



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 158(3) EPC

(43) Date of publication:
24.10.2001 Bulletin 2001/43

(51) Int Cl.7: **H01H 73/06**

(21) Application number: **99974116.8**

(86) International application number:
PCT/JP99/05518

(22) Date of filing: **07.10.1999**

(87) International publication number:
WO 01/27959 (19.04.2001 Gazette 2001/16)

(84) Designated Contracting States:
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE**
Designated Extension States:
AL LT LV MK RO SI

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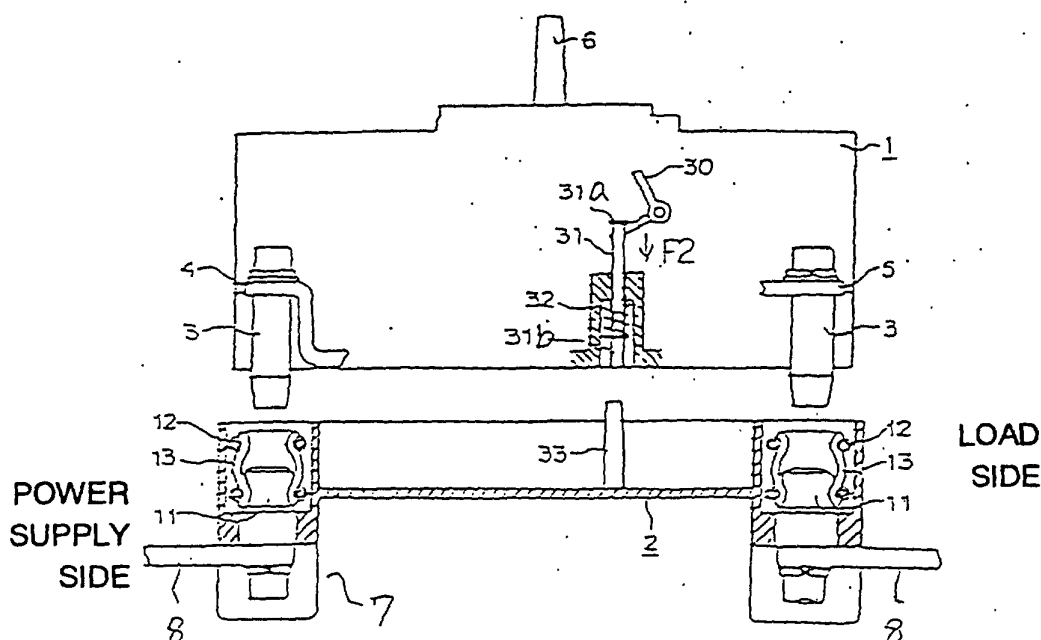
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(54) **PLUG-IN CIRCUIT BREAKER**

(57) A structure is employed in which a safety trip apparatus (20) is formed from a trip rod (21) which engages with a trip mechanism portion (30), a compression spring (22) which biases the trip rod (21) towards an installation base (2), and a case (23) which houses the compression spring (22) and the trip rod (21), and the safety trip apparatus (20) is secured to a circuit

breaker body (1) by a rear cover (25). When the trip rod (21) is rotated, the state is fixed in which the engagement between the trip rod (21) and the trip mechanism portion (30) is released. In addition, by installing and removing the rear cover (25), the safety trip apparatus (20) can be installed on or removed from the circuit breaker body (1).

FIG. 7



Description

Technical Field

[0001] This invention relates to a circuit breaker, and in particular it relates to a safety trip apparatus which is installed in a plug-in type circuit breaker.

Background Art

[0002] Figure 6 is a side cross-sectional view of essential portions showing the state in which a circuit breaker body of a conventional plug-in type circuit breaker shown in Japanese Published Unexamined Patent Application Hei 8-250009, for example, is installed on an installation base.

[0003] Figure 7 is a side cross-sectional view of essential portions showing the state in which the circuit breaker body of Figure 6 is removed.

[0004] In the figures, the circuit breaker body 1 has plug-in contact terminals 3 which are connecting contact members inside a case made of a molded insulator, a power supply side terminal 4 and a load side terminal 5 which are each connected to a plug-in terminal 3, a switching contact (not shown) which is electrically connected between the power supply side terminal 4 and the load side terminal 5 and which opens and closes a circuit through which load current flows, a switching mechanism portion (not shown) which opens and closes the switching contact, a trip mechanism portion (not shown) which operates the switching mechanism portion when an overcurrent flows in the circuit, and a handle 6 which can manually operate the switching mechanism.

[0005] A trip shaft 30 which forms a portion of the trip mechanism portion is biased in the clockwise direction by a spring (not shown), and when an overcurrent flows in the circuit, it rotates (F1) by a prescribed amount in the counterclockwise direction and operates the switching mechanism portion. 31 is a trip rod which is a trip operating member. One end 31a loosely engages the trip shaft 30, and the other end 31b abuts against a projection 33 installed on the installation base 2. 32 is a compression spring which biases the trip rod 31 towards the installation base 2.

[0006] Studs 11 for connecting the power supply side and the load side to external conductors 8 and connectors 13, which are connecting members for electrically connecting the studs 11 and the plug-in terminals 3 of the circuit breaker body 1 with a prescribed contact pressure from a contact spring 12, are installed on a base 7 which is made of a molded insulator and which forms the installation base 2.

[0007] In a plug-in type circuit breaker which is formed in this manner, in the state in which the circuit breaker body 1 is installed on the installation base 2, the other end 31b of the trip rod 31 and the projection 33 are abutting and the trip rod 31 is pushed upwards, so the one

end 31a of the trip rod 31 does not act on the trip shaft 30. Accordingly, the switching contact of the circuit breaker body 1 is in a closed contact state, and it conducts the load current.

[0008] In the state in which current is flowing in this manner, in order to remove the circuit breaker body 1 from the installation base 2, if the circuit breaker body 1 is moved upwards while being maintained roughly parallel (Figure 7), the trip rod 31 is displaced downwards (F2) by the action of the compression spring 32, its one end 31a acts on the trip shaft 30, the trip shaft 30 is rotated in the counterclockwise direction, the switching mechanism is operated, and before the plug-in terminals 3 and the connectors 13 separate, the switching contact is opened, and the load current is interrupted.

[0009] As a conventional plug-in type circuit breaker is constituted in the above-described manner, in the state in which the circuit breaker body 1 is removed from the installation base 2, the trip rod 31 has rotated the trip shaft 30 in the counterclockwise direction and the trip mechanism is in an operated state, so there was the problem that in this state the switching operation of the circuit breaker body 1 could not be tested.

[0010] This invention was made in order to solve such problems, and its object is to obtain a plug-in type circuit breaker which can easily perform switching operation even in a state in which the circuit breaker body has been removed.

Disclosure of the Invention

[0011] A plug-in type circuit breaker according to this invention is a plug-in type circuit breaker having a circuit breaker body with a switching contact which opens and closes a circuit in which a load current is flowing, a trip mechanism portion which opens the switching contact, and a connecting contact member which leads the load current to the circuit, an installation base on which the circuit breaker body is installed and which has a terminal member which is connected to an external conductor and which is connected by plugging in to the connecting contact member, and a safety trip apparatus which operates the trip mechanism portion before the terminal member and the connecting contact member separate and opens the switching contact when the circuit breaker body is removed from the installation base with the switching contact in a closed state, wherein the safety trip apparatus can be installed on and removed from the circuit breaker body, and switching operation of the circuit breaker body is possible when the safety trip apparatus is removed.

[0012] In addition, it is one in which the safety trip apparatus has a trip operating member which engages with the trip mechanism portion, a compression spring which biases the trip operating member towards the installation base, and a case which houses the compression spring and the trip operating member, and in which when the safety trip apparatus is installed, it is secured

to the circuit breaker body by a securing member.

[0013] Also, it is one in which when the safety trip apparatus is installed, if the trip operating member is rotated, it is possible to perform switching operation of the circuit breaker body by releasing the engagement between the trip operating member and the trip mechanism portion.

[0014] Furthermore, it is a plug-in type circuit breaker having a circuit breaker body with a switching contact which opens and closes a circuit in which a load current is flowing, a trip mechanism portion which opens the switching contact, and a connecting contact member which leads the load current to the circuit, an installation base on which the circuit breaker body is installed and which has a terminal member which is connected to an external conductor and which is connected by plugging in to the connecting contact member, and a safety trip apparatus which has a safety trip function of operating the trip mechanism portion before the terminal member and the connecting contact member separate and opening the switching contact when the circuit breaker body is removed from the installation base with the switching contact in a closed state, wherein the safety trip apparatus has a trip operating member which engages with the trip mechanism portion, a compression spring which biases the trip operating member towards the installation base, and a case which houses the compression spring and the trip operating member, and if the trip operating member is rotated, it is possible to perform switching operation of the circuit breaker body by releasing the engagement between the trip operating member and the trip mechanism portion.

[0015] Also, it is one in which if the trip operating member is rotated, a projection of the trip operating member and a recess of the case interfit, and a state is fixed in which the engagement of the trip operating member and the trip mechanism portion is released.

Brief Description of the Drawings

[0016]

Figure 1 is a longitudinal cross-sectional view of essential portions showing the state in which a circuit breaker body of a plug-in type circuit breaker according to a first embodiment of this invention is installed on an installation base.

Figure 2 is an enlarged cross-sectional view showing the installed state of a safety trip apparatus according to the first embodiment of this invention and an enlarged interior perspective view showing a trip rod and a case in an interfitting state.

Figure 3 is a longitudinal cross-sectional view of essential portions showing an intermediate state of removing a circuit breaker body of a plug-in type circuit breaker according to the first embodiment of this invention from an installation base.

Figure 4 is an enlarged cross-sectional view of the

safety trip apparatus when the engagement with a trip mechanism portion according to the first embodiment of this invention has been released and an enlarged interior perspective view showing the trip rod and the case in an interfitting state.

Figure 5 is an enlarged cross-sectional view showing the safety trip apparatus according to the first embodiment of this invention when being removed.

Figure 6 is a side cross-sectional view of essential portions showing the state in which a circuit breaker body of a conventional plug-in type circuit breaker is installed on an installation base.

Figure 7 is a side cross-sectional view of essential portions showing the removed state of the circuit breaker body of Figure 6.

Best Mode for Carrying Out the Invention

First Embodiment

[0017] Figure 1 is a longitudinal cross-sectional view of essential portions showing the state in which a circuit breaker body of a plug-in type circuit breaker according to a first embodiment of this invention is installed on an installation base. In the figure, 1-8, 11-13, and 30 are the same as in the explanation of the above-described conventional apparatus, so an explanation will be omitted.

[0018] Figure 2 is an enlarged view showing the installed state of a safety trip apparatus. (a) is an enlarged side cross-sectional view, (b) is a plan view of (a), and (c) is an enlarged interior perspective view showing the state in which a trip rod and a case are interfit. Figure 3 is a longitudinal cross-sectional view of essential portions showing an intermediate state during the removal of the circuit breaker body of Figure 1 from the installation base.

[0019] 14 is a stud cover which secures and insulates a stud 11.

[0020] The trip shaft 30 which forms a portion of a trip mechanism portion is biased in the clockwise direction by a spring (not shown), and when an overcurrent flows in a circuit, it rotates by a prescribed amount (F3) in the counterclockwise direction and operates a switching mechanism portion.

[0021] 20 is a safety trip apparatus. It is formed from a trip rod 21 which is a trip operating member, a compression spring 22, and a case 23. One end 21a of the trip rod 21 loosely engages with a pressing portion 30a of the trip shaft 30, and the other end 21b abuts a bush 24 installed on the installation base 2. A projection 21c which is integrally installed on the trip rod 21 loosely fits in a through hole 23a in the case 23, so the trip rod 21 is biased towards the installation base 2 by the compression spring 22.

[0022] 25 is a rear cover which is a securing member. It is disposed on the bottom surface of the circuit breaker body 1, and it secures a case 23 of the safety trip apparatus.

ratus 20 which is loosely inserted into an insertion hole 1a of the circuit breaker body 1. Instead of by the rear cover 25, the case 23 may be secured inside the insertion hole 1a of the circuit breaker body 1 by screws or the like, or the case 23 may be inserted and secured by a press fit or a snap fit or the like in the insertion hole 1a of the circuit breaker body 1.

[0023] In a plug-in type circuit breaker formed in this manner, in the state in which the circuit breaker body 1 is installed on the installation base 2, the other end 21b of the trip rod 21 abuts the bush 24, and the trip rod 21 is pressed on the side facing the trip shaft 30, so the one end 21a of the trip rod 21 does not act on the pressing portion 30a of the trip shaft 30, and accordingly, the switching contact of the circuit breaker body 1 is in a closed state and conducts a load current.

[0024] In the state in which a current is being conducted as described above, in order to remove the circuit breaker body 1 from the installation base 2, if the circuit breaker body 1 is moved in the direction of the arrow (Figure 3), the trip rod 21 is displaced to the left (F4) due to the action of the compression spring 22, its one end 21a acts on the pressing portion 30a of the trip shaft 30, the trip shaft 30 is rotated in the counterclockwise direction, the switching mechanism is operated, and before the plug-in terminals 3 and the connectors 13 separate, the switching contact is opened and the load current is interrupted.

[0025] Figure 4 is an enlarged cross-sectional view of the safety trip apparatus at the time of releasing its engagement with the trip mechanism portion. (a) is an enlarged side cross-sectional view, (b) is a plan view of (a), and (c) is a enlarged interior perspective view showing the state in which the trip rod and the case interfit.

[0026] In the figures, if the other end 21b of the trip rod 21 is rotated by approximately 90 in the direction of the arrow from the state shown in Figure 2 by a screwdriver or the like and it is brought to the state shown in Figure 4, the projection 21c of the trip rod 21 which was engaging with the top surface portion 23b of the case 23 fits into the recess 23c of the case 23, and in addition, the one end 21a of the trip rod 21 also rotates by approximately 90 and is no longer engaged with the pressing portion 30a of the trip shaft 30, so even if the trip rod 21 moves in direction F5, it does not act on the pressing portion 30a of the trip shaft 30.

[0027] In addition, the projection 21c of the trip rod 21 fits into the recess 23c of the case 23, so the trip rod 21 becomes unable to rotate from this position, and in addition, the projection 21c is pressed into the recess 23c by the compression spring 22, so the state is fixed in which the engagement between the one end 21a of the trip rod 21 and the pressing portion 30a of the trip shaft 30 is released.

[0028] From this state, in order to return to the state shown in Figure 2 in which the one end 21a of the trip rod 21 and the pressing portion 30a of the trip shaft 30 engage, the other end 21b of the trip shaft 21 can be

pressed towards the trip shaft 30 against the pressing force of the compression spring 22 and rotated by approximately 90 in the opposite direction from the arrow by a screwdriver or the like.

[0029] A plug-in type circuit breaker formed in this manner is fixed in a state in which the engagement between the one end 21a of the trip rod 21 and the pressing portion 30a of the trip shaft 30 is released, so in a state in which the circuit breaker body 1 is removed, it is possible to carry out switching operation, so malfunctions do not take place even if vibrations which are generated when the switching portion is operated manually by the handle 6 are transmitted to the trip rod 21, and it is possible to carry out switching operation.

[0030] In addition, the safety trip apparatus 20 which is loosely inserted into the insertion hole 1a of the circuit breaker body 1 in this manner has a structure such that it can be easily installed and removed by installation and removal of the rear cover 23. Figure 5 is an enlarged view showing when the safety trip apparatus is removed. (a) is an enlarged side cross-sectional view, and (b) is a plan view of (a).

[0031] From the above-described state in which the engagement between the one end 21a of the trip rod 21 and the pressing portion 30a of the trip shaft 30 is released, if the rear cover 23 attached to the rear surface of the circuit breaker body 1 is removed, the safety trip apparatus 20 formed from the trip rod 21, the compression spring 22, and the case 23 can easily be removed from the circuit breaker body 1, and in the state in which the circuit breaker body 1 is removed, if the safety trip apparatus 20 is removed, switching operation of the circuit breaker body 1 can be carried out, and it can later be installed in a circuit breaker body 1 in which a safety trip apparatus 20 is not installed.

[0032] In the above description, the case was explained in which the safety trip apparatus 20 is secured to the circuit breaker body 1 by the rear cover 25 and the safety trip apparatus 20 can be installed and removed, but a structure may be employed in which the rear cover 25 is integrally formed with the circuit breaker body 1 and cannot be installed and removed, and in the same manner, in a state in which the circuit breaker body 1 is removed, switching operation can be carried out.

Possibility of Industrial Use

[0033] As described above, in a plug-in type circuit breaker according to this invention, in a state in which a circuit breaker body is removed, if a safety trip apparatus is removed, switching operation of the circuit breaker body can be carried out, and it can be additionally installed in a circuit breaker body in which a safety trip apparatus is not installed.

[0034] In addition, the safety trip apparatus can be easily installed and removed from the circuit breaker body by attaching and removing the rear cover.

[0035] In addition, if the other end of the trip rod is

rotated by a screwdriver or the like, the one end of the trip rod no longer acts on the pressing portion of the trip shaft, so in a state in which the circuit breaker body is removed, switching operation can be carried out.

[0036] Furthermore, a state is fixed in which the engagement between the one end of the trip rod and the pressing portion of the trip shaft is released, so in a state in which the circuit breaker body has been removed, switching operation can be carried out without malfunctions even when vibrations generated at the time of manual switching of the switching mechanism portion by operation of the handle are transmitted to the trip rod.

Claims

1. A plug-in type circuit breaker having a circuit breaker body with a switching contact which opens and closes a circuit in which a load current is flowing, a trip mechanism portion which opens the switching contact, and a connecting contact member which leads the load current to the circuit, an installation base on which the circuit breaker body is installed and which has a terminal member which is connected to an external conductor and which is connected by plugging in to the connecting contact member, and a safety trip apparatus which operates the trip mechanism portion before the terminal member and the connecting contact member separate and opens the switching contact when the circuit breaker body is removed from the installation base with the switching contact in a closed state, **characterized in that** the safety trip apparatus can be installed on and removed from the circuit breaker body, and switching operation of the circuit breaker body is possible when the safety trip apparatus is removed.

2. The plug-in type circuit breaker of claim 1 **characterized in that** the safety trip apparatus has a trip operating member which engages with the trip mechanism portion, a compression spring which biases the trip operating member towards the installation base, and a case which houses the compression spring and the trip operating member, and when the safety trip apparatus is installed, it is secured to the circuit breaker body by a securing member.

3. The plug-in type circuit breaker of claim 2 **characterized in that** when the safety trip apparatus is installed, if the trip operating member is rotated, it is possible to perform switching operation of the circuit breaker body by releasing the engagement between the trip operating member and the trip mechanism portion.

4. A plug-in type circuit breaker having a circuit break-

er body with a switching contact which opens and closes a circuit in which a load current is flowing, a trip mechanism portion which opens the switching contact, and a connecting contact member which leads the load current to the circuit, an installation base on which the circuit breaker body is installed and which has a terminal member which is connected to an external conductor and which is connected by plugging in to the connecting contact member, and a safety trip apparatus which has a safety trip function of operating the trip mechanism portion before the terminal member and the connecting contact member separate and opening the switching contact when the circuit breaker body is removed from the installation base with the switching contact in a closed state, **characterized in that** the safety trip apparatus has a trip operating member which engages with the trip mechanism portion, a compression spring which biases the trip operating member towards the installation base, and a case which houses the compression spring and the trip operating member, and if the trip operating member is rotated, it is possible to perform switching operation of the circuit breaker body by releasing the engagement between the trip operating member and the trip mechanism portion.

5. The plug-in type circuit breaker of claim 2 **characterized in that** if the trip operating member is rotated, a projection of the trip operating member and a recess of the case interfit, and a state is fixed in which the engagement of the trip operating member and the trip mechanism portion is released.

FIG. 1

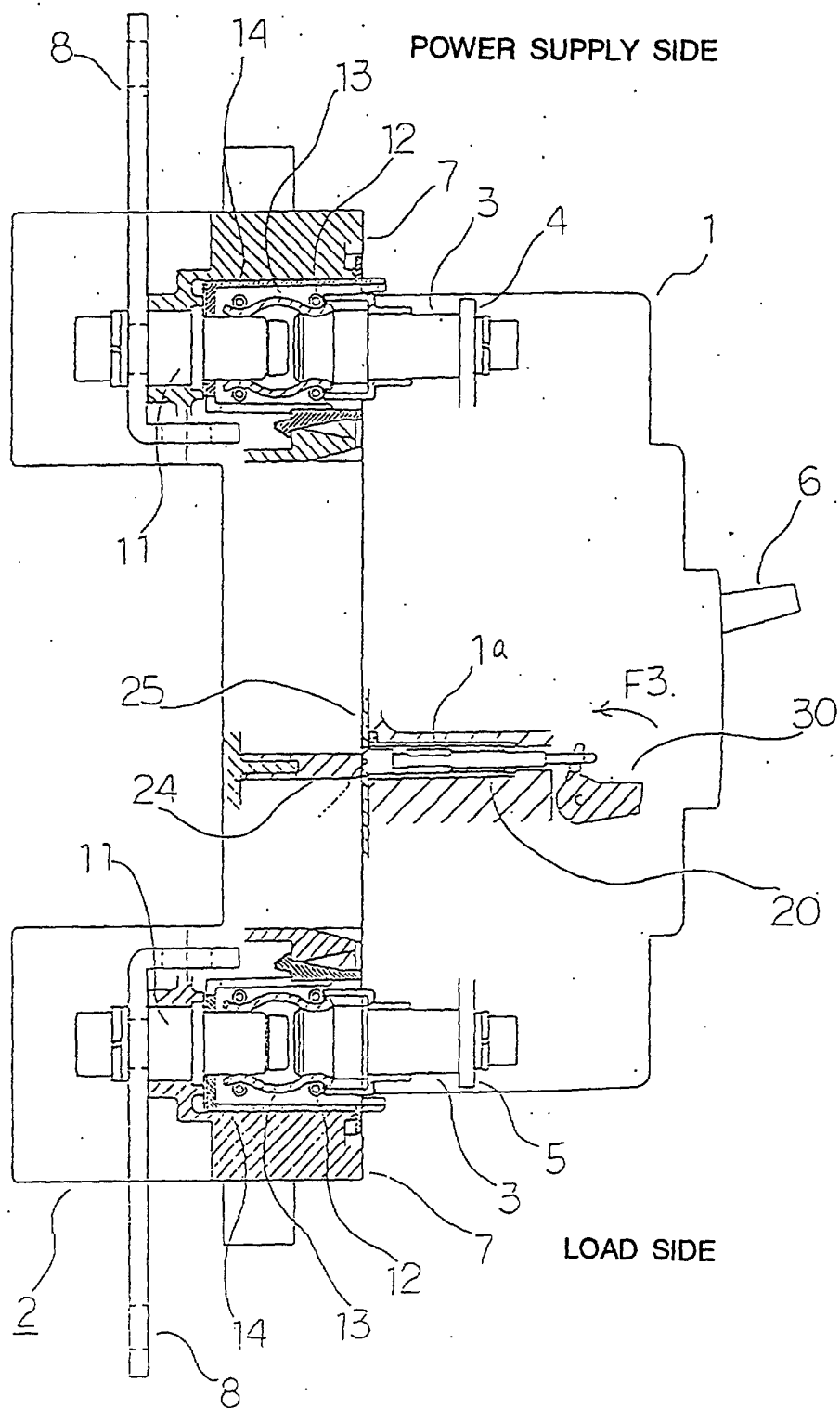


FIG. 2

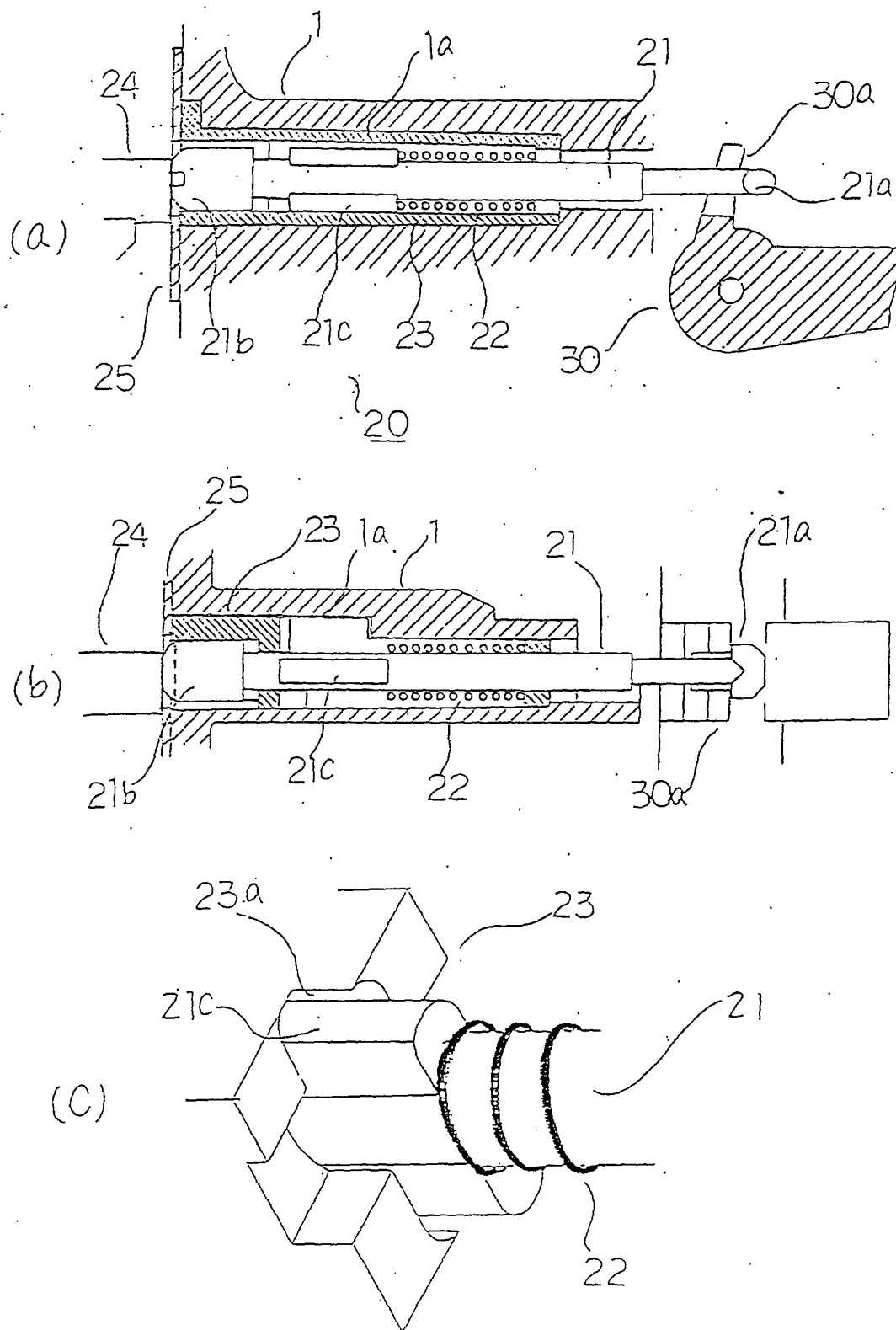


FIG. 3

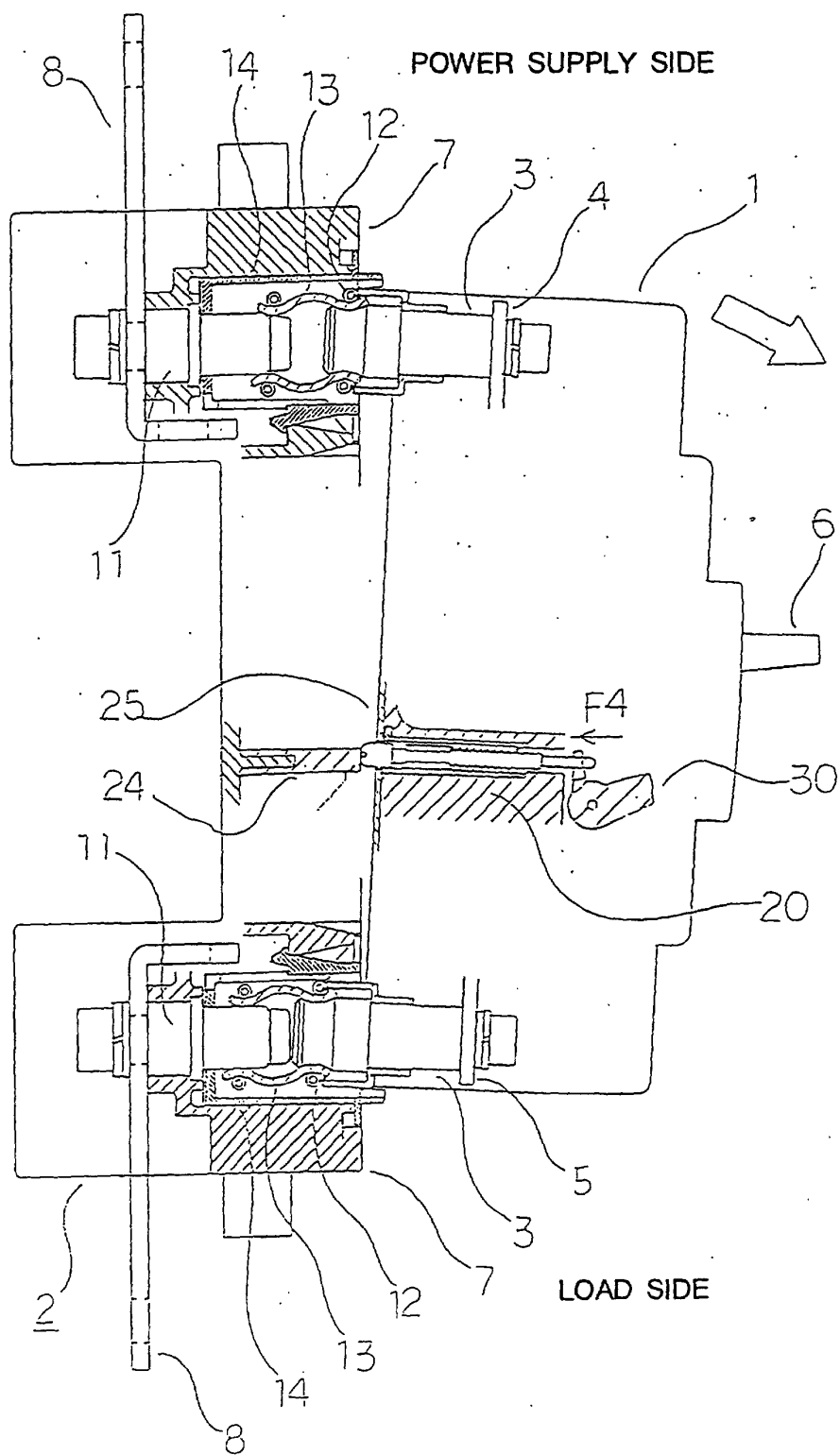


FIG. 4

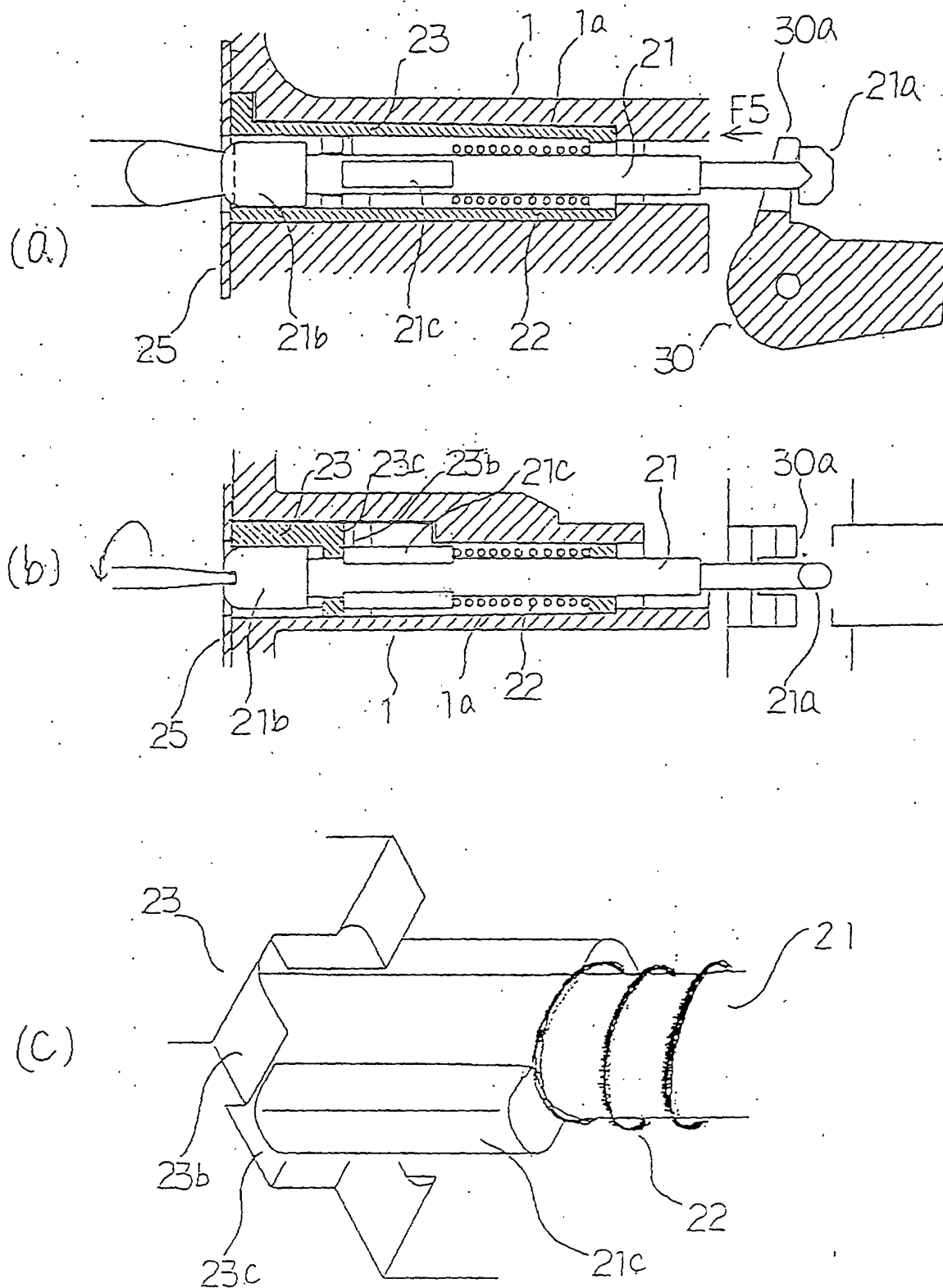


FIG. 5

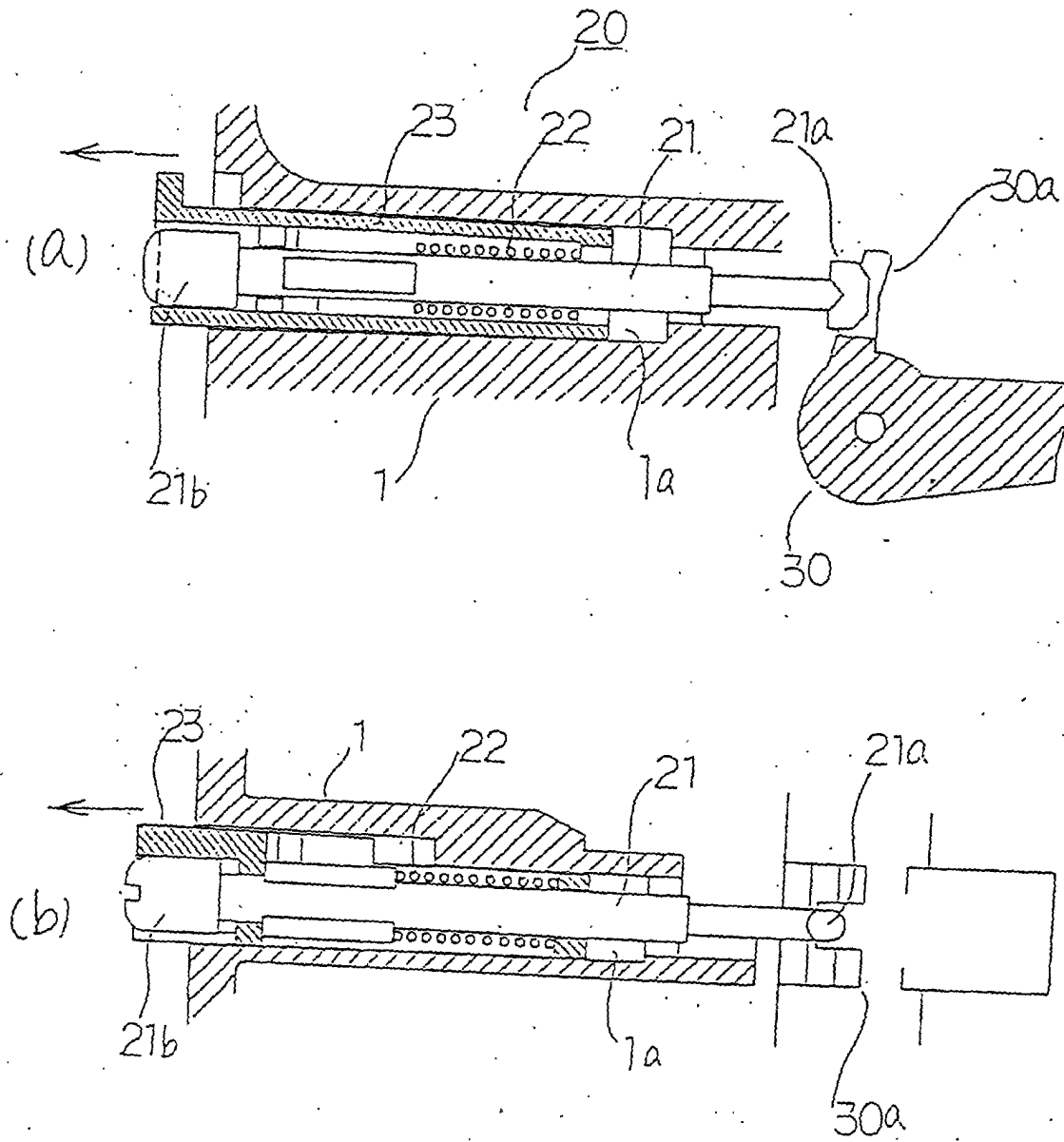


FIG. 6

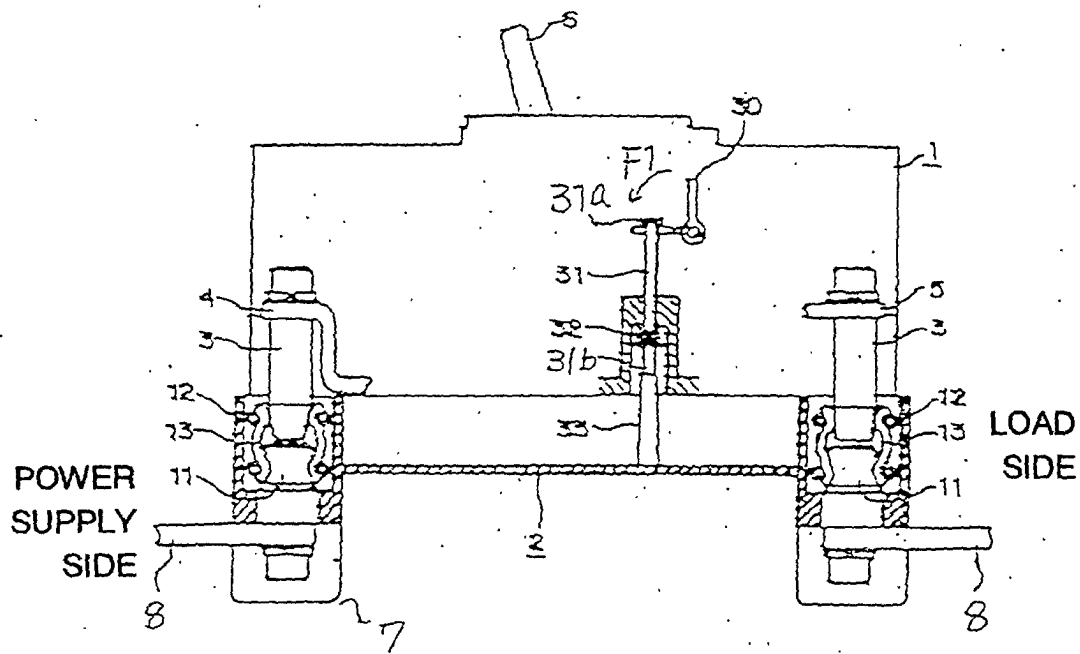
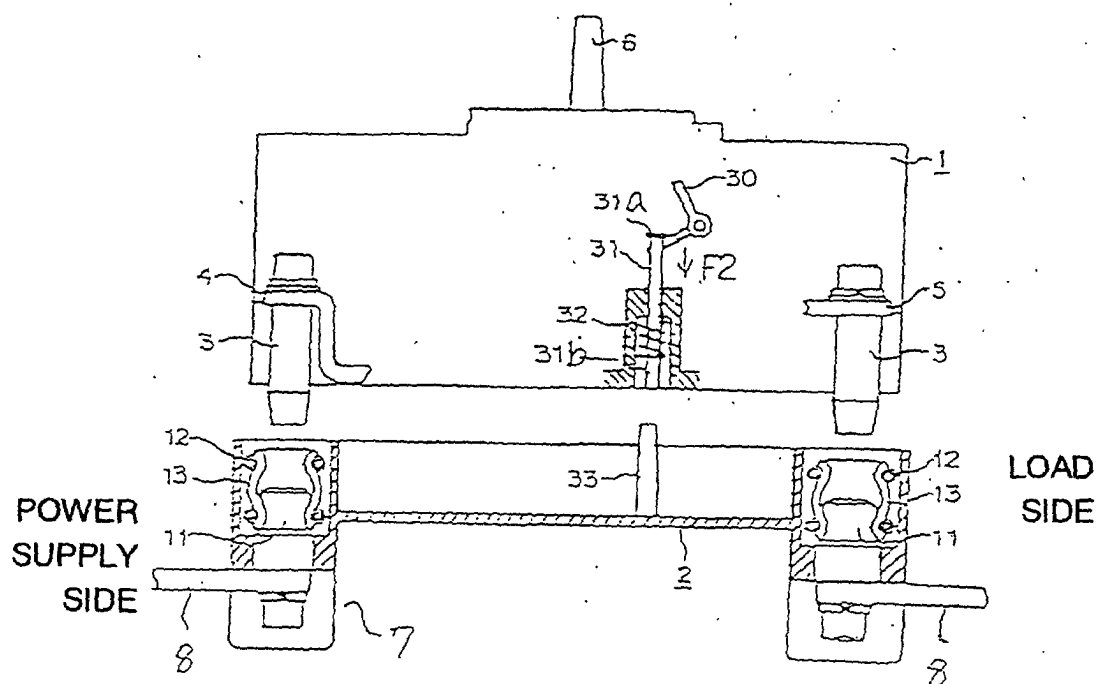


FIG. 7



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP99/05518

A. CLASSIFICATION OF SUBJECT MATTER Int.Cl ⁷ H01H73/06		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) Int.Cl ⁷ H01H71/00-83/22		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched Jitsuyo Shinan Koho 1926-1996 Jitsuyo Shinan Toroku Koho 1996-1999 Kokai Jitsuyo Shinan Koho 1971-1999 Toroku Jitsuyo Shinan Koho 1994-1999		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, 8-185782, A (Mitsubishi Electric Corporation), 10 July, 1996 (10.07.96), Figs. 1 to 5 (Family: none)	1-2, 5 3-4
Y	JP, 56-136428, A (Siemens AG), 24 October, 1981 (24.10.81), Column 7, line 1 to Column 8, line 2; Column 12, line 12 to Column 14, line 13 & EP, 35083, A & DE, 3008249, A & AT, 3226, A	3-4
A	JP, 8-250008, A (Terasaki Denki Kangyo K.K.), 27 September, 1996 (27.09.96) (Family: none)	1-5
A	JP, 11-96861, A (Fuji Electric Co., Ltd.), 09 April, 1999 (09.04.99) (Family: none)	1-5
A	JP, 3-133019, A (Westinghouse Electric Corporation), 06 June, 1991 (06.06.91) & US, 4950848, A & EP, 419276, A & AU, 6133590, A & CN, 1051455, A & ZA, 9006726, A & BA, 9004675, A	1-5
☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.		
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Date of the actual completion of the international search 20 December, 2011 (20.12.11)		Date of mailing of the international search report 11 January, 2000 (11.01.00)
Name and mailing address of the ISA/ Japanese Patent Office		Authorized officer
Facsimile No.		Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP99/05518

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	& MX, 167511, A	

Form PCT/ISA/210 (continuation of second sheet) (July 1992)