) is a top cross-sectional view of an essential part of Fig. 9(a), and Fig. 9 (c) is an enlarged perspective view of an internal part showing a fitted state of a trip rod and a case.

[0004] Referring to Fig. 8, a circuit breaker body includes: a plug-in terminal 4 serving as a terminal connecting member on the power supply side and on the load side to which a tulip-shaped connector 3 serving as a connection contact member, which is held in a case made of a molded insulator under a predetermined contact pressure applied by a pressure spring 2; a power supply terminal 5 and a load side terminal 6 attached respectively to each plug-in terminal 4; a switch contact (not shown) that is electrically connected between the power supply side terminal 5 and load side terminal 6, and makes and breaks a circuit where a load current flows; a switch mechanism (not shown) bringing this switch contact into an open or closed state; a trip mechanism (not shown) causing this switch mechanism to operate when an over-current flows in the circuit; and a handle 1a with which the switch mechanism can be manually operated.

[0005] Disposed on the mounting base 7, into which the circuit breaker body 1 is plugged, are a plug-in base 8 made of a molded insulator; an external conductor 9 that is connected to both of the power supply side and the load side of the plug-in base 8; and a plug-in stud 10 serving as a terminal member to be plugged in and connected to the connector 3.

[0006] Numeral 11 designates a stud cover for fixing and insulating the plug-in stud 10.

[0007] Numeral 12 designates a trip shaft forming a part of the trip mechanism. This trip shaft 12 is biased clockwise by means of a spring (not shown). When any over-current flows in the circuit, the trip shaft 12 turns counterclockwise (in a direction indicated by the arrow F12) by a predetermined amount to bring the switch mechanism (not shown) into operation.

[0008] Numeral 13 designates a trip rod serving as a tripping operation member, one end 13a of which is engaged with the trip shaft 12 so as to move freely and the other end 13b of which is in contact with a protrusion 8a disposed at the plug-in base 8. Numeral 14 designates a compression spring giving an impetus to the trip rod 13 toward the plug-in base 8. Numeral 15 (shown in Fig. 9) designates a case located around outer circumferences of the trip rod 13 and compression spring 14. These trip rod 13, compression spring 14 and case 15 form a safety trip apparatus.

[0009] In the conventional Plug-In Circuit Breaker constructed as described above, in the state that the circuit breaker body 1 is mounted onto the mounting base 7, the other end 13b of the trip road 13 is in contact with the protrusion 8a, and the trip rod 13 is pressed onto the side of the trip shaft 12. Therefore, one end 13a of the trip rod 13 does not act on a retainer 12a of the trip shaft 12. Accordingly the switch contact of the circuit breaker body 1 is in a closed-circuit state to conduct a load current.

[0010] In the state of conducting current as described above, when carrying out operation of detaching the circuit breaker body 1 from the mounting base 7, the trip rod 13 moves toward the side of the plug-in base 8 by the action of the compression spring 14, and one end 13a of the trip rode 13 acts on the retainer 12a of the trip shaft 12 to cause the trip shaft 12 to turn in a direction indicated by the arrow F12. This turn of the trip shaft 12 causes the switch mechanism to operate eventually to bring the switch contact in an open circuit resulting in interruption of a load current before the connector 3 separates from the plug-in stud 10.

[0011] Furthermore, in case of causing the other end 13b of the trip rod 13 to turn by substantially 90° with the use of, e.g., screwdriver to bring it into a state as shown in Fig. 9, a protrusion 13c of the trip rod 13 moves to an upper surface portion 15b of the case 15, and thereafter is fitted to a concave part 15c. In addition, one end 13a of the trip rod 13 turns by substantially 90° as well and becomes disengaged with the retainer 12a of the trip shaft 12, whereby the trip rod 13 comes to be incapable of moving in a direction indicated by the arrow F13. Thus the other end 13a of the trip rod 13 comes not to act on the retainer 12a of the trip shaft 12.

[0012] In such a state, since the protrusion 13c of the trip rod 13 is fitted to the concave part 15c of the case 15, the trip rod 13 cannot turn from this position. Moreover, since the protrusion 13c of the trip rod 13 is pressed onto the concave part 15c by means of the compression spring 14, the condition becomes stationary in the state that the engagement between one end 13a of the trip rod 13 and the retainer 12a of the trip shaft 12 is released. It is possible to operate the switch mechanism with the handle 1a in the state that the circuit breaker body 1 is detached from the mounting base 7 to check whether the

switch contact is open or closed.

[0013] In the conventional Plug-In Circuit Breaker constructed as described above, in the closed-circuit state of the switch contact of the circuit breaker body 1, when inserting the circuit breaker body 1 into the mounting base 7 in the state capable of performing an open/close check, specifically, in the state that the trip rod 13 is made stationary, the safety trip apparatus does not perform any tripping operation, and therefore arc is generated when the plug-in stud 10 comes in contact with the connector 3.

[0014] Besides, when detaching the circuit breaker body 1 having been plugged in under the state that the trip rod 13 is made stationary, the safety trip apparatus does not perform the tripping operation, either. Consequently another problem exists in that the arc is generated when the connector 3 separates from the plug-in stud 10.

[0015] This invention is made to solve such problems, and has an object of obtaining a Plug-In Circuit Breaker in which the open/close check can be performed easily even in the state that the circuit breaker body is detached from the mounting base; as well as the safety trip apparatus can perform a primary tripping operation in the case of plugging the circuit breaker body into the mounting base, or in the case of detaching the circuit breaker body from the mounting base in the state that the open/close check can be carried out, specifically in the state that the trip rod is made stationary.

Disclosure of Invention

[0016] A Plug-In Circuit Breaker according to the present invention includes: a circuit breaker body including a switch contact that makes and breaks a circuit where a load current flows, a trip mechanism that brings the mentioned switch contact into an open circuit, and a connection contact member that conducts a load current to the mentioned circuit; and a mounting base including a terminal member that connects an external conductor as well as connects the mentioned connection contact member plugged in, and carries the mentioned circuit breaker. This Plug-In Circuit Breaker further includes: a trip rod causing the mentioned trip mechanism to operate; a lever acting on the mentioned trip rod when plugging the mentioned circuit breaker body in the mentioned mounting base or detaching the mentioned circuit breaker body from the mentioned mounting base; an elastic member giving an impetus to this lever; and a lock mechanism for locking the mentioned lever against a bias force given by the mentioned elastic member when the mentioned circuit breaker body is detached from the mentioned mounting base. This Plug-In Circuit Breaker is provided with a safety trip apparatus that causes the mentioned lock mechanism to be released (unlocked) to make the mentioned lever act on the mentioned trip rod by the bias force given by the mentioned elastic member, and brings the mentioned trip mechanism into operation resulting in an open circuit of the mentioned switch contact before the mentioned connection contact member comes in contact with the mentioned terminal member at the time of plugging the mentioned circuit breaker body in themention edmountingbase in a state that the mentioned switch contact is in a closed circuit; and that makes the mentioned lever act on the mentioned trip rod by the bias force given by the mentioned elastic member, and brings the mentioned trip mechanism into operation resulting in an open circuit of the mentioned switch contact before separation between the mentioned terminal member and the mentioned connection contact member at the time of detaching the mentioned circuit breaker body from the mentioned mounting base in a state that the mentioned switch contact is in a closed circuit.

[0017] As a result, it is possible to carry out an open/close check easily even in the state that the circuit breaker body is detached from the mounting base. In addition, the safety trip apparatus performs a primary tripping operation even in the case of plugging the circuit breaker body in the mounting base, or in the case of detaching the circuit breaker body from the mounting base in the state that the open/close check can be carried out, specifically, in the state that the trip rod is made stationary.

[0018] In the Plug-In Circuit Breaker according to the invention, it is preferable that the mentioned lock mechanism includes a projection-engaging portion disposed at the circuit breaker body; an arm to engage with the mounting base when the mentioned circuit breaker body is plugged in the mentioned mounting base; and a projection that is engaged with and locked at the mentioned projection-engaging portion when the mentioned circuit breaker body is detached from the mentioned mounting base, and is released from the mentioned projection-engaging portion in dependence upon engagement between the mentioned mounting base and the mentioned arm when the mentioned circuit breaker body is plugged in the mounting base.

[0019] In the Plug-In Circuit Breaker according to the invention, it is preferable that the mentioned lever is provided with a cylindrical part acting on the trip rod at one end portion and a projection engaging with the projection-engaging portion at the other end portion, and is held in a turnable manner by means of an elastic member about a pin, which is inserted and fitted at a substantially central portion, acting as a fulcrum.

[0020] As a result, it is possible to reliably lock the lock mechanism and release the lock thereof.

[0021] In the Plug-In Circuit Breaker according to the invention, it is preferable that a distance between the centers of the pin and the cylindrical part is made substantially the same as, or larger than, a distance between the centers of the mentioned pin and a protrusion of the lever, which can come in contact with a lever catching portion formed at the plug-in base.

[0022] As a result, it is possible to bring the switch contact into an open circuit to interrupt the load current before the connector serving as a connection contact member comes apart from the plug-in stud serving as a terminal

member, even if either of the power supply side or the load side is pulled out at the time of pulling the circuit breaker body out of the mounting base.

[0023] In the Plug-In Circuit Breaker according the invention, it is preferable that a contact surface of the projection coming in contact with the projection-engaging portion is formed into a taper configuration.

[0024] As a result, the projection can be easily released from the projection-engaging portion at the time of plugging in the circuit breaker body. In addition, it is possible to achieve a firm engagement of the projection therewith.

Brief Description of Drawings

[0025]

Fig. 1 is a longitudinal cross sectional view of an essential part in a state that a circuit breaker body of a Plug-In Circuit Breaker is detached from a mounting base according to a first preferred embodiment of the present invention.

Fig. 2 is a top cross sectional view of an essential part of the circuit breaker body of Fig. 1.

Fig. 3 is an enlarged perspective view of a safety trip apparatus of the Plug-In Circuit Breaker according to the first embodiment of the invention.

Fig. 4 is a longitudinal cross sectional view of the essential part showing a state on the way of plugging the circuit breaker body of the Plug-In Circuit Breaker in the mounting base according to the first embodiment of this invention.

Fig. 5 is a longitudinal cross sectional view of essential portion in the state of having plugged the circuit breaker body of the Plug-In Circuit Breaker in the mounting base according the first embodiment of this invention.

Fig. 6 is a top sectional view of an essential part of Fig. 5.

Fig. 7 is a bottom sectional view of the essential part of Fig. 5.

Fig. 8 is a longitudinal cross sectional view of an essential part in a state that the circuit breaker body of the conventional Plug-In Circuit Breaker is plugged in the mounting base.

Figs. 9 are enlarged cross sectional views when the engagement with a trip mechanism of the safety trip apparatus of Fig. 8 is released. Fig. 9 (a) is an enlarged side sectional view, Fig. 9 (b) is a top sectional view of essential part of Fig. 9(a), and Fig. 9(c) is an enlarged perspective view of an internal part showing a fitted state between a trip rod and a case.

Description of Reference Numerals in the Drawings

[0026] Reference numeral 1 designates a circuit breaker body, numeral 1a designates a handle, and numeral 2 designates a pressure spring; numeral 3 designates a connector (connection contact member), numeral 4 designates a plug-in terminal, and numeral 5 designates a power supply side terminal; numeral 6 designates a load side terminal, numeral 7 designates a mounting base, numeral 8 designates a plug-in base, numeral 8a designates an arm catching part, numeral 8b designates a lever catchingpart, numeral 9 designates an external conductor, and numeral 10 designates a plug-in stud (terminal member); numeral 11 designates a stud cover, and numeral 12 designates a trip shaft (trip mechanism); numeral 15 designates an intermediate actuator, numeral 15a designates a shaft, and numeral 20 designates a safety trip apparatus; numeral 21 designates a trip rod, numeral 21a designates an insert bore, numeral 21b designates a tip portion, and numeral 22 designates a lever; numeral 22a designates a through hole, numeral 22b designates a cylindrical part, numeral 22c designates an arm, and numeral 22ddesignates projection; numeral 22e designates a protrusion, numeral 23 designates a helical spring, and numeral 24 designates a clamping screw; and numeral 25 designates a bracket, numeral 25a designates a through hole, numeral 25b designates a through hole, numeral 25c designates an engaging hole, numeral 25d designates a projection engaging portion, numeral 26 designates a pin, and numeral 30 designates a lock mechanism.

Best Mode for Carrying Out the Invention

Embodiment 1.

[0027] Fig. 1 is a cross sectional view of an essential part in the state that a circuit breaker body of a Plug-In Circuit Breaker is detached from a mounting base according to a first preferred embodiment of the present invention. Fig. 2 is a top sectional view of the essential part of the circuit breaker body taken from a load side. Fig. 3 is an enlarged perspective view of a safety trip apparatus of the Plug-In Circuit Breaker according to the first embodiment of this invention.

[0028] With reference to Figs. 1 and 2, a circuit breaker body 1 comprises within a case made of a molded insulator: a plug-in terminal 4 serving as a terminal connecting member on the power supply side and on the load side to which a tulip-shaped connector 3 serving as a connection contact member, which is held in a case made of a molded insulator under a predetermined contact pressure applied by a pressure spring 2; a power supply side terminal 5 and a load side terminal 6 attached respectively to each plug-in terminal 4; a switch contact (not shown) that is electrically connected between the power supply side terminal 5 and load side terminal 6, and makes and breaks a circuit where a load current flows; a switch mechanism (not shown) bringing this switch contact into an open or closed state; a trip mechanism (not shown) causing this switch mechanism to operate; and a handle 1a with which the switch mechanism can be operated.

[0029] The mounting base 7, into which the circuit breaker body 1 is plugged, is provided with a plug-in base 8 made of a molded insulator; an external conductor 9 that is connected to both of the power supply side and the load side of the plug-in base 8; and a plug-in stud 10 serving as a terminal member to be plugged in and connected to the connector 3.

[0030] Numeral 11 designates a stud cover for fixing and insulating the plug-in stud 10.

[0031] Numeral 12 designates a trip shaft forming a part of the trip mechanism. This trip shaft 12 is biased counterclockwise by means of a spring (not shown). When an over-current flows in the circuit, the trip shaft 12 turns counterclockwise (in a direction indicated by the arrow F1) by a predetermined amount to bring the switch mechanism (not shown) into operation.

[0032] Numeral 15 designates an intermediate actuator that cooperates with a trip rod 21 as described later to turn in a direction indicated by the arrow F2 about a shaft 15a as a fulcrum, and causes the trip shaft 12 to operate.

[0033] With reference to Fig. 3, numeral 20 designates a safety trip apparatus, which is comprised of: a trip rod 21 causing the intermediate actuator 15 to turn; a lever 22 that acts on the trip rod 21 when plugging the circuit breaker body 1 into the mounting base 7, or detaching the circuit breaker body 1 from the mounting base 7; a helical spring 23 serving as an elastic member giving an impetus to this lever 22; and a bracket 25 secured to the circuit breaker body 1 by means of a clamping screw 24; and a pin 26 that runs through a through hole 25a of the bracket 25, a through hole 22a of the lever 22, the helical spring 23 and a through hole 25b of the bracket 25, and inserted and fitted in a substantially central portion of the lever 22 to hold the lever 22 in a turnable manner.

[0034] The lever 22, which is held in a turnable manner about the pin 26 as the fulcrum, is provided in a protruding manner at one end portion thereof with a cylindrical part 22b to be inserted and fitted to a insert hole 21a of the trip rod 21. The lever 22 is also provided integrally at the other endportion thereof with an arm 22c to be engaged with the mounting base 7 when the circuit breaker body 1 is plugged in the mounting base 7, and a projection 22d to be engaged with a projection-engaging portion 25d of an engaging hole 25 provided in the bracket 25.

[0035] Furthermore, in the helical spring 23, one end 23a thereof is engaged with and caught at a spring catching portion 25e of the bracket 25, and the other end 23b is engaged with and caught at a protrusion 22e, which is provided at the lever 22 in a protruding manner. The helical spring 23 gives an impetus to the lever 22 in a direction indicated by the arrow F3. When the circuit breaker body 1 is plugged in the mounting base 7, the arm 22c comes to engage with the mounting base 7, and the projection 22d is released from the projection-engaging portion 25d. Thus the lever 22 turns in a direction indicated by the arrow F3 and moves in a direction indicated by the arrow F4, and eventually a tip portion 21b of the trip rod 21 acts on the intermediate actuator 15a.

[0036] Additionally, in the mentioned construction, a lock mechanism 30 is formed of the proj ection-engaging portion 25d of the engaging hole 25c provided in the bracket 25, the arm 22c to be engaged with an arm catching portion 8a of the mounting base 7 as described later when the circuit breaker body 1 is plugged in the mounting base 7, and the projection 22d that is engaged with and caught at the proj ection-engaging portion 25d when the circuit breaker body 1 is detached from the mounting base 7 and that is released from the projection-engaging portion 25d in dependence upon the engagement between the mounting base 7 and the arm 22 when the circuit breaker 1 is plugged in the mounting base 7.

[0037] In the Plug-In Circuit Breaker provided with the safety trip apparatus 20 constructed as described above, in the lock state that the projection 22d of the lever 22 of the safety trip apparatus 20 is engaged with the projection-engaging portion 25d of the bracket 25 when the circuit breaker body 1 is detached from the mounting base 7, the trip rod 21 does not act on the intermediate actuator 15. Accordingly it is possible to carry out an open/close check of the switch contact by operating the switch mechanism with the use of the handle 1a.

[0038] Fig. 4 is a longitudinal cross sectional view of essential portion in the state on the way of plugging the circuit breaker body of the Plug-In Circuit Breaker into the mounting base according to the first embodiment of this invention.

[0039] Fig. 5 is a longitudinal cross sectional view of essential part in the state that the circuit breaker of the Plug-In Circuit Breaker is plugged in the mounting base according to the first embodiment of this invention. Fig. 6 is a top cross sectional view of essential part of the circuit breaker body viewed from a load side. Fig. 7 is a bottom cross sectional view of essential part of the circuit breaker body viewed from a power supply side.

[0040] Now, operations when the circuit breaker body 1 is plugged in the mounting base 7 from the state of being detached from the mounting base 7 are described with reference to Figs. 4 to 7.

[0041] When the circuit breaker body 1 is plugged in the mounting base 7, before the plug-in stud 10 serving as a terminal member and the connector 3 serving as a connection contact member are in contact with each other, the arm 22c of the lever 22 comes to be engaged with the arm catching portion 8a formed at the plug-in base 8 and receives the force in a direction indicated by the arrow F5. The proj ection 22d becomes released from the projection-engaging portion 25d, and the lever 22 turns by the bias force given by the helical spring 23. Accordingly the trip rod 21 moves in a direction indicated by the arrow F6, and then a tip portion 21b thereof acts on the intermediate actuator 15, which turns in a direction indicated by the arrow F7 about the shaft 15a as a fulcrum. This turning of the intermediate actuator 15 causes the trip shaft 12 to turn in a direction indicated by the arrow F8, and causes the switch mechanism to operate to bring

the switch contact into an open circuit resulting in interruption of a load current.

[0042] Furthermore, at this time, the lever 22 moves in a direction indicated by the arrow F9 (shown in Fig. 5) by the bias force given by the helical spring 23, and the protrusion 22e of the lever 22 comes in contact with the lever catching portion 8b formed at the plug-in base 7.

[0043] When the circuit breaker body 1 is further plugged in, the connector 3 and the plug-in stud 10 are electrically connected by the connector 3 being inserted in a fitted manner after the connector 3 has been brought into contact with the plug-in stud 10, and the connector 3 and the plug-in stud 10 are held in contact under a predetermined contact pressure given by the pressure spring 2. In addition, the lever catching portion 8b is pressed by the protrusion 22e of the lever 22, the lever 22 turns in a direction indicated by the arrow F10 (shown in Fig. 7) against the bias force given by the helical spring 23, and the trip rod 21 moves to such a position as not to act on the intermediate actuator 21 (Figs. 5 through 7).

[0044] Now, operations in the case of pulling out the circuit breaker body 1 having been plugged in the mounting base 7 of above construction are described.

[0045] The operation in the case of pulling out the circuit breaker body 1 is carried out in a reverse way of the plug-in operation as described above. When the circuit breaker body 1 is pulled out, the protrusion 22e of the lever 22, which has been in contact with the lever catching portion 8b formed at the plug-in base 8, turns in a direction indicated by the arrow F11 (shown in Fig. 7) under the bias force given by the helical spring 23. Subsequently the trip rod 21 moves in a direction indicated by the arrow F6 (shown in Fig. 4), and then the tip portion 21b thereof acts on the intermediate actuator 21, which turns in a direction indicated by the arrow F7 about the shaft 15a as the fulcrum. Eventually the trip shaft 12 is caused to turn in a direction indicated by the arrow F8, and the switch contact is brought into an open circuit before separation of the connector 3 from the plug-in stud 10, resulting in interruption of the load current.

[0046] In addition, referring to Fig. 7, an alphabet letter c represents a distance between the centers of position of the pin 26 and the cylindrical part 22b; and an alphabet letter d represents a distance between the centers of position of the pin 26 and the protrusion 22e. Relation between c and d is set to be $d \leqq c$. By setting like this, a traveling dimension of the trip rod 21 is larger than the turning angle of the lever 22, thereby making it possible to bring the switch contact into an open circuit to interrupt the load current before the separation between the connector 3 and the plug-in stud 10 even if either the power supply side or the load side is pulled out at the time of pulling the circuit breaker body 1 out of the mounting base 7.

[0047] Furthermore, with reference to Fig. 3, dimension of the projection 22d, which is engaged with the proj ection-engaging portion 25d, is set to be a taper configuration of a<b, supposing that the dimension of the projection 22d on the side proximate to the position of the pin 26 is a and dimension thereof on the side remote from the position of the pin 26 is b. The purpose of this setting is to make the projection 22d easily released from the proj ection-engaging portion 25d when pulling out the circuit breaker body 1, or to achieve a firm engagement of the projection 22d therewith.

Industrial Applicability

[0048] As described above, a Plug-In Circuit Breaker according to the present invention is suitable for reliably bringing a switch contact into an open circuit when inserting or pulling a circuit breaker body in or out of a mounting base.

Claims

1. A Plug-In Circuit Breaker comprising: a circuit breaker body (1) including a switch contact that makes and breaks a circuit where a load current flows, a trip mechanism (12) that brings said switch contact into an open circuit, and a connection contact member (3) that conducts a load current to said circuit; a mounting base (7) including a terminal member (10) that connects an external conductor (9) as well as connects said connection contact member (3) plugged in, and mounts said circuit breaker (1) thereon; and a trip rod (21) causing said trip mechanism to operate, **characterized in that**
the Plug-In Circuit Breaker further comprises: a lever (22) acting on said trip rod (21) when plugging said circuit breaker body (1) in said mounting base (7) or detaching said circuit breaker body (1) from said mounting base (7) ; an elastic member (23) giving an impetus to this lever (21); and a lock mechanism (30) for locking said lever (22) against a bias force given by said elastic member (23) when said circuit breaker body (1) is detached from said mounting base (7);
the Plug-In Circuit Breaker being provided with a safety trip apparatus (20) that causes said lock mechanism (30) to be released to make said lever (22) act on said trip rod (21) by the bias force given by said elastic member (23), and brings said trip mechanism (12) into operation resulting in an open circuit of said switch contact before said connection contact member (3) comes in contact with said terminal member (10) at the time of plugging said circuit breaker body (1) in said mounting base (7) in a state that said switch contact is in a closed circuit; and that makes said lever (22) act on said trip rod (21) by the bias force given by said elastic member (23), and brings said trip mechanism (12) into operation resulting in an open circuit of said switch contact before separation between said terminal member (10) and said connection contact member (3) at the time of

detaching said circuit breaker body (1) from said mounting base (7) in a state that said switch contact is in a closed circuit.

2. The Plug-In Circuit Breaker according to claim 1, wherein said lock mechanism comprises: a projection-engaging portion (25d) disposed at the circuit breaker body (1); an arm (22c) to engage with said mounting base (7) when said circuit breaker body (1) is plugged in said mounting base (7); and a projection (22d) that is engaged with and locked at said projection-engaging portion (25d) when said circuit breaker body (1) is detached from said mounting base (7), and is released from said projection-engaging portion (25d) in dependence upon engagement between said mounting base (7) and said arm (22c) when said circuit breaker body (1) is plugged in said mounting base (7).

3. The Plug-In Circuit Breaker according to claim 1, wherein said lever (22) is provided with a cylindrical part (22b) acting on the trip rod (21) at one end portion and a projection (22d) engaging with the projection-engaging portion (25d) at the other end portion, and is held in a turnable manner by means of an elastic member (23) about a pin (26), which is inserted and fitted at a substantially central portion, acting as a fulcrum.

4. The Plug-In Circuit Breaker according to claim 3, wherein a distance (c) between the centers of said pin (26) and the cylindrical part (22b) is made substantially the same as, or larger than, a distance (d) between the centers of said pin (26) and a protrusion (22e) of the lever (22), which can come in contact with a lever catching portion (8b) formed at the plug-in base (7).

5. The Plug-In Circuit Breaker according to claim 2, wherein a contact surface of said projection (22d) coming in contact with the projection-engaging portion (25d) is formed into a taper configuration.

Patentansprüche

1. Einsteck-Kreisunterbrecher, umfassend:

Einen Kreisunterbrecherkörper (1), der einen Schaltkontakt, welcher einen Kreis, in dem ein Laststrom fließt, herstellt oder unterbricht, einen Auslösemechanismus (12), der den Schaltkontakt in einen offenen Kreis bringt, und ein Verbindungskontaktelement (3) aufweist, das einen Laststrom zum Kreis leitet,
eine Befestigungsbasis (7), die ein Anschlusselement (10) aufweist, das einen externen Leiter (9) und auch das eingesteckte Verbindungskontaktelement (3) verbindet, und den Kreisunterbrecher (1) hieran befestigt,
und eine Auslösestange (21), die den Auslösemechanismus arbeiten lässt, **dadurch gekennzeichnet, dass**
der Einsteck-Kreisunterbrecher weiter umfasst:
einen Hebel (22), der auf die Auslösestange (21) wirkt, wenn der Kreisunterbrecherkörper (1) in die Befestigungsbasis (7) eingesteckt wird oder der Kreisunterbrecherkörper (1) von der Befestigungsbasis (7) abgenommen wird,
ein elastisches Element (23), das diesem Hebel (22) einen Anstoß verleiht, und
einen Verriegelungsmechanismus (30) zum Verriegeln des Hebels (22) gegen eine durch das elastische Element (23) aufgebrachte Vorspannkraft, wenn der Kreisunterbrecherkörper (1) von der Befestigungsbasis (7) abgenommen wird,
wobei der Einsteck-Kreisunterbrecher mit einer Sicherheitsauslöseeinrichtung (20) versehen ist, die den Verriegelungsmechanismus (30) freigeben lässt, damit der Hebel (22) durch die durch das elastische Element (23) aufgebrachte Vorspannkraft auf die Auslösestange (21) wirkt, und den Auslösemechanismus (12) in einen Betrieb bringt, der zu einem offenen Kreis des Schaltkontakts führt, bevor das Verbindungskontaktelement (3) zur Zeit des Einsteckens des Kreisunterbrecherkörpers (1) in die Befestigungsbasis (7) mit dem Anschlusselement (10) in einen Zustand kommt, dass sich der Schaltkontakt in einem geschlossenen Kreis befindet, und die den Hebel (22) durch die durch das elastische Element (23) aufgebrachte Vorspannkraft auf die Auslösestange (21) wirken lässt, und den Auslösemechanismus (12) in einen Betrieb bringt, der zu einem offenen Kreis des Schaltkontakts vor einer Trennung zwischen dem Anschlusselement (10) und dem Verbindungskontaktelement (3) zur Zeit des Abnehmens des Kreisunterbrecherkörpers (1) von der Befestigungsbasis (7) in einen Zustand führt, dass sich der Schaltkontakt in einem geschlossenen Kreis befindet.

2. Einsteck-Kreisunterbrecher gemäß Anspruch 1, bei dem der Verriegelungsmechanismus umfasst: einen Vorsprungseingriffabschnitt (25d), der am Kreisunterbrecherkörper (1) angeordnet ist, einen Arm (22c), um mit der Befestigungsbasis (7) in Eingriff zu sein, wenn der Kreisunterbrecherkörper (1) in die Befestigungsbasis (7) eingesteckt ist, und einen Vorsprung (22d), der mit dem Vorsprungseingriffsabschnitt (25d) in Eingriff ist und an diesem verriegelt ist, wenn der Kreisunterbrecherkörper (1) von der Befestigungsbasis (7) abgenommen ist, und vom Vorsprungseingriffsabschnitt (25d) in Abhängigkeit

vom Eingriff zwischen der Befestigungsbasis (7) und dem Arm (22c) freigegeben ist, wenn der Kreisunterbrecherkörper (1) in die Befestigungsbasis (7) eingesteckt ist.

3. Einsteck-Kreisunterbrecher gemäß Anspruch 1, bei dem der Hebel (22) mit einem Zylinderteil (22b), das auf die Auslösestange (21) an einem Endabschnitt wirkt, und mit einem Vorsprung (22d) versehen ist, der mit dem Vorsprungseingriffsabschnitt (25d) am anderen Endabschnitt in Eingriff ist, und auf drehbare Weise mittels eines elastischen Elements (23) um einen in einem im Wesentlichen mittigen Abschnitt eingefügten und eingepassten Stift (26) gehalten wird, der als ein Drehpunkt wirkt.

4. Einsteck-Kreisunterbrecher gemäß Anspruch 3, bei dem ein Abstand (c) zwischen den Mitten des Stifts (26) und des Zylinderteils (22b) im Wesentlichen gleich oder größer als ein Abstand (d) zwischen den Mitten des Stifts (26) und einem Vorsprung (22e) des Hebels (22) hergestellt wird, der mit einem an der Einsteck-Basis (7) ausgebildeten Hebelaufnahmeabschnitt (8b) in Kontakt kommen kann.

5. Einsteck-Kreisunterbrecher gemäß Anspruch 2, bei dem eine Kontaktfläche des Vorsprungs (22d), die mit dem Vorsprungseingriffsabschnitt (25d) in Kontakt kommt, sich verjüngend ausgebildet ist.

Revendications

1. Disjoncteur enfichable comprenant : un corps de disjoncteur (1) incluant un contact d'interrupteur qui établit et coupe un circuit où un courant de charge s'écoule, un mécanisme de déclenchement (12) qui amène ledit contact d'interrupteur dans un circuit ouvert, et un élément de contact de connexion (3) qui conduit un courant de charge audit circuit ; une base de montage (7) incluant un élément terminal (10) qui relie un conducteur externe (9) et qui relie aussi bien ledit élément de contact de connexion (3) enfiché, et qui monte ledit disjoncteur (1) dessus ; et une tige de déclenchement (21) amenant ledit mécanisme de déclenchement à fonctionner, **caractérisé en ce que**
le disjoncteur enfichable comprend en outre : un levier (22) agissant sur ladite tige de déclenchement (21) en enfichant ledit corps de disjoncteur (1) dans ladite base de montage (7) ou en détachant ledit corps de disjoncteur (1) de ladite base de montage (7) ; un élément élastique (23) donnant une impulsion à ce levier (21) ; et un mécanisme de verrouillage (30) pour verrouiller ledit levier (22) contre une force de déplacement donnée par ledit élément élastique (23) lorsque ledit corps de disjoncteur (1) est détaché de ladite base de montage (7) ;
le disjoncteur enfichable étant muni d'un appareil de déclenchement de sécurité (20) qui amène ledit mécanisme de verrouillage (30) à être libéré pour faire que ledit levier (22) agit sur ladite tige de déclenchement (21) par la force de déplacement donnée par ledit élément élastique (23), et amène ledit mécanisme de déclenchement (12) à fonctionner aboutissant à un circuit ouvert dudit contact d'interrupteur avant que ledit élément de contact de connexion (3) ne vienne en contact avec ledit élément terminal (10) au moment de l'enfichage dudit corps de disjoncteur (1) dans ladite base de montage (7) dans un état où ledit contact d'interrupteur est dans un circuit fermé ; et **en ce que** ledit levier (22) agit sur ladite tige de déclenchement (21) par la force de déplacement donnée par ledit élément élastique (23), et amène ledit mécanisme de déclenchement (12) à fonctionner aboutissant à un circuit ouvert dudit contact d'interrupteur avant la séparation entre ledit élément terminal (10) et ledit élément de contact de connexion (3) au moment du détachement dudit corps de disjoncteur (1) de ladite base de montage (7) dans un état où ledit contact d'interrupteur est dans un circuit fermé.

2. Disjoncteur enfichable selon la revendication 1, dans lequel ledit mécanisme de verrouillage comprend : une partie de mise en prise de partie en saillie (25d) disposée au niveau du corps de disjoncteur (1) ; un bras (22c) pour mettre en prise ladite base de montage (7) lorsque ledit corps de disjoncteur (1) est enfiché dans ladite base de montage (7) ; et une partie en saillie (22d) qui est en prise avec et verrouillée à ladite partie de mise en prise de partie en saillie (25d) lorsque ledit corps de disjoncteur (1) est détaché de ladite base de montage (7), et est libéré de ladite partie de mise en prise de partie en saillie (25d) en fonction de la mise en prise entre ladite base de montage (7) et ledit bras (22c) lorsque ledit corps de disjoncteur (1) est enfiché dans ladite base de montage (7).

3. Disjoncteur enfichable selon la revendication 1, dans lequel ledit levier (22) est muni d'une partie cylindrique (22b) agissant sur la tige de déclenchement (21) au niveau d'une partie d'extrémité et d'une partie en saillie (22d) mettant en prise la partie de mise en prise de partie en saillie (25d) au niveau de l'autre partie d'extrémité, et est maintenu d'une façon à pouvoir être tourné au moyen d'un élément élastique (23) autour d'un ergot (26), qui est inséré et ajusté au niveau d'une partie sensiblement centrale, agissant comme un point d'appui.

4. Disjoncteur enfichable selon la revendication 3, dans lequel une distance (c) entre les centres dudit ergot (26) et de la partie cylindrique (22b) est rendue sensiblement la même que, ou plus grande que, une

distance (d) entre les centres dudit ergot (26) et d'une protubérance (22e) du levier (22), qui peuvent entrer en contact avec une partie de capture de levier (8b) formée au niveau de la base enfichable (7).

5. Disjoncteur enfichable selon la revendication 2, dans lequel une surface de contact de ladite partie en saillie (22d) venant en contact avec la partie de mise en prise de partie en saillie (25d) est formée en une configuration allant en s'amincissant.

Fig .1

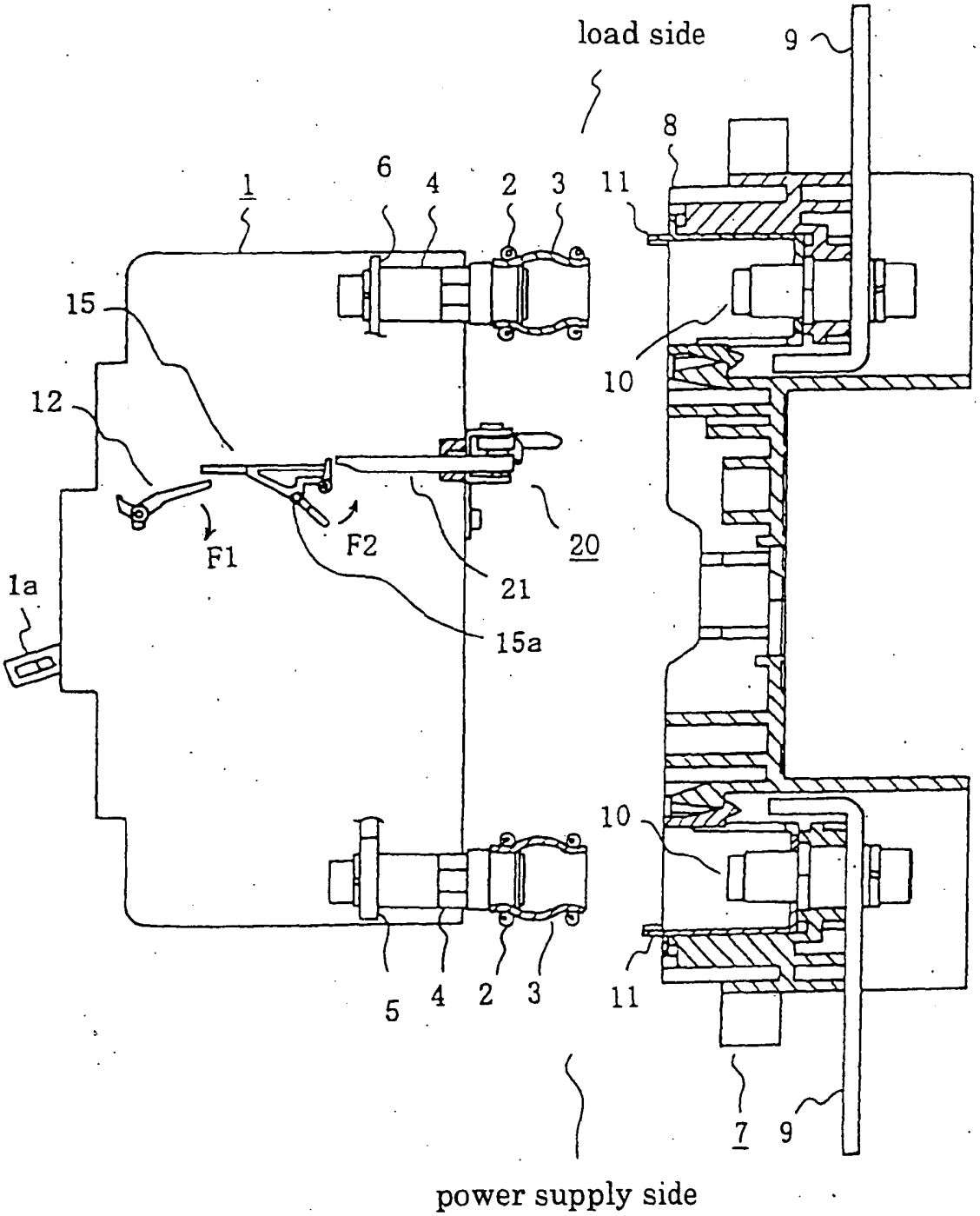

load side
9
8
6
4
2
3
11
1
15
10
12
F1
F2
20
21
1a
15a
10
5
4
2
3
11
7
9
power supply side

Fig.2

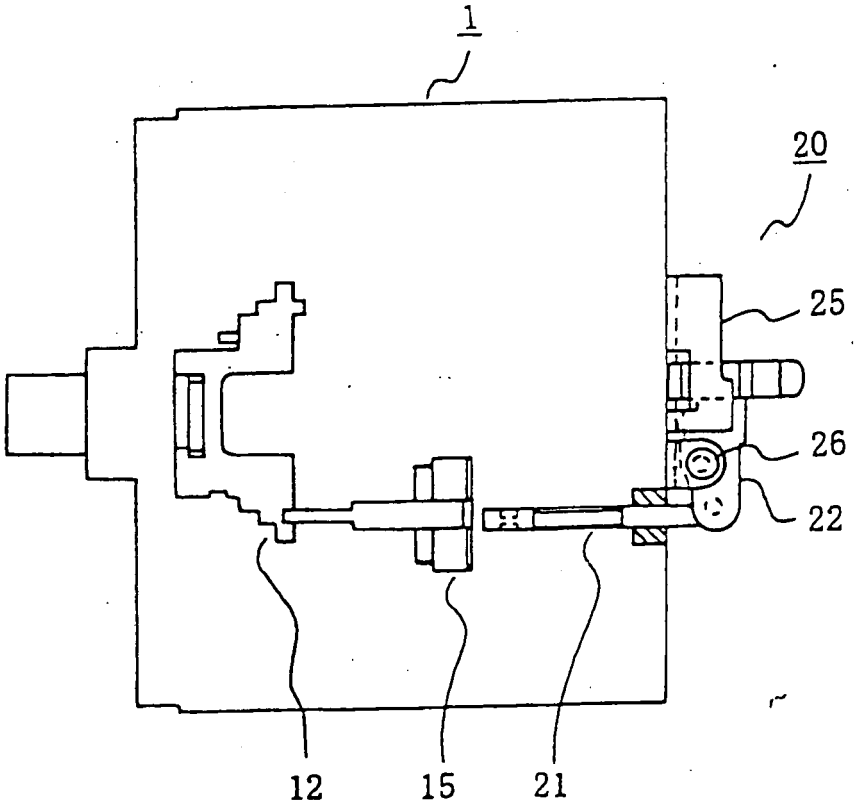


Fig.3

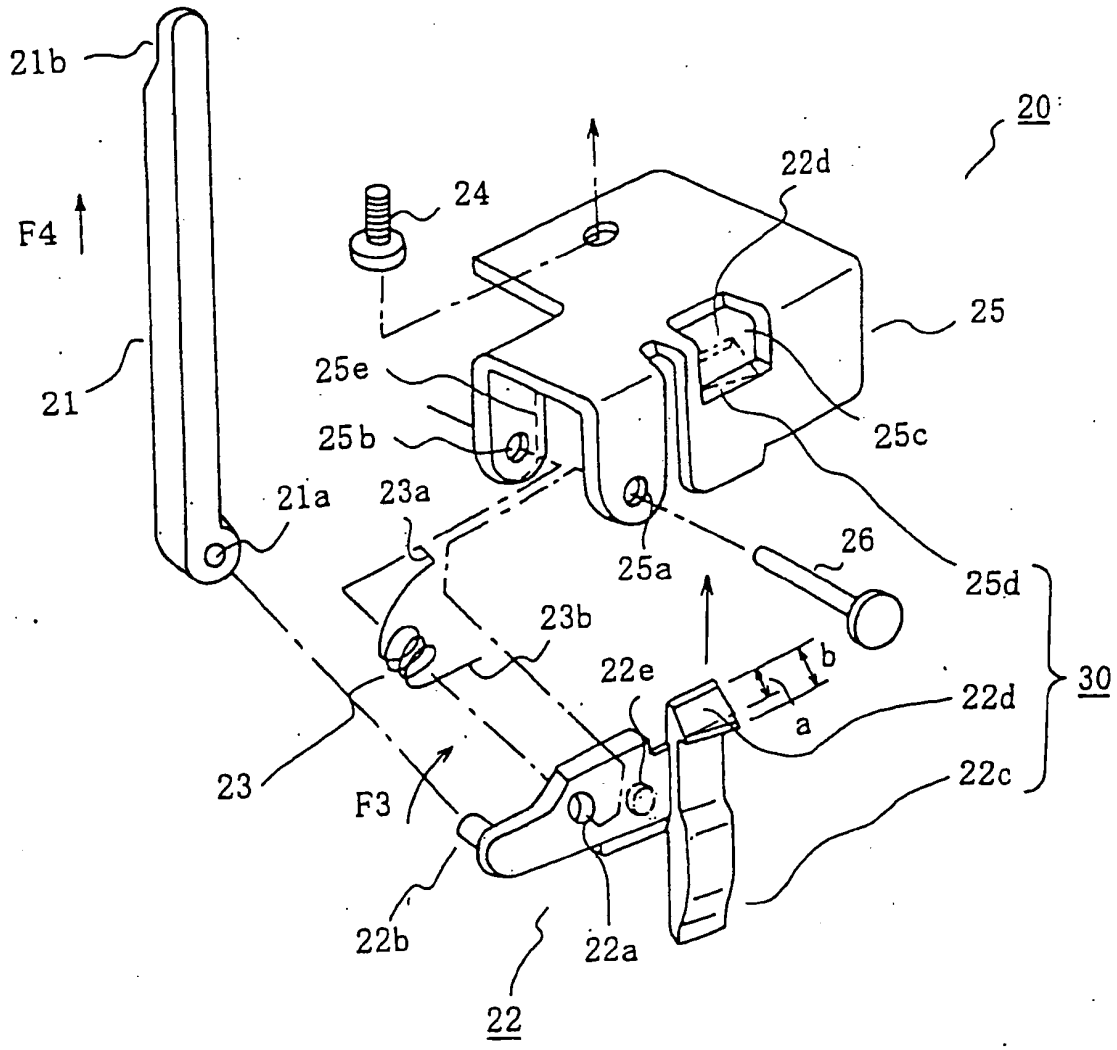

21b
F4
21
24
20
22d
25
25e
25b
25c
21a
23a
25a
26
25d
23b
22e
b
a
22d
30
23
F3
22c
22b
22a
22

Fig.4

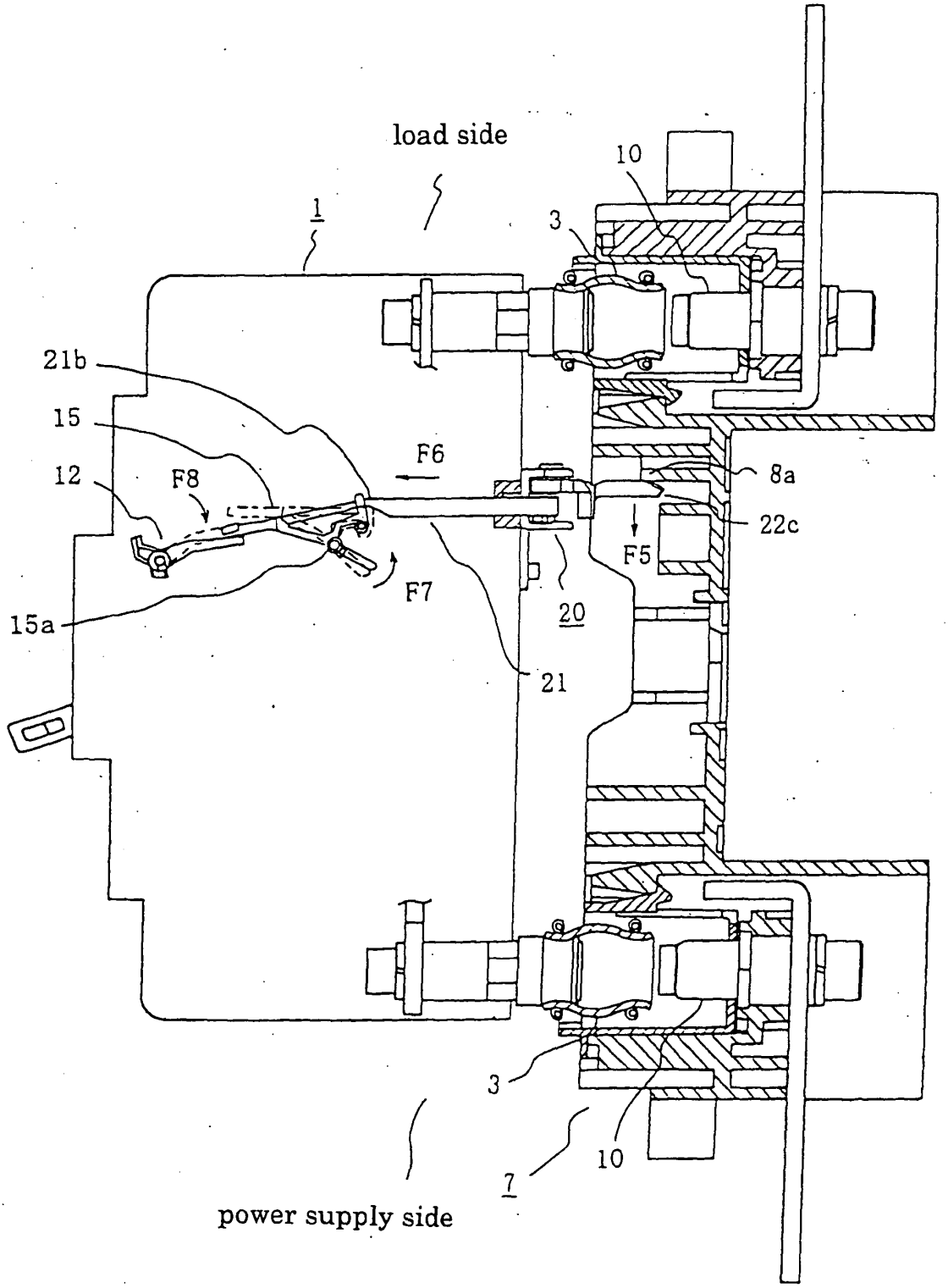

load side
1
10
3
21b
15
12
F8
F6
8a
22c
F5
F7
15a
20
21
3
10
7
power supply side

Fig.5

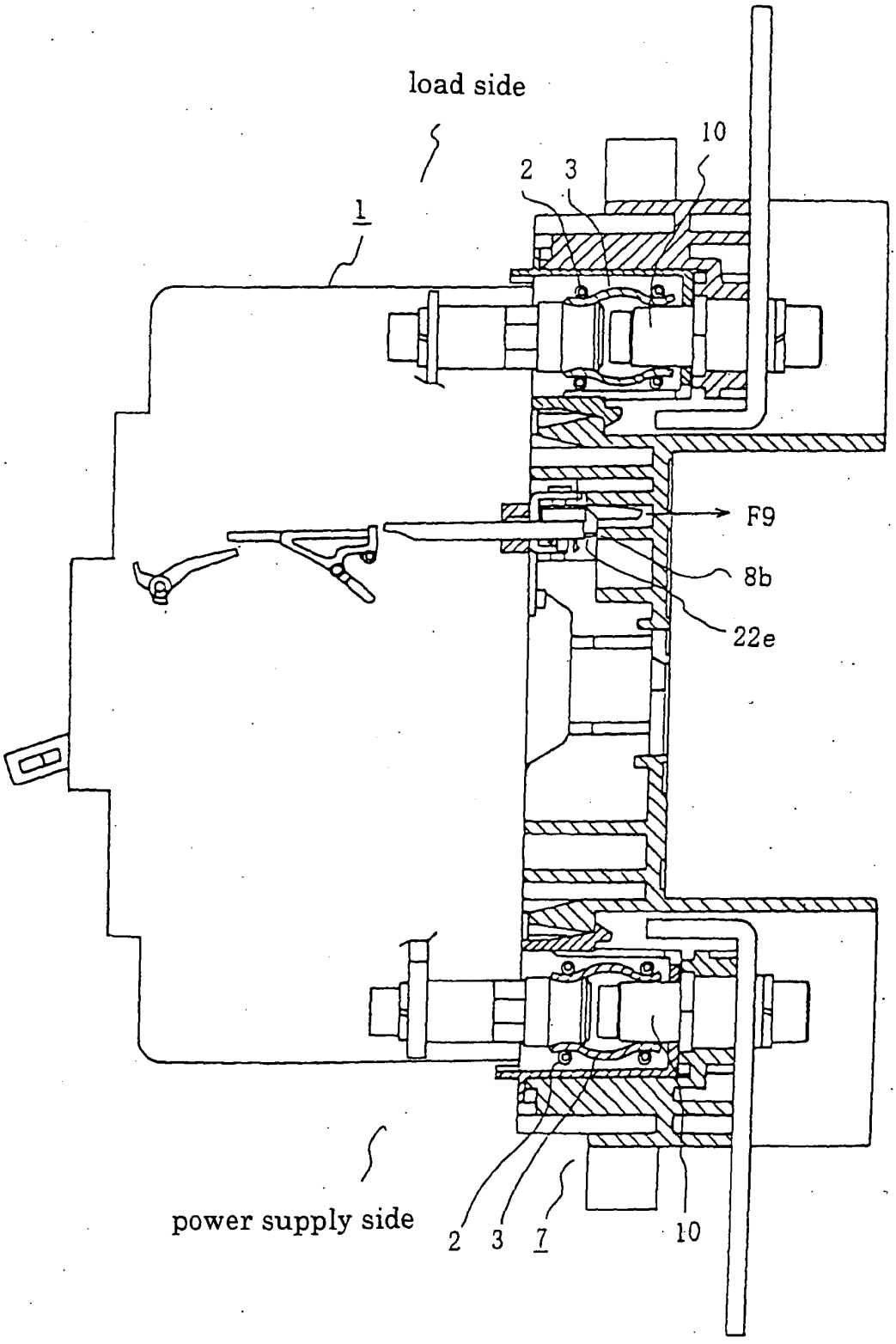


Fig .6

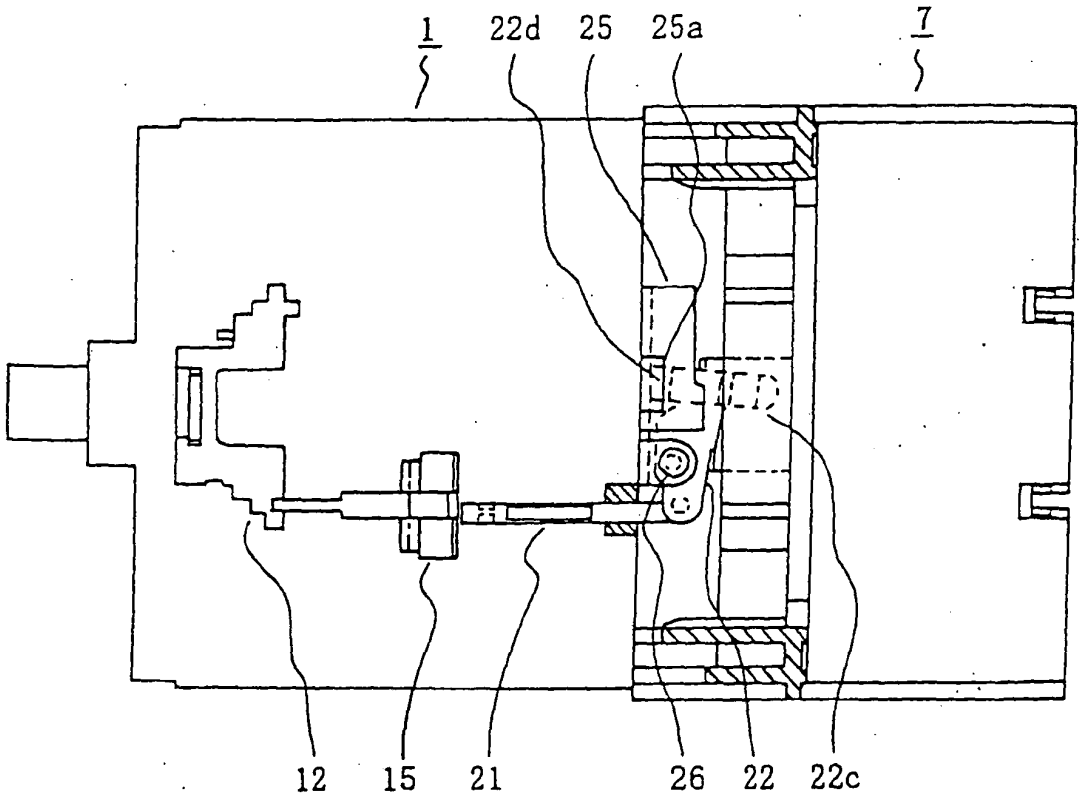


Fig.7

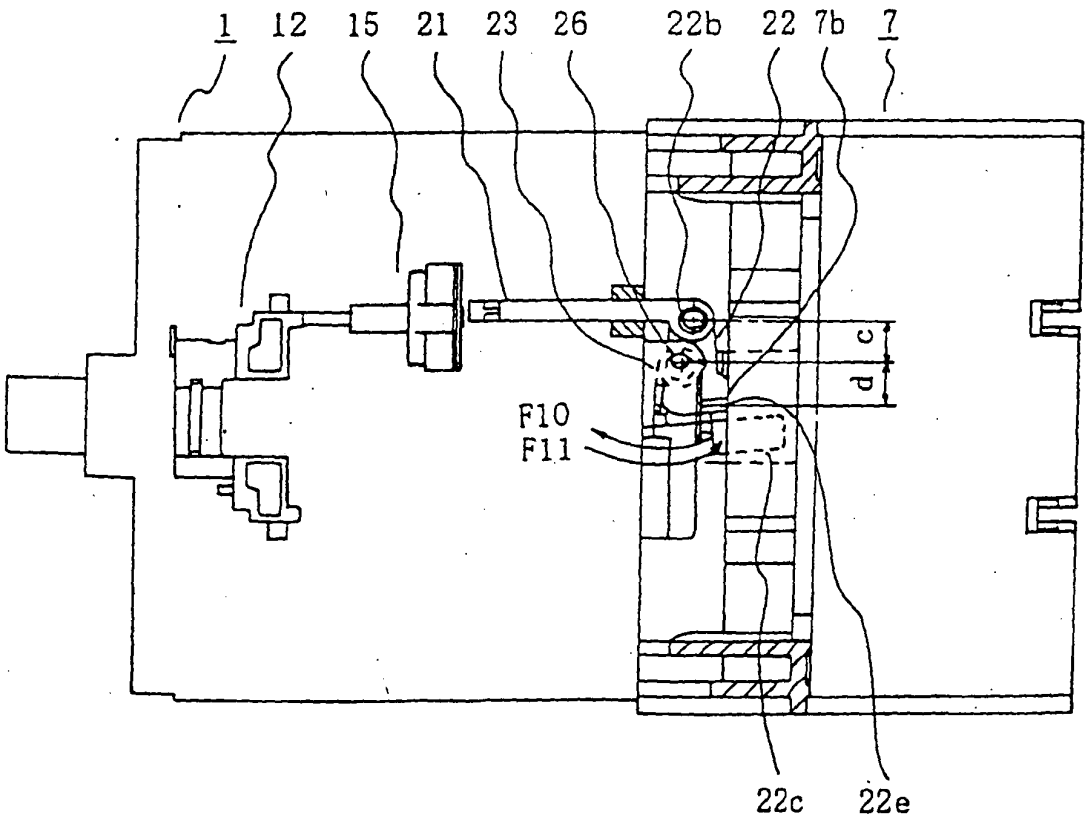


Fig.8

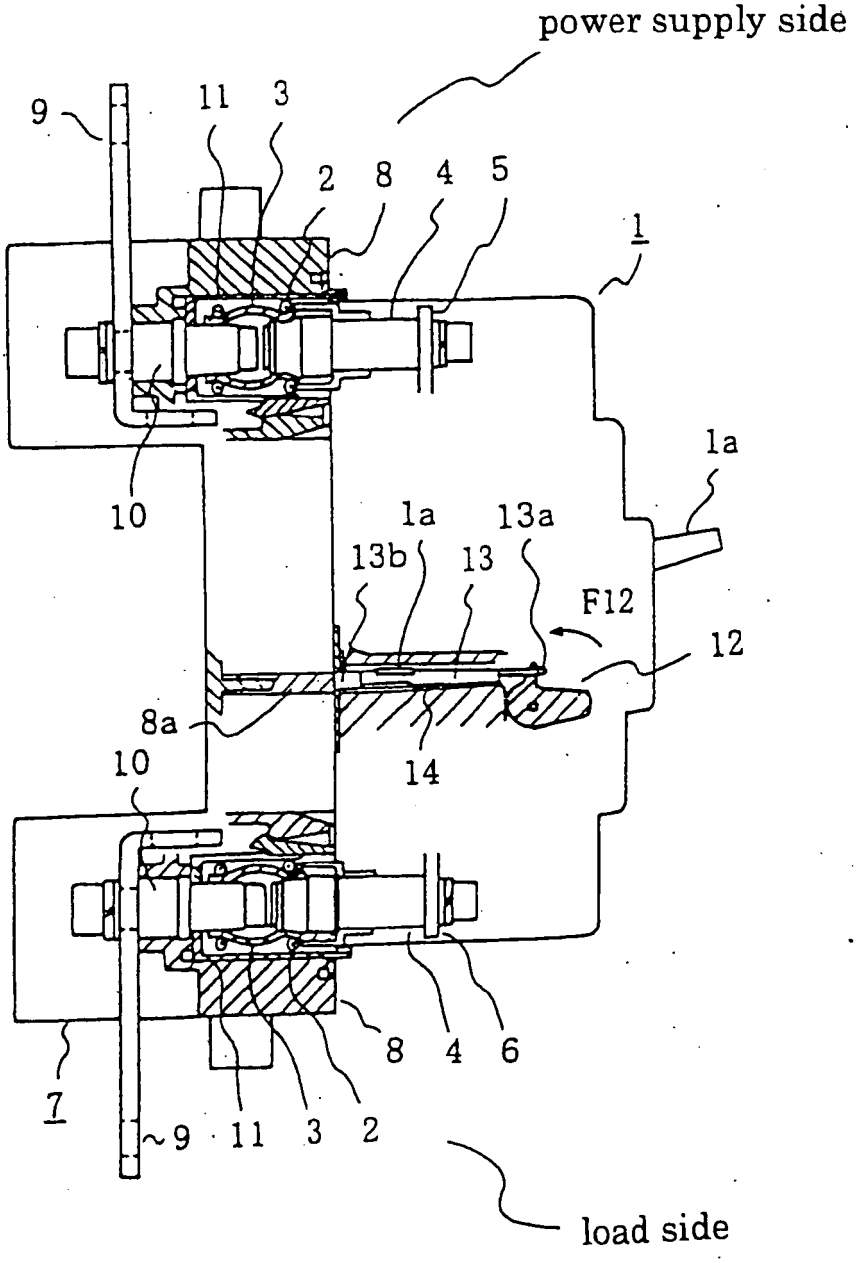
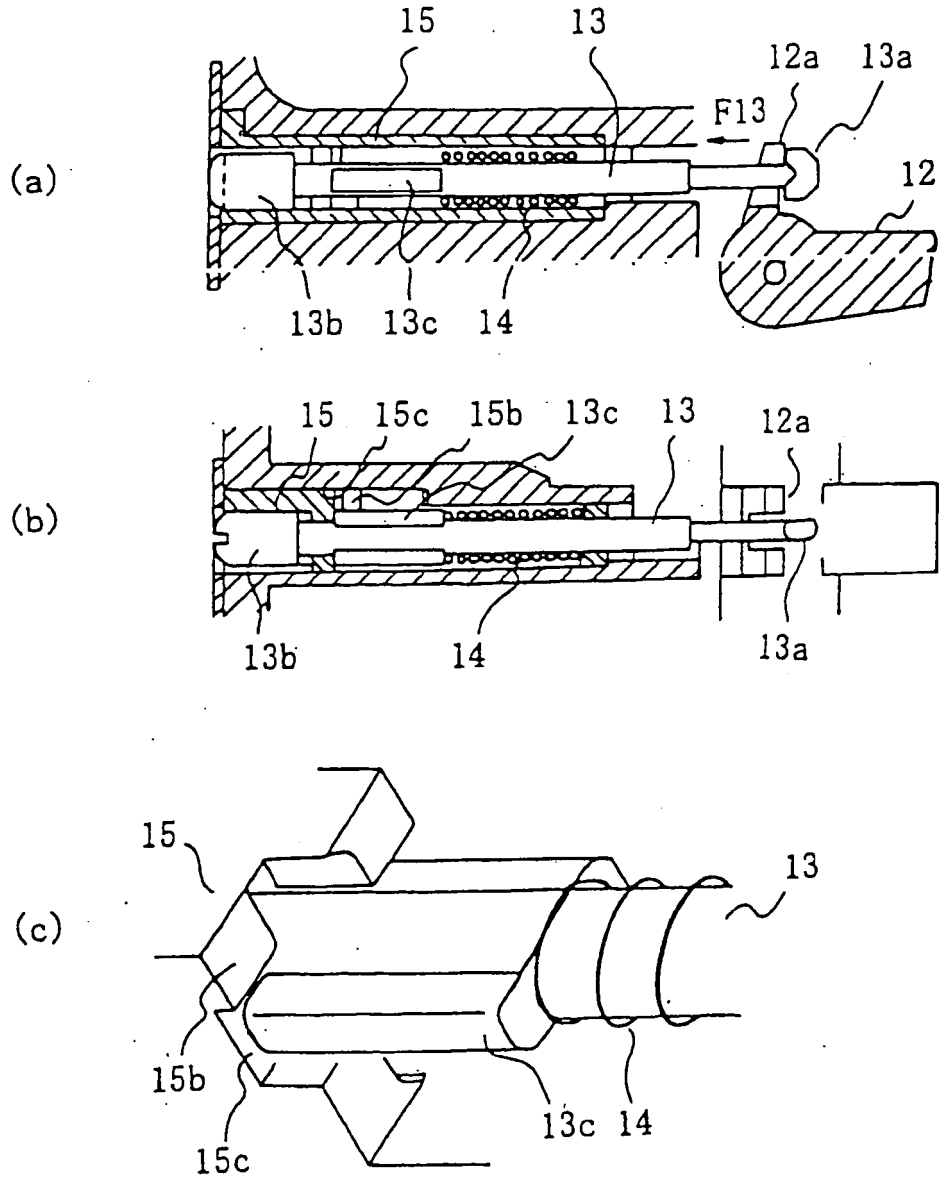

power supply side
9
11
3
2
8
4
5
1
1a
10
1a
13a
13b
13
F12
12
8a
10
14
8
4
6
7
9
11
3
2
load side

Fig.9


(a)
15
13
12a
13a
F13
12
13b
13c
14
(b)
15
15c
15b
13c
13
12a
13b
14
13a
(c)
15
13
15b
15c
13c
14

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 0127959 A **[0002]**