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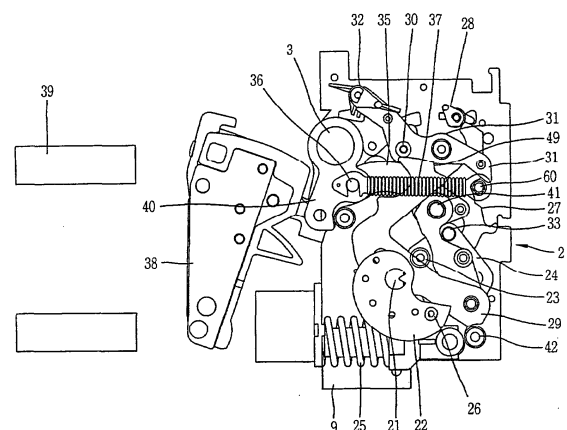
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(54) **Air circuit breaker, breaking spring of air circuit breaker and connection method thereof**

(57) An air circuit breaker, a breaking spring of the air circuit breaker, and its connection method are disclosed. The air circuit breaker includes: a cam (22); a driving lever (24) connected with the cam and rotated; a closing spring (25) compressed by the driving lever (24); a plurality of links (29,34,35) that transfer a driving force generated when the closing spring is stretched; a switching shaft (3) connected with one or the links by a connection shaft (36) and rotated according to movement of the link; and a breaking spring (37) having a fixing hole (52,72) with one side opened at one end portion (51,70) thereof, so as to be fixed to the connection shaft (36) perpendicularly in an axial line direction of the connection shaft. A space for assembling does not need to be formed at an end portion of the connection shaft, obtaining a compact structure. In addition, a tool can be simplified, an installation can be facilitated, an assembling time can be shortened, and a fabrication cost can be reduced.

FIG. 6



Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to an air circuit breaker, a breaking spring of the air circuit breaker and its connection method, and more particularly, to an air circuit breaker capable of simply installing a breaking spring, the breaking spring of the air circuit breaker and its connection method.

2. Description of the Related Art

[0002] In general, the air circuit breaker is a device that breaks a circuit (i.e., blocks an electrical connection) when a load is turned on or off, when an overload occurs, when a short circuit accident occurs, or when an electrical leak or shock occurs.

[0003] As shown in FIGs. 1 to 3, the related art air circuit breaker includes a switching mechanism part 102 that switches a circuit by moving a movable contactor 138 to a terminal 139.

[0004] The switching mechanism part 102 includes a cam 122 connected with a rotational shaft 121 and rotated manually or automatically; a driving lever 124 rotatably installed at a frame 109 supporting both sides of the switching mechanism part 102, includes a lever roller 123, and is rotated as the lever roller 123 is driven along a curved surface of the cam 122 when the cam 122 is rotated; a closing spring 125 which has one end connected with a lower end portion of the driving lever 124 and the other end supported by the frame 109, and is compressed due to the rotation of the driving lever according to the rotation of the cam 122 to store elastic energy; a first latch 127 which extends in a vertical direction so as to be elastically installed at the frame 109 and has a certain recess on its lower surface, and is locked as a pin 126 installed at the cam 122 is caught in the recess; a closing switch 128 installed at an upper side of the first latch 127 and releasing the locked state of the first latch 127; a first link 129 which is rotatably installed at the rotational shaft 121, extends in a vertical direction, has a lower end portion connected with an upper end portion of the driving lever 14 so as to be rotated according to the rotation of the driving lever 124, and includes a certain recess 149 at an upper portion thereof; a second latch 131 which is disposed at an upper side of the first link 129, includes a latch roller 130 that contacts with an upper surface of the first link 129, is rotated according to rotation of the first link 129, and is locked when the latched roller 130 is caught by the recess 149 of the first link 129; a breaking spring 132 which is installed at an upper side of the second latch 131 and releases a locked state of the second latch 131; a stopper 142 which is installed at a lower side of the frame 109 and prevents the first link 129 from being rotated by more than a certain displacement

in a breaking operation of the air circuit breaker; a second link 134 which has a lower end portion connected together with the first link 129 to the driving lever 124, and is disposed to contact with a pin 133 formed at the driving lever 124; a third link 135 which is connected with an upper end of the second link 134 by a connection pin 141 and rotated according to a displacement of the second link 134; a switching shaft 103 which is rotatably installed at the frame 109, and connected with the third link 135 so as to be rotated when the third link 135 is moved; a connection shaft 136 which connects the third link 135 to the switching shaft 103; a breaking spring which has one end fixed at the connection shaft 136 and the other end supported by the frame 109; and a leg 140 which is fixed at the switching shaft 103 and moves the movable contactor 138 to the terminal 139 when the switching shaft 103 is rotated.

[0005] During a closing operation of the air circuit breaker, the breaking spring 137 is stretched when the movable contactor 138 is moved to the terminal 139 by a driving force generated according to rapid stretching of the closing spring 125, and during a breaking operation of the air circuit breaker, the breaking spring 137 provides an elastic force for returning the movable contactor 138 to its initial state. As shown in FIG. 4, one end of the breaking spring 137 is fixed at both ends of the connection shaft 136 and the other end thereof is fixed at a support shaft 160 installed at the frame 109.

[0006] With reference to FIG. 5, the breaking spring 137 includes a first fixing part 151 which is formed in a ring shape and has a fixing hole 154 so as to be inserted to both ends of the connection shaft 136; a second fixing part 152 which is formed in a ring shape and has a fixing hole 155 so as to be inserted to the support shaft 160; and a coil-shaped elastic member 153 interposed between the first and second fixing parts 151 and 152.

[0007] The related art air circuit breaker constructed as described above performs a charging operation for accumulating elastic energy to the closing spring 125, a closing operation for connecting the movable contactor 138 to the terminal 139 by virtue of the elastic force of the closing spring 125, and a breaking operation for separating the movable contactor 138 from the terminal 139.

[0008] The charging operation of the air circuit breaker is performed as follows. As shown in FIG. 2, in a breaking state that the movable contactor 138 is separated from the terminal 139, when the rotational shaft 131 is rotated manually or automatically, the cam 122 is rotated, and accordingly, the driving lever 124 is rotated to compress the closing spring 125.

[0009] The closing operation of the air circuit breaker is performed as follows. As shown in FIG. 3, the elastic energy of the closing spring 125 is transferred via respective link mechanisms of the switching mechanism part 102, whereby switching shaft 103 connected with the third link 135 is rotated and the movable contactor 138 comes in contact with the terminal 139, conducting current.

[0010] At this time, the breaking spring 137 is stretched according to movement of the connection shaft 136.

[0011] The breaking operation of the air circuit breaker is performed as follows. In breaking a circuit, the movable contactor 138 is separated from the terminal 139 by virtue of the elastic force of the stretched breaking spring 137 to return to its original state as shown in FIG. 1.

[0012] In the related art air circuit breaker, in order to assemble the breaking spring 137, the second fixing part 152 of the breaking spring 137 is first inserted to the support shaft 160, both ends of the support shaft 160 are then fixed at the frame 109 supporting both sides of the switching mechanism part 102. And then, the breaking spring 137 is stretched by using a tool and the first fixing part 151 is insertedly fixed at both ends of the connection shaft 136.

[0013] However, in the related art air circuit breaker, because the first fixing part 151 of the breaking spring 137 has a closed loop shape, after the elastic member 153 is stretched, the first fixing part 151 should be moved toward the end portion of the connection shaft 136 and inserted through the end portion of the connection shaft 136. That is, a space for assembling should be secured between the end portion of the connection shaft 136 and the frame 109, which makes it difficult to obtain a compact construction.

[0014] In particular, a sufficient space can be hardly obtained between the end portion of the connection shaft 136 and the frame 109 due to many components of the switching mechanism part 102, so the structure of the tool for stretching the breaking spring 137 is complicated, causing a problem that it is difficult to design the tool and the process of installing the breaking spring 137 is complicated.

SUMMARY OF THE INVENTION

[0015] Therefore, in order to address the above matters the various features described herein have been conceived. One aspect of the exemplary embodiments is to provide an air circuit breaker capable of having a compact structure by omitting a space for assembling at an end portion of a connection shaft, a breaking spring of the air circuit breaker and its connection method.

[0016] Another aspect of the exemplary embodiments is to provide an air circuit breaker capable of simplifying a tool, facilitation installation, shortening an assembling time, and reducing a fabrication cost, a breaking spring of the air circuit breaker, and its connection method.

[0017] This specification provides an air circuit breaker that may include: a cam which is connected with a rotational shaft and rotated; a driving lever which is connected with the cam and rotated; a closing spring which is connected with the driving lever and compressed according to rotation of the driving lever; a plurality of links that transfer a driving force generated when the closing spring is stretched; a switching shaft which is connected with one of the links by a connection shaft and rotated accord-

ing to movement of the link; and a breaking spring having a fixing hole with one side opened at one end portion thereof so as to be fixed to the connection shaft perpendicularly in an axial line direction of the connection shaft and the other end portion fixed to a support shaft installed at the frame on which the plurality of links are supported.

[0018] The breaking spring may include: a first fixing part having a fixing hole to be inserted to an outer circumferential surface of the connection shaft; a second fixing part having a fixing hole inserted to the support shaft; and an elastic member interposed between the first and second fixing parts.

[0019] The first fixing part may have a hook-like shape.

[0020] The first fixing part may have a rectangular plate shape.

[0021] The fixing hole may include an entrance through which the connection shaft is inserted, and a receiving part communicating with the entrance and receiving the connection shaft.

[0022] The receiving part may be formed at a farther position than the entrance with respect to the first fixing part along a stretching direction of the elastic member.

[0023] An end portion of the first fixing part may include a stop hole in which a tool is caught.

[0024] This specification also provides a breaking spring of an air circuit breaker, that may include: a switching mechanism part that compresses a closing spring by converting a rotational movement of a rotational shaft, is included in the air circuit breaker which switches a circuit by moving a movable contactor according to an elastic restoration force of the closing spring, is stretched during a closing operation of the air circuit breaker in order to store elastic energy for returning the movable contactor during a breaking operation of the air circuit breaker, and has one end having a fixing hole with one side opened so as to be combined with a connection shaft which connects a link of the switching mechanism part perpendicularly to an axial line direction of the connection shaft.

[0025] This specification also provides a method for connecting a breaking spring of an air circuit breaker which includes a switching mechanism part that compresses a closing spring by converting a rotational movement of a rotational shaft, is included in the air circuit breaker which switches a circuit by moving a movable contactor according to an elastic restoration force of the closing spring, is stretched during a closing operation of the air circuit breaker in order to store elastic energy for returning the movable contactor during a breaking operation of the air circuit breaker, and has one end portion with a fixing hole opened outwardly, that may include: connecting the other end portion of the breaking spring to a support shaft formed at a frame of the switching mechanism; stretching the breaking spring toward a connection shaft that connects a link of the switching mechanism part; positioning an entrance of the fixing hole at the side of the connection shaft; and inserting the connection shaft into the fixing hole.

[0026] The method may further include: inserting a tool

into a stop hole formed at one side of the fixing hole before stretching the breaking spring.

[0027] The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

[0029] In the drawings:

FIG. 1 is a sectional view showing an air circuit breaker according to the related art;

FIG. 2 is a sectional view showing a compressed state of a closing spring in FIG. 1;

FIG. 3 is a sectional view showing a closed state in FIG. 1;

FIG. 4 is a perspective view showing a mounted state of a breaking spring in FIG. 1;

FIG. 5 is a front view showing a breaking spring of the air circuit breaker in FIG. 1

FIG. 6 is a sectional view showing an air circuit breaker according to one exemplary embodiment of the present invention;

FIG. 7 is a sectional view showing a compressed state of the closing spring in FIG. 6;

FIG. 8 is a sectional view showing a closed state of the air circuit breaker in FIG. 6;

FIG. 9 is a perspective view showing a mount state of the breaking spring of the air circuit breaker in FIG. 6;

FIG. 10 is a front view showing the breaking spring in FIG. 6;

FIG. 11 is a view showing a tool for stretching the breaking spring in FIG. 6; and

FIG. 12 is a front view of a breaking spring according to another exemplary embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0030] The air circuit breaker according to the present invention will now be described in detail with reference to the accompanying drawings.

[0031] As shown in FIGs. 6 to 8, the air circuit breaker according to the present invention includes a switching mechanism part 2 that switches a circuit by rotating a movable contactor 38 such that the movable contactor 38 contacts with or separated from a terminal 39.

[0032] The switching mechanism part 2 includes a cam 22 which is connected with a rotational shaft 21 and ro-

tated manually or automatically; a driving lever 24 which is rotatably installed at a frame 9 supporting both sides of the switching mechanism part 2, includes a lever roller 23, and is rotated as the lever roller 23 is driven along a curved surface of the cam 22 when the cam 22 is rotated; a closing spring 25 which has one end connected with a lower end portion of the driving lever 24 and the other end supported by the frame 9, and is compressed due to the rotation of the driving lever according to the rotation of the cam 22 to store elastic energy; a first latch 27 which extends in a vertical direction so as to be elastically installed at the frame 9 and has a certain recess on its lower surface, and is locked as a pin 26 installed at the cam 22 is caught in the recess; a closing switch 28 which is installed at an upper side of the first latch 27 and releases the locked state of the first latch 27; a first link 29 which is rotatably installed at the rotational shaft 21, extends in a vertical direction, has a lower end portion connected with an upper end portion of the driving lever 14 so as to be rotated according to the rotation of the driving lever 24, and includes a certain recess 49 at an upper portion thereof; a second latch 31 which is disposed at an upper side of the first link 29, includes a latch roller 130 that contacts with an upper surface of the first link 29, is rotated according to rotation of the first link 29, and is locked when the latched roller 30 is caught by the recess 49 of the first link 29; a breaking spring 32 which is installed at an upper side of the second latch 31 and releases a locked state of the second latch 31; a stopper 42 which is installed at a lower side of the frame 9 and prevents the first link 29 from being rotated by more than a certain displacement in a breaking operation of the air circuit breaker; a second link 34 which has a lower end portion connected together with the first link 29 to the driving lever 24, and is disposed to contact with a pin 33 formed at the driving lever 24; a third link 35 which is connected with an upper end of the second link 34 by a connection pin 41 and rotated according to a displacement of the second link 34; a switching shaft 3 which is rotatably installed at the frame 9, and connected with the third link 35 so as to be rotated when the third link 35 is moved; a connection shaft 36 which connects the third link 35 to the switching shaft 3; a breaking spring which has one end fixed at the connection shaft 36 and the other end supported by the frame 9; and a leg 40 which is fixed at the switching shaft 3 and moves the movable contactor 38 to the terminal 39 when the switching shaft 3 is rotated.

[0033] During a closing operation of the air circuit breaker, the breaking spring 137 is stretched when the movable contactor 138 is moved to the terminal 139 by a driving force generated according to rapid stretching of the closing spring 125, and during a breaking operation of the air circuit breaker, the breaking spring 137 provides an elastic force for returning the movable contactor 138 to its initial state. As shown in FIG. 9, one end of the breaking spring 137 is fixed at an end portion of the connection shaft 136 and the other end thereof is fixed at a

support shaft 160 installed at the frame 109.

[0034] With reference to FIG. 10, the breaking spring 37 includes a first fixing part 51 which has a fixing hole 52 with one side opened so as to be inserted to an outer circumferential surface of the connection shaft 36; a second fixing part 55 which is formed in a ring shape and has a fixing hole 56 so as to be inserted to the support shaft 60; and a coil-shaped elastic member 57 interposed between the first and second fixing parts 51 and 55.

[0035] The first fixing part 51 has a substantially hook-like shape. The fixing hole 52 of the first fixing part 51 includes an entrance 53 opened outwardly and a receiving part 54 communicating with the entrance 53 and allowing the connection shaft 36 to be housed and maintained to be caught therein.

[0036] A stop hole 58 is formed at an end portion of the first fixing part 51 to allow a tool 80 for stretching the breaking spring 37 to be inserted thereinto. As shown in FIG. 11, the tool 80 includes a rod part 82, a hook part 84 formed to be bent in a hook-like shape at one end of the rod part 82, and a handle part 86 formed at the other end of the rod part 82. The hook part 85 has a diameter smaller than that of the stop hole 58.

[0037] With such a structure, when the breaking spring 37 is desired to be installed, first, the support shaft 60 is inserted into the fixing hole 56 of the second fixing part 55. Next, the hook part 84 of the tool 80 is inserted into the stop hole 58, and then, the elastic member 57 is stretched such that the center of the entrance 53 of the fixing hole 52 to pass through the center of the connection shaft 36. In this state, the first fixing part 51 is pressed to allow the connection shaft 36 to be inserted through the entrance 53 of the fixing hole 52 of the first fixing part 51. Accordingly, the connection shaft 36 is received in the receiving part 54.

[0038] The air circuit breaker according to the present invention constructed as described above performs a charging operation for accumulating elastic energy to the closing spring 25, a closing operation for connecting the movable contactor 138 to the terminal 39 by virtue of the elastic force of the closing spring 25, and a breaking operation for separating the movable contactor 38 from the terminal 39.

[0039] The charging operation of the air circuit breaker is performed as follows. As shown in FIG. 7, in a breaking state that the movable contactor 38 is separated from the terminal 39, when the rotational shaft 31 is rotated manually or automatically, the cam 22 is rotated, and accordingly, the driving lever 24 is rotated to compress the closing spring 25.

[0040] The closing operation of the air circuit breaker is performed as follows. As shown in FIG. 8, the elastic energy of the closing spring 25 is transferred via respective link mechanisms of the switching mechanism part 2, whereby switching shaft 3 connected with the third link 35 is rotated and the movable contactor 38 comes in contact with the terminal 39, conducting current.

[0041] At this time, the breaking spring 137 is stretched

according to movement of the connection shaft 136.

[0042] The breaking operation of the air circuit breaker is performed as follows. In breaking a circuit, the movable contactor 38 is separated from the terminal 39 by virtue of the elastic force of the stretched breaking spring 37 to return to its original state as shown in FIG. 6.

[0043] In the air circuit breaker according to the present invention, because the first fixing part 51 fixed at the end portion of the connection shaft 36 of the breaking spring 37 has the hook-like shape, the breaking spring 37 can be mounted by simply pulling the first fixing part 51 and hooking it to the connection shaft 36. Thus, no space is required for assembling the breaking spring 37 between the connection shaft 36 and the frame 9 and designing of the tool for pulling the first fixing part 51 can be simplified.

[0044] FIG. 12 is a front view of a breaking spring according to another exemplary embodiment of the present invention. In describing the breaking spring according to another exemplary embodiment of the present invention, the same elements as those in the former exemplary embodiment are given the same reference numerals. As shown in FIG. 12, the breaking spring 37 of the air circuit breaker includes a first fixing part 70 having a fixing hole 72 with one side opened and inserted to an outer circumferential surface of the connection shaft 36; a second fixing part 55 formed in a ring shape and having a fixing hole 56 so as to be inserted to the support shaft 60; and a coil-shaped elastic member 57 interposed between the first fixing part 70 and the second fixing part 55.

[0045] The first fixing part 70 includes a rectangular platy body 71 and a fixing hole 72 opened from one side of the body 71. A stop hole 78 is formed spaced apart from the fixing hole 72 on the body 71, into which the tool 80 is combined. Here, preferably, the center of the stop hole 78 comes on the same line as that of the fixing hole 72.

[0046] The fixing hole 72 includes an entrance 73 formed to be opened outwardly at the side of the body 71 and a receiving part 74 communicating with the entrance 73 and receiving the connection shaft 36. The receiving part 74 is formed at a farther position from the second fixing part 55 along a stretching direction of the elastic member 57 compared with the entrance 73.

[0047] With such a structure, when the breaking spring 37 is desired to be installed, first, the second fixing part 55 is connected to the support shaft 60. Next, the hook part 84 of the tool 80 is inserted into the stop hole 78, and the elastic member 57 is stretched such that the center of the entrance 73 of the fixing hole 72 of the first fixing part 70 passes through the center of the connection shaft 36. Thereafter, the first fixing part 70 is pressed to allow the connection shaft 36 to be inserted into the entrance 73 of the fixing hole 72 of the first fixing part 70. Accordingly, the connection shaft 36 is received in the receiving part 74.

[0048] As so far described, the air circuit breaker, the breaking spring of the air circuit breaker and its connec-

tion method according to the present invention have the following advantages.

[0049] That is, first, because the fixing hole with one side opened is formed at one end of the breaking spring, after the breaking sprig is stretched, it does not need to be moved in an axial line direction of the connection shaft. Thus, the breaking spring can be easily installed.

[0050] Second, because there is no need to secure a space for assembling between the end portion of the connection shaft and the frame, a compact structure can be obtained.

[0051] Third, because the breaking spring does not need to be moved in the axial line direction of the connection shaft after being stretched, the structure of the tool can be simplified, the assembly time can be shortened, and the fabrication cost can be reduced.

[0052] As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalents of such metes and bounds are therefore intended to be embraced by the appended claims.

Claims

1. An air circuit breaker comprising:

a cam which is connected with a rotational shaft and rotated;
 a driving lever which is connected with the cam and rotated;
 a closing spring which is connected with the driving lever and compressed according to rotation of the driving lever;
 a plurality of links that transfer a driving force generated when the closing spring is stretched;
 a switching shaft which is connected with one of the links by a connection shaft and rotated according to movement of the link; and
 a breaking spring which has one end portion with a fixing hole with one side opened so as to be fixed to the connection shaft perpendicularly in an axial line direction of the connection shaft and the other end portion fixed to a support shaft installed at the frame on which the plurality of links are supported.

2. The air circuit breaker of claim 1, wherein the breaking spring comprises:

a first fixing part having a fixing hole to be inserted to an outer circumferential surface of the con-

nection shaft;

a second fixing part having a fixing hole inserted to the support shaft; and

an elastic member interposed between the first and second fixing parts.

3. The air circuit breaker of claim 2, wherein the first fixing part has a hook-like shape.

4. The air circuit breaker of claim 2, wherein the first fixing part has a rectangular plate shape.

5. The air circuit breaker of claim 4, wherein the fixing hole comprises an entrance through which the connection shaft is inserted, and a receiving part communicating with the entrance and receiving the connection shaft.

6. The air circuit breaker of claim 5, wherein the receiving part is formed at a farther position than the entrance with respect to the first fixing part along a stretching direction of the elastic member.

7. The air circuit breaker of claim 2, wherein an end portion of the first fixing part comprises a stop hole in which a tool is caught.

8. A breaking spring of an air circuit breaker, comprising:

a switching mechanism part that compresses a closing spring by converting a rotational movement of a rotational shaft, is included in the air circuit breaker which switches a circuit by moving a movable contactor according to an elastic restoration force of the closing spring, is stretched during a closing operation of the air circuit breaker in order to store elastic energy for returning the movable contactor during a breaking operation of the air circuit breaker, and has one end having a fixing hole with one side opened so as to be combined with a connection shaft which connects a link of the switching mechanism part perpendicularly to an axial line direction of the connection shaft.

9. The breaking spring of claim 8, wherein the breaking spring comprises:

a first fixing part having a fixing hole to be inserted to an outer circumferential surface of the connection shaft;
 a second fixing part having a certain fixing hole to be inserted to a support shaft installed between frames supporting the switching mechanism part; and
 an elastic member interposed between the first and second fixing parts.

10. The breaking spring of claim 9, wherein the first fixing part has a hook-like shape.
11. The breaking spring of claim 9, wherein the first fixing part has a rectangular plate shape. 5
12. The breaking spring of claim 11, wherein the fixing hole comprises an entrance through which the connection shaft is inserted, and a receiving part communicating with the entrance and receiving the connection shaft. 10
13. The breaking spring of claim 12, wherein the receiving part is formed at a farther position than the entrance with respect to the first fixing part along a stretching direction of the elastic member. 15
14. The breaking spring of claim 9, wherein an end portion of the first fixing part comprises a stop hole in which a tool is caught. 20
15. A method for connecting a breaking spring of an air circuit breaker which includes a switching mechanism part that compresses a closing spring by converting a rotational movement of a rotational shaft, 25
is included in the air circuit breaker which switches a circuit by moving a movable contactor according to an elastic restoration force of the closing spring, is stretched during a closing operation of the air circuit breaker in order to store elastic energy for returning the movable contactor during a breaking operation of the air circuit breaker, and has one end portion with a fixing hole opened outwardly, the method comprising: 30
connecting the other end portion of the breaking spring to a support shaft formed at a frame of the switching mechanism; 35
stretching the breaking spring toward a connection shaft that connects a link of the switching mechanism part; 40
positioning an entrance of the fixing hole at the side of the connection shaft; and
inserting the connection shaft into the fixing hole. 45
16. The method of claim 15, further comprising:
inserting a tool into a stop hole formed at one side of the fixing hole before stretching the breaking spring. 50

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FIG. 1

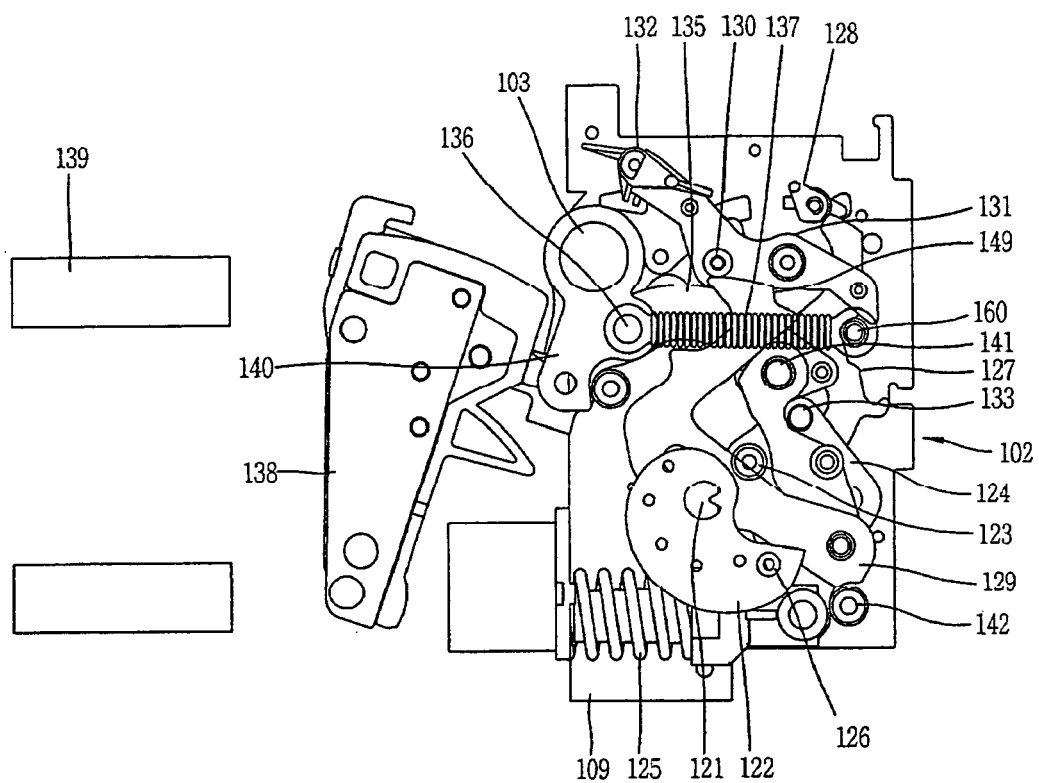


FIG. 2

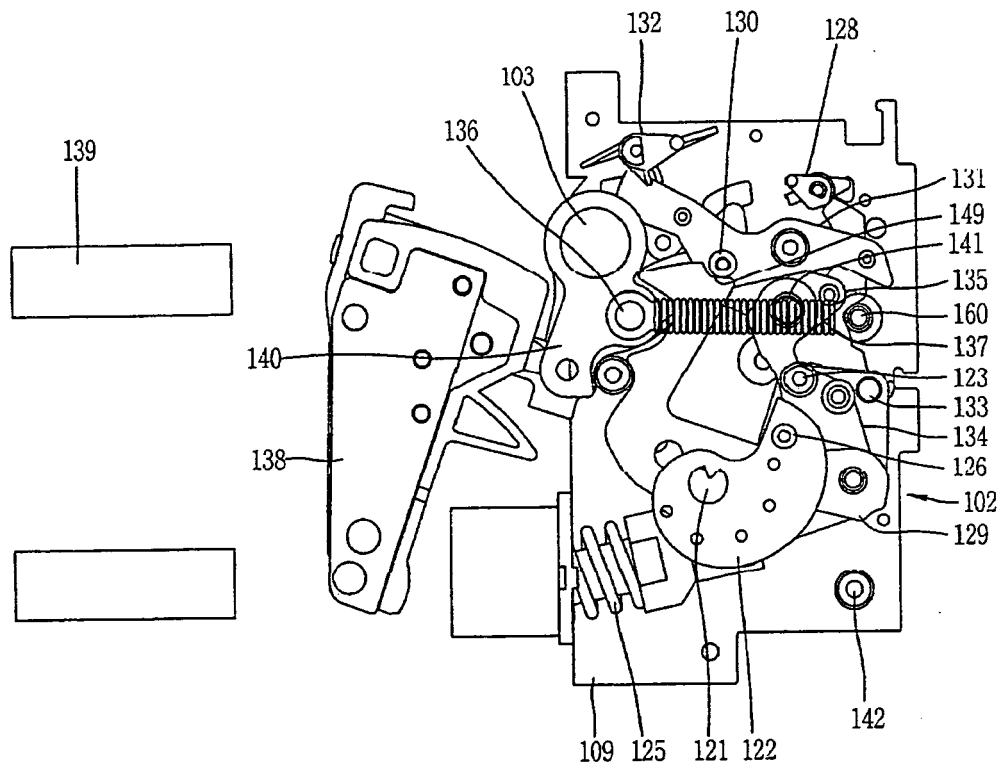


FIG. 3

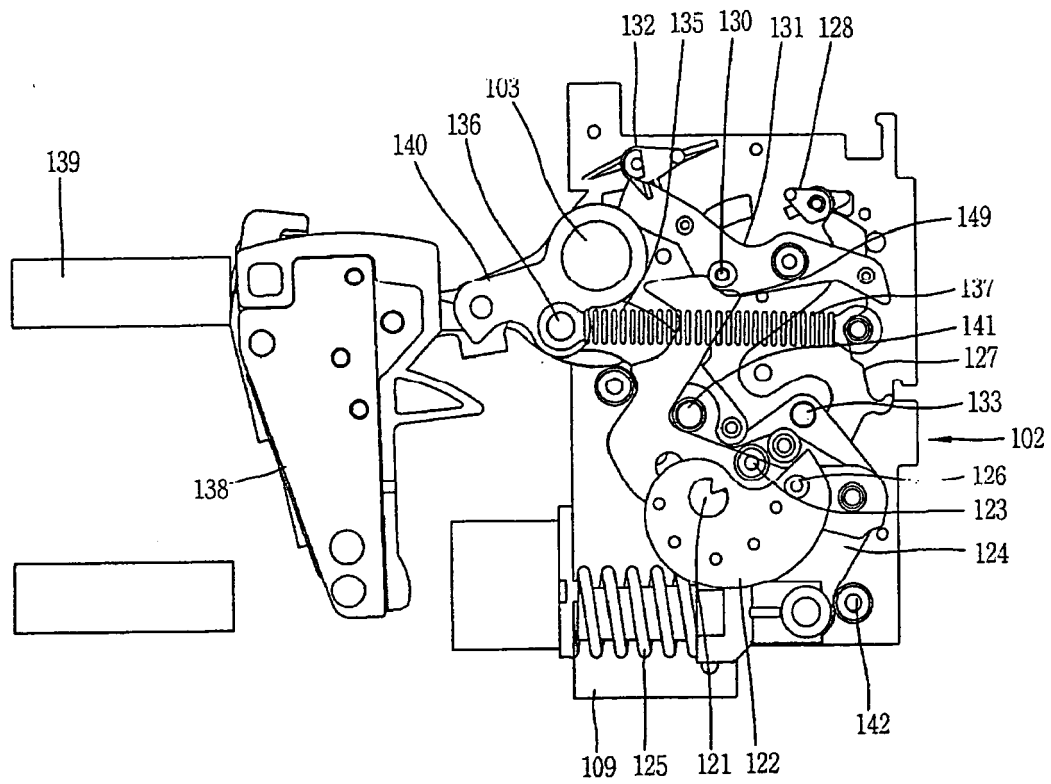


FIG. 4

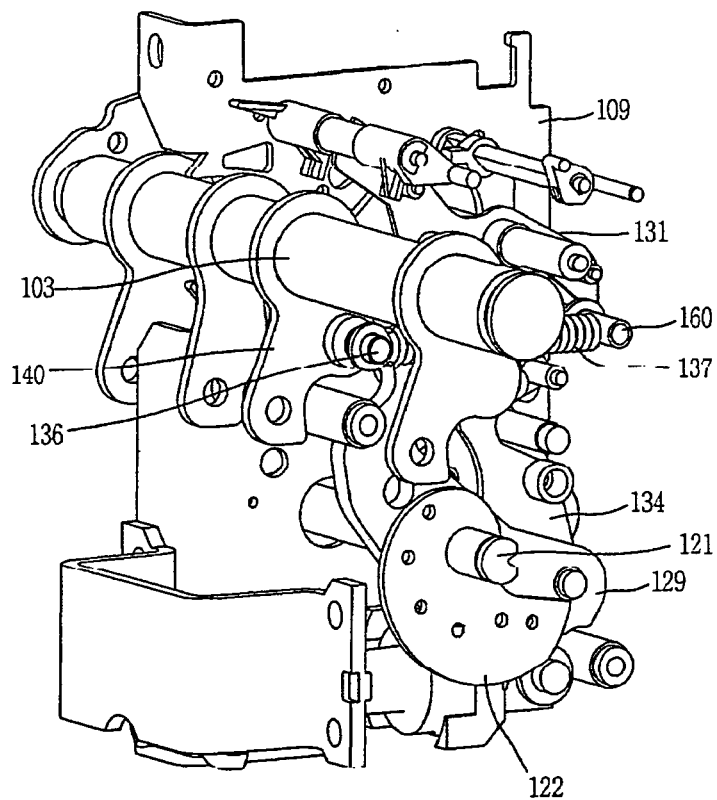


FIG. 5

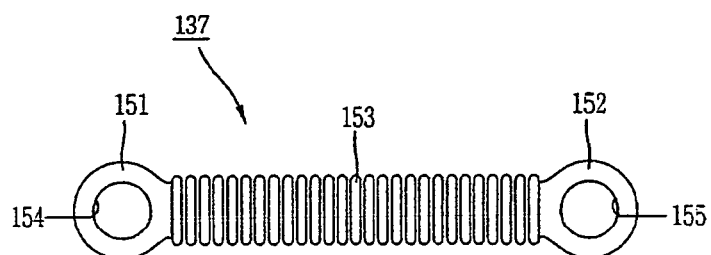


FIG. 6

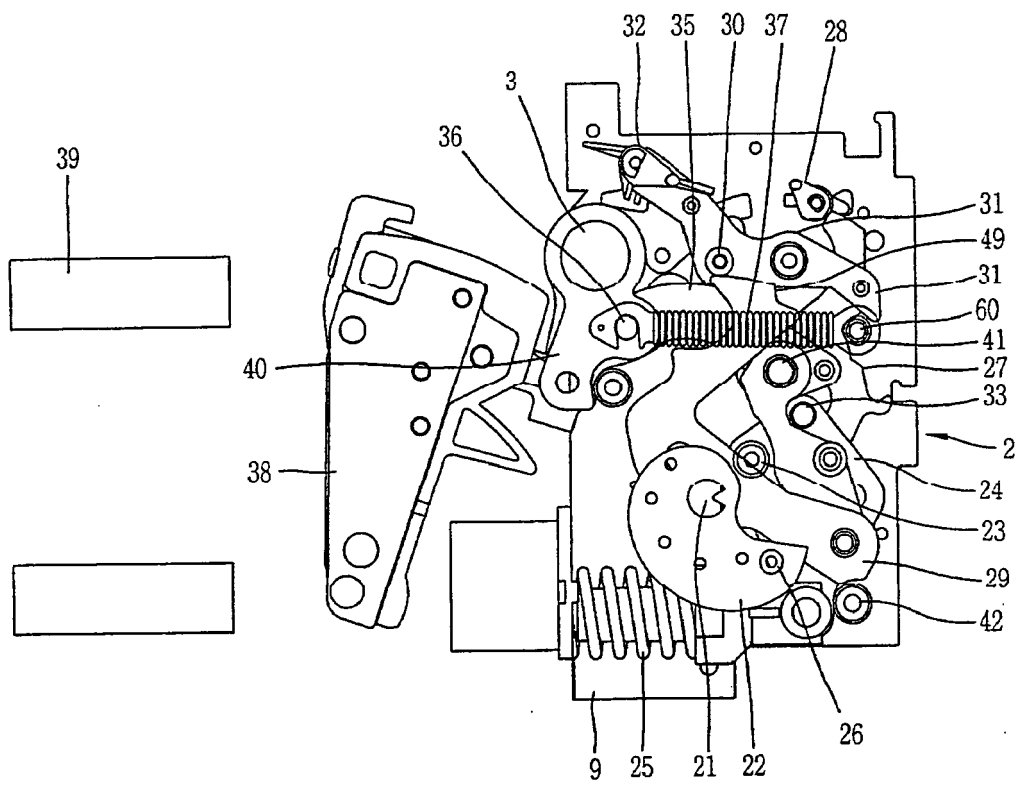


FIG. 7

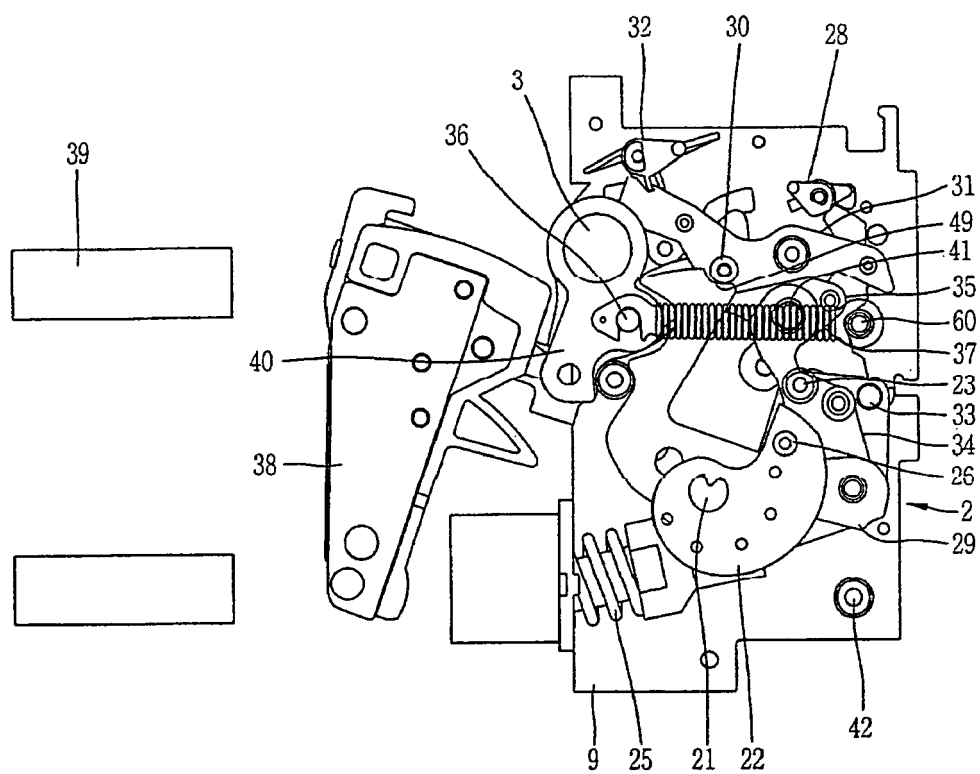


FIG. 8

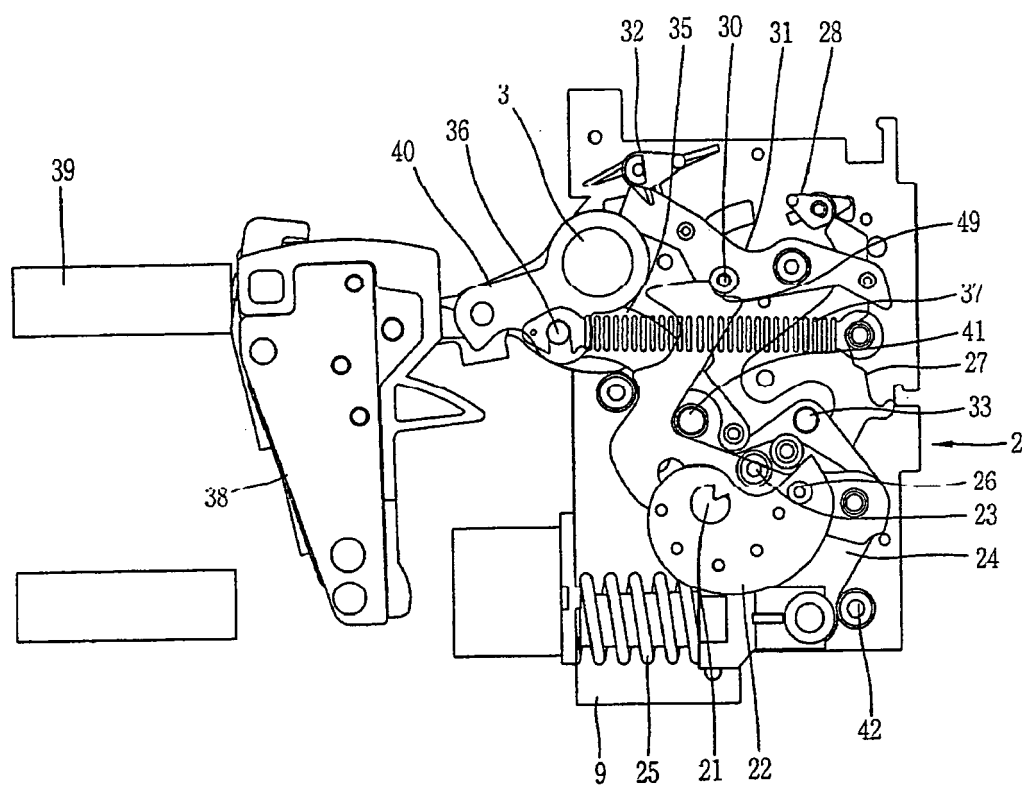


FIG. 9

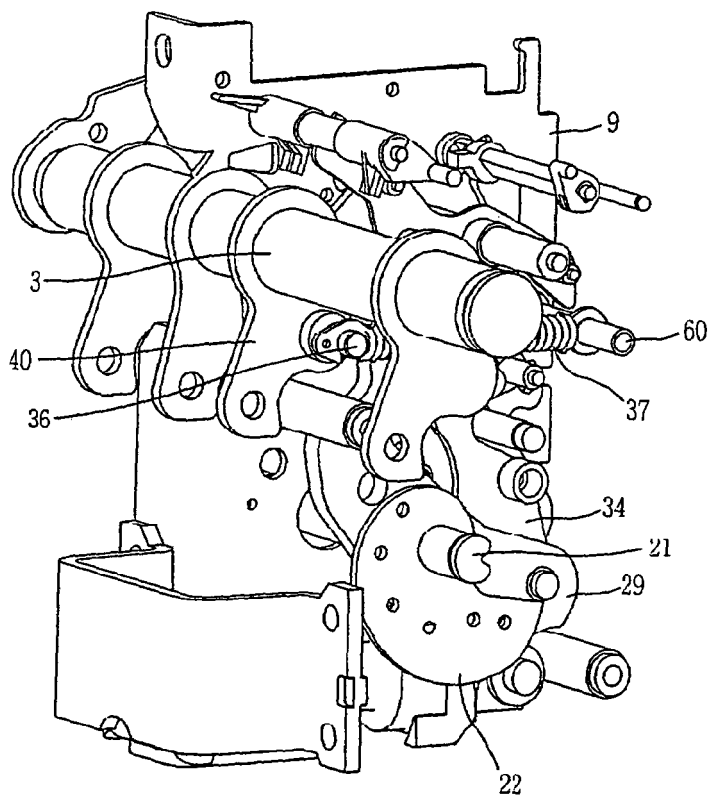


FIG. 10

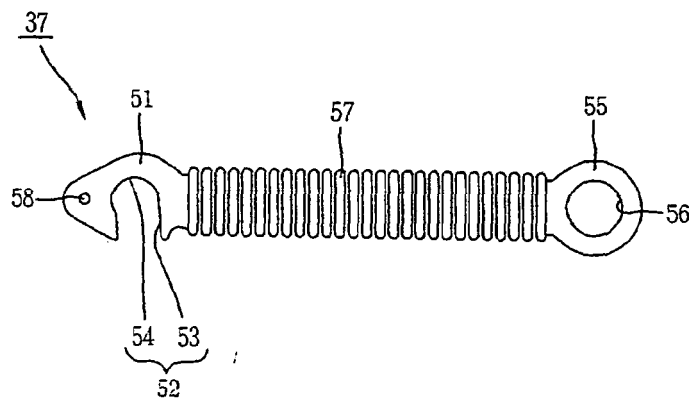


FIG. 11

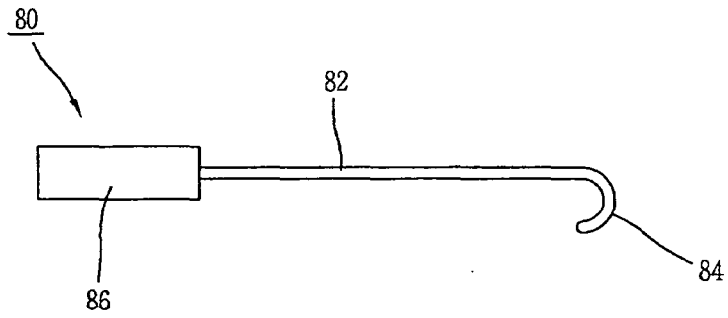
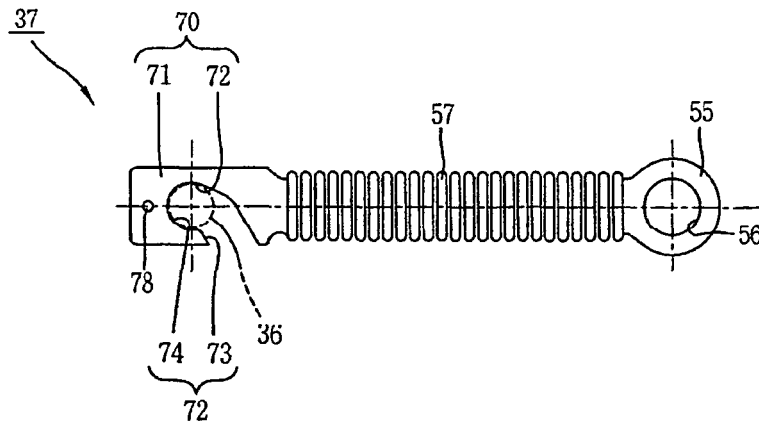


FIG. 12





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 01 9930

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 6 144 002 A (COUDERT PATRICK [FR] ET AL) 7 November 2000 (2000-11-07) * column 5, line 16 - column 6, line 22; figures 4,5 *	1-3, 8-10,15	INV. H01H3/30
X	EP 0 696 039 A (SCHNEIDER ELECTRIC SA [FR]) 7 February 1996 (1996-02-07) * column 2, line 40 - column 4, line 20; figures 1-3 *	1-3, 8-10,15	ADD. H01H71/52
A	US 5 181 069 A (OLEKSINSKI JOHN A [US] ET AL) 19 January 1993 (1993-01-19) * figure 5 *	4,11	
A	FR 2 663 152 A (MERLIN GERIN [FR]) 13 December 1991 (1991-12-13) * figures 2,3 *	4,11	
			TECHNICAL FIELDS SEARCHED (IPC)
			H01H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 10 January 2008	Examiner MAEKI-MANTILA, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 07 01 9930

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

10-01-2008

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6144002	A	07-11-2000	AU 754416 B2	14-11-2002
			AU 5714199 A	04-05-2000
			BR 9904986 A	05-09-2000
			CA 2283991 A1	30-04-2000
			CN 1253366 A	17-05-2000
			CZ 9903822 A3	12-07-2000
			DE 69929873 T2	07-09-2006
			EA 1841 B1	27-08-2001
			EP 0997919 A1	03-05-2000
			ES 2258320 T3	16-08-2006
			FR 2785444 A1	05-05-2000
			HU 9903981 A2	28-08-2000
			ID 25949 A	16-11-2000
			JP 2000149726 A	30-05-2000
			KR 20000029413 A	25-05-2000
			PL 336036 A1	08-05-2000
			TR 9902695 A2	21-07-2000
			TW 434623 B	16-05-2001
			ZA 9906752 A	02-05-2000

EP 0696039	A	07-02-1996	CN 1119781 A	03-04-1996
			DE 69507218 D1	25-02-1999
			DE 69507218 T2	29-07-1999
			ES 2128685 T3	16-05-1999
			FR 2723252 A1	02-02-1996
			US 5571255 A	05-11-1996

US 5181069	A	19-01-1993	NONE	

FR 2663152	A	13-12-1991	NONE	
