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

(11) EP 2 098 379 A1

(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
09.09.2009 Bulletin 2009/37

(21) Application number: **07711050.0**

(22) Date of filing: **06.03.2007**

(51) Int Cl.:
B42F 13/22 *(2006.01)* ***B42F 3/04*** *(2006.01)*

(86) International application number:
PCT/CN2007/000717

(87) International publication number:
WO 2008/052401 (08.05.2008 Gazette 2008/19)

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR

(30) Priority: **31.10.2006 CN 200610143213**

(71) Applicant: **Leco Stationery Manufacturing Co. Ltd.**
New Territories, Hong Kong (CN)

(72) Inventors:
- **CHENG, Hungyu**
  Hong Kong (CN)
- **NG, Wingyiu**
  Hong Kong (CN)
- **DENG, Xitao**
  Chongqing 400030 (CN)

(74) Representative: **Fröderberg, Anders Oskar**
BRANN AB
Västgötagatan 2
P.O. Box 17192
104 62 Stockholm (SE)

(54) A LEVER CLAMP MECHANISM

(57) A lever arch mechanism comprises: a base; two first ring members attached fixedly onto the base at one end, two first ring members being separated from and parallel with each other; a ring assembly attached movably onto the base, the ring assembly comprising two second ring members separated from and parallel with each other and a bending portion bent toward the center of the base, the middle of the bending portion projecting upwards to form a protrusion, two first ring members and two second ring members being disposed in such a way that they face to each other respectively so that the respective ring members facing to each other form a closed loop when the ring assembly moves; an elastic member for pushing the ring assembly away from the base by its elastic force; a projection extending upwards from the base; and a lever mechanism attached rotatably onto the projection for contacting the ring assembly, the lever mechanism being used to press the ring assembly onto the base or move the ring assembly away from the base for closing or opening the lever arch mechanism. A recess is formed on the bending portion at least at one side of the protrusion. According to the invention, the lever handle may rotate at a small angle and rise to a relatively low height when the lever arch mechanism is opened. Thus, the distal end of the handle does not interfere with pages, which facilitates adding or removing pages.

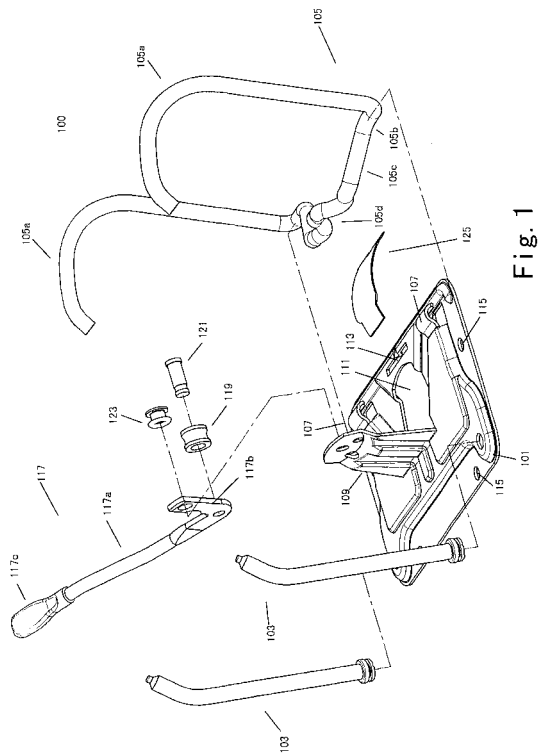

Fig. 1

EP 2 098 379 A1

Description

Field of the Invention

[0001] This invention relates to a lever arch mechanism.

Background of the Invention

[0002] A lever arch mechanism is a type of stationery widely used for retaining pages such as loose-leaf pages. A conventional lever arch mechanism comprises: a substantially flat base; two first ring members separated from each other and having an end fixedly attached onto one longitudinal side of the base, the first ring members extending generally vertically upwards from the base and bent slightly at their other end to form a bending portion; two second ring members separated from each other and having an end movably attached onto the other longitudinal side of the base, the second ring members extending generally vertically upwards from the base and bent slightly at the other end to form the other bending portion, thereby forming a closed loop by engaging with the bending portion on the other end of two first ring members when the lever arch mechanism is closed, two second ring members connected integrally with each other at their ends near the base by a connecting portion to allow two second ring members move together, the connecting portion having a generally U-shaped bending portion bent at its middle portion towards the center of the base, the middle of the bending portion slightly protruding upward to form a protrusion; a generally upstanding projection formed at the center of the base by cutting the base and bending the cut portion upwards; a leaf spring with one end attached in a groove cut in the base adjacent the other longitudinal side and the other end abutting resiliently against the underside of the generally U-shaped bending portion of the connecting portion, the leaf spring pushing the connecting portion away from the base plane to allow two second ring members move together and away from two first ring members fixedly attached, thus opening the lever arch mechanism; and a lever rotatably attached onto the projection and having a roller for abutting against the protrusion. By pressing and rotating the lever downward, the roller may resist against the upward pushing force of the leaf spring and move along a direction away from the lever handle to a position where the connecting portion presses against the base, thereby moving two second ring members together to a position where two second ring members contact with two first ring members that are attached fixedly to form a closed loop respectively. By rotating the lever upward and away from the base, the roller may move along a direction towards the lever handle to a position where it is possible to release the pressing against the connecting portion, so that the connecting portion may move away from the base under the action of the upward pushing force of the leaf spring, thereby moving two second ring members together and away from two first ring members to form an open loop respectively. As a result, the lever arch mechanism is opened.

[0003] In the conventional lever arch mechanism, when the lever arch mechanism is opened, the lever handle rotates at a large angle and rises to a high position. The distal end of the handle interferes possibly with pages when pages are added or removed from the lever arch mechanism, thus obstructing the loose-leaf pages from being added or removed from the lever arch mechanism and resulting in much inconvenience for accessing loose-leaf pages.

[0004] Accordingly, there is a need for an improvement in the lever arch mechanism.

Summary of the Invention

[0005] The present invention is proposed in consideration of the above problems in the conventional lever arch mechanism.

[0006] Therefore, one object of the invention is to provide a lever arch mechanism in which the lever handle may rotate at a small angle and rise to a relatively low height when the lever arch mechanism is opened. Thus, the distal end of the handle does not interfere with pages, which facilitates adding or removing pages.

[0007] According to the invention, a lever arch mechanism is provided, comprising: a flat base; two first ring members attached fixedly onto the base at one end, two first ring members being separated from and parallel with each other; a ring assembly attached movably onto the base, the ring assembly comprising two second ring members separated from and parallel with each other, two second ring members connecting integrally with each other by a connecting portion, the connecting portion comprising a bending portion bent toward the center of the base, the middle of the bending portion projecting upwards to form a protrusion, two first ring members and two second ring members being disposed in such a way that they face to each other respectively so that the respective ring members facing to each other form a closed loop when the ring assembly moves; an elastic member with one end attached onto the base and the other end abutting against the ring assembly, the elastic member pushing the ring assembly away from the base by its elastic force; a projection extending upwards from the base; and a lever mechanism attached rotatably onto the projection for contacting the ring assembly, the lever mechanism being used to press the ring assembly onto the base or move the ring assembly away from the base for closing or opening the lever arch mechanism; wherein a recess is formed on the bending portion at least at one side of the protrusion.

[0008] According to one aspect of the invention, the depth of the recess is sized so that a distance between the peak of the protrusion and the valley of the recess is equal to or lager than the diameter of the steel wire from which the ring members are made.

[0009] According to other aspect of the invention, the depth of the recess is sized so that a distance between the peak of the protrusion and the valley of the recess is equal to or lager than 4.5 mm.

[0010] Moreover, according to the present invention, the inclined angle of the lever handle with respect to the lever body is as small as possible so that the lever handle does not extend to a too high position. According to the lever arch mechanism of the invention, since a recess is formed on the bending portion at least at one side of the protrusion, the lever handle may rotate at a small angle and rise to a relatively low height when the lever arch mechanism is opened. Thus, the distal end of the handle does not interfere with pages, which facilitates adding or removing pages.

Brief Description of the Drawings

[0011]

Fig.1 is an exploded perspective view of a lever arch mechanism according to a first embodiment of the invention;

Fig.2 is a one side perspective view of the lever arch mechanism according to the first embodiment of the invention in a ring-closed configuration;

Fig.3 is an other side perspective view of the lever arch mechanism according to the first embodiment of the invention in a ring-closed configuration;

Fig.4 is a bottom perspective view of the lever arch mechanism according to the first embodiment of the invention in a ring-closed configuration;

Fig.5 is a one side perspective view of the lever arch mechanism according to the first embodiment of the invention in a ring-open configuration;

Fig.6 is an other side perspective view of the lever arch mechanism according to the first embodiment of the invention in a ring-open configuration;

Fig.7 is a one side bottom perspective view of the lever arch mechanism according to the first embodiment of the invention in a ring-open configuration;

Fig.8 is an other side bottom perspective view of the lever arch mechanism according to the first embodiment of the invention in a ring-open configuration;

Fig.9A is a perspective view of the ring members of the lever arch mechanism according to the first embodiment of the invention;

Fig.9B is a front view of the ring members of the lever arch mechanism according to the first embodiment of the invention;

Fig.9C is an enlarged view of the circled portion in Fig.9B with a scale of 2:1;

Fig.9D is a top view of the ring members of the lever arch mechanism according to the first embodiment of the invention;

Fig.9E is a side view of the ring members of the lever arch mechanism according to the first embodiment of the invention;

Fig.10A is a front view of the lever arch mechanism according to the first embodiment of the invention in a ring-closed configuration;

Fig.10B is a top view of the lever arch mechanism according to the first embodiment of the invention in a ring-closed configuration;

Fig.10C is a right view of the lever arch mechanism according to the first embodiment of the invention in a ring-closed configuration;

Fig.10D is a left view of the lever arch mechanism according to the first embodiment of the invention in a ring-closed configuration;

Fig.11A is a front view of the lever arch mechanism according to the first embodiment of the invention in a ring-open configuration;

Fig.11B is a top view of the lever arch mechanism according to the first embodiment of the invention in a ring-open configuration;

Fig.11C is a right view of the lever arch mechanism according to the first embodiment of the invention in a ring-open configuration;

Fig.11D is a left view of the lever arch mechanism according to the first embodiment of the invention in a ring-open configuration;

Fig.12 is an exploded perspective view of a lever arch mechanism according to a second embodiment of the invention;

Fig.13 is a one side perspective view of the lever arch mechanism according to the second embodiment of the invention in a ring-closed configuration;

Fig.14 is an other side perspective view of the lever arch mechanism according to the second embodiment of the invention in a ring-closed configuration;

Fig.15 is a bottom perspective view of the lever arch mechanism according to the second embodiment of the invention in a ring-closed configuration;

Fig.16 is a one side perspective view of the lever arch mechanism according to the second embodiment of the invention in a ring-open configuration;

Fig.17 is an other side perspective view of the lever arch mechanism according to the second embodiment of the invention in a ring-open configuration;

Fig.18 is a one side bottom perspective view of the lever arch mechanism according to the second embodiment of the invention in a ring-open configuration;

Fig.19 is an other side bottom perspective view of the lever arch mechanism according to the second embodiment of the invention in a ring-open configuration;

Fig.20A is a perspective view of the ring members of the lever arch mechanism according to the second embodiment of the invention;

Fig.20B is a front view of the ring members of the lever arch mechanism according to the second embodiment of the invention;

Fig.20C is an enlarged view of the circled portion in Fig.20B with a scale of 2:1;

Fig.20D is a top view of the ring members of the lever arch mechanism according to the second embodiment of the invention;
Fig.20E is a side view of the ring members of the lever arch mechanism according to the second embodiment of the invention;
Fig.21A is a front view of the lever arch mechanism according to the second embodiment of the invention in a ring-closed configuration;
Fig.21B is a top view of the lever arch mechanism according to the second embodiment of the invention in a ring-closed configuration;
Fig.21C is a right view of the lever arch mechanism according to the second embodiment of the invention in a ring-closed configuration;
Fig.21D is a left view of the lever arch mechanism according to the second embodiment of the invention in a ring-closed configuration;
Fig.22A is a front view of the lever arch mechanism according to the second embodiment of the invention in a ring-open configuration;
Fig.22B is a top view of the lever arch mechanism according to the second embodiment of the invention in a ring-open configuration;
Fig.22C is a right view of the lever arch mechanism according to the second embodiment of the invention in a ring-open configuration;
Fig.22D is a left view of the lever arch mechanism according to the second embodiment of the invention in a ring-open configuration;
Fig.23 is an exploded perspective view of a lever arch mechanism according to a third embodiment of the invention;
Fig.24 is a one side perspective view of the lever arch mechanism according to the third embodiment of the invention in a ring-closed configuration;
Fig.25 is an other side perspective view of the lever arch mechanism according to the third embodiment of the invention in a ring-closed configuration;
Fig.26 is a bottom perspective view of the lever arch mechanism according to the third embodiment of the invention in a ring-closed configuration;
Fig.27 is a one side perspective view of the lever arch mechanism according to the third embodiment of the invention in a ring-open configuration;
Fig.28 is an other side perspective view of the lever arch mechanism according to the third embodiment of the invention in a ring-open configuration;
Fig.29 is a one side bottom perspective view of the lever arch mechanism according to the third embodiment of the invention in a ring-open configuration;
Fig.30 is an other side bottom perspective view of the lever arch mechanism according to the third embodiment of the invention in a ring-open configuration;
Fig.31A is a perspective view of the ring members of the lever arch mechanism according to the third embodiment of the invention;
Fig.31B is a front view of the ring members of the lever arch mechanism according to the third embodiment of the invention;
Fig.31C is an enlarged view of the circled portion in Fig.31B with a scale of 2:1;
Fig.31D is a top view of the ring members of the lever arch mechanism according to the third embodiment of the invention;
Fig.31E is a side view of the ring members of the lever arch mechanism according to the third embodiment of the invention;
Fig.32A is a front view of the lever arch mechanism according to the third embodiment of the invention in a ring-closed configuration;
Fig.32B is a top view of the lever arch mechanism according to the third embodiment of the invention in a ring-closed configuration;
Fig.32C is a right view of the lever arch mechanism according to the third embodiment of the invention in a ring-closed configuration;
Fig.32D is a left view of the lever arch mechanism according to the third embodiment of the invention in a ring-closed configuration;
Fig.33A is a front view of the lever arch mechanism according to the third embodiment of the invention in a ring-open configuration;
Fig.33B is a top view of the lever arch mechanism according to the third embodiment of the invention in a ring-open configuration;
Fig.33C is a right view of the lever arch mechanism according to the third embodiment of the invention in a ring-open configuration; and
Fig.33D is a left view of the lever arch mechanism according to the third embodiment of the invention in a ring-open configuration.

Detailed Description of the Preferred Embodiments

[0012] Figs.1 to 11 show a lever arch mechanism 100 according to a first embodiment of the invention. The lever arch mechanism 100 according to the invention comprises a generally flat base 101. Two first ring members 103 that are separated from and parallel with each other are attached fixedly onto a longitudinal side of the base 101. Two first ring members 103 substantially extend vertically upwards from the base 101 and are bent slightly at their free ends to form a bending portion respectively. A ring assembly 105 is attached movably onto the other longitudinal side of the base 101. The ring assembly 105 comprises two second ring members 105a that are separated from and parallel with each other and a connecting portion 105b for connecting integrally two second ring members 105a. Each of two second ring members 105a has a bending portion formed on its free end respectively to allow two second ring members 105a of the ring assembly 105 to engage with the corresponding one of two first ring members 103 that are attached fixedly onto the base 101 to form a closed loop. Two second ring mem-

bers 105a of the ring assembly 105 are connected integrally with each other at their other ends near the base 101 by the connecting portion 105b. The connecting portion 105b has a generally U-shaped bending portion 105c bent substantially horizontally at its middle towards the center of the base, and the middle of the bending portion 105c protrudes slightly upward to form a protrusion 105d. A recess 105e is formed on the bending portion 105c at both sides of the protrusion 105d respectively. The first ring members 103 and the ring assembly 105 have a generally circular or elliptical cross section respectively, and are made from suitable materials such as steel wire or the like. The ring assembly 105 is attached movably onto the base 101 by two turned-over portions 107. Two turned-over portions 107 are formed on one side of the base 101 provided with the ring assembly 105 by cutting or punching the base and turning the cut or punched portions of the base over.

[0013] A generally upstanding projection 109 is substantially formed in the middle of the base 101 by cutting or punching the base 101 near a longitudinal side of the base provided with the ring assembly 105 and bending the cut or punched portions of the base upwards from the base. A cutout 111 (as shown in Figs 1 and 4) is left in the base 101 because the projection 109 is bent upwards. An elongated slot 113 is formed near the edge of the longitudinal side of the base provided with the ring assembly 105, and its function will be described later. One or more holes 115 may also be formed in the base for attaching the lever arch mechanism onto a cover of files or notebooks.

[0014] The lever arch mechanism 100 according to the invention further comprises a lever 117. The lever 117 comprises a lever body 117a, a lever head 117b extending obliquely and upwards from one end of the lever body 117a and a lever handle (operation end) 117c extending from other end of the lever body 117a. The lever arch mechanism 100 according to the invention also comprises a roller 119 which is preferably made from plastics. The roller 119 is attached onto a joint between the lever body 117a and the lever head 117b through a pin shaft 121.

[0015] In the assembled lever arch mechanism 100, two first ring members 103 are mounted fixedly on one longitudinal side of the base 101 by a connection such as rivets, welding or any other known connection means. Two ends of the connecting portions 105b of the ring assembly 105 are fixed movably by two turned-over portions 107 so that the ring assembly 105 is attached movably onto the base 101. The U-shaped bending portion 105c of the connecting portions 105b substantially locates near the projection 109 to movably attach the ring assembly 105 onto other longitudinal side of the base 101 so that two second ring members 105a of the ring assembly 105 align with two first ring members 103 attached fixedly. The lever 117 provided with the roller 119 is attached rotatably onto the projection 109 at the free end of the lever head 117b by a fastener 123 such as a rivet so that the roller 119 may move substantially on the bending portion 105c of the ring assembly 105. A leaf spring 125 is bended slightly into a generally arcuate shape, with one end of the leaf spring 125 inserted into the elongated slot 113 of the base 101 to be retained on the base 101, with other end located below the bending portion 105c of the ring assembly 105 and abutting resiliently against the bending portion 105c of the ring assembly 105 for pushing the bending portion 105c of the ring assembly 105 upwards by its resilience. Of course, the mounting position of the leaf spring 125 is not limited to the illustrated position as long as the leaf spring 125 can abut against the underside of the bending portion 105c. Further, the shape of the leaf spring 125 also is not limited to the illustrated shape as long as the leaf spring 125 can abut against the underside of the bending portion 105c to generate an upward pushing force.

[0016] In the ring-open configuration of the lever arch mechanism shown in Fig.5, by grasping the lever handle 117c to rotate the lever 117 downwards and towards the base, the lever head 117b may rotate clockwise around the fastener 123 from the configuration shown in Fig.5, thereby moving the roller 119 mounted onto the joint between the lever body 117a and the lever head 117b to the protrusion 105d along the bending portion 105c of the ring assembly 105 in a direction away from the lever handle 117c (i.e. moving the roller 119 from the recess 105e to the protrusion 105d), and pressing the connecting portion 105b onto the base 101 against the upward pushing force of the leaf spring 125. As a result, two second ring members 105a of the ring assembly 105 move together to a position where they contact with two opposite first ring members 103 to form two closed loops for retaining loose-leaf pages, as shown in Fig.2.

[0017] In contrast, in the ring-closed configuration of the lever arch mechanism shown in Fig.2, by grasping the lever handle 117c to rotate the lever 117 upwards and away from the base, the lever head 117b may rotate counterclockwise around the fastener 123 from the configuration shown in Fig.2, thereby moving the roller 119 mounted onto the joint between the lever body 117a and the lever head 117b from the protrusion 105d along the bending portion 105c of the ring assembly 105 in a direction towards the lever handle 117c (i.e. moving the roller 119 from the protrusion 105d to the recess 105e), and releasing the pressing of the connecting portion 105b onto the base 101. As a result, the connecting portion 105b moves away from the base 101 under the action of the upward pushing force of the leaf spring 125 so that two second ring members 105a of the ring assembly 105 move from two first ring members 103 to form two open loops for accessing loose-leaf pages.

[0018] Compared with the conventional lever arch mechanisms, since the recess 105e is formed on the bending portion 105c, the rotational angle of the lever handle 117c from the ring-open configuration to the ring-closed configuration becomes much less than that of the conventional lever arch mechanisms. Thus, the lever

handle 117c does not interfere with pages retained by the lever arch mechanism. Preferably, according to the invention, the depth of the recess 105e is sized so that a distance A between the peak of the protrusion 105d and the valley of the recess 105e is equal to or lager than the diameter D of the steel wire from which the ring members are made (as shown in Fig. 9B and 9C). Furthermore, the depth of the recess 105e is preferably sized so that the distance A between the peak of the protrusion 105d and the valley of the recess 105e is equal to or lager than 4.5 mm.

[0019] To ensure that the lever arch mechanism is closed and opened properly, a depression 105f is preferably formed on the middle of the protrusion 105d to receive the roller 119 when the lever arch mechanism is closed.

[0020] Two stoppers 127a and 127b for limiting respectively the rotation ranges of the lever head 117b when the lever arch mechanism being closed and opened are provided on one side of the projection 109 facing the ring assembly. Of course, only one stopper 127b for limiting the rotation range of the lever head 117b when the lever arch mechanism being opened may be provided on the projection 109. Limiting the rotation ranges of the lever head 117b when the lever arch mechanism being closed may be performed by abutting the lever body 117a against the base 101. Preferably, the stopper 127b is used to limit the lever arch mechanism to a position where the lever arch mechanism is allowed to open at a given range.

[0021] Figs.12 to 22 show the lever arch mechanism 200 according to a second embodiment of the invention. The structure of the lever arch mechanism 200 according to the second embodiment of the invention is substantially similar to that of the lever arch mechanism 100 according to the first embodiment of the invention except that only one recess 205e is formed at one side of the protrusion 205d facing the lever handle. Parts of the lever arch mechanism 200 according to the second embodiment corresponding to parts of the lever arch mechanism 100 according to the first embodiment are indicated by the same reference numerals, plus "100". The description for the same parts will be omitted.

[0022] In the lever arch mechanism 200 according to the second embodiment of the invention, two second ring members 205a of the ring assembly 205 are connected integrally with each other at their other ends near the base by the connecting portion 205b. The connecting portion 205b has a generally U-shaped bending portion 205c bent substantially horizontally at its middle towards the center of the base, and the middle of the bending portion 205c protrudes slightly upward to form a protrusion 205d. A recess 205e is formed at one side of the protrusion 205d facing the lever handle 217c. In the second embodiment of the invention, one stopper 227b for limiting the rotation range of the lever head 217b when the lever arch mechanism being opened is preferably provided on the projection 209 adjacent the lever head, thereby limiting the lever arch mechanism to a position where the lever arch mechanism is allowed to open at a given range. Of course, two stoppers may be provided on the projection 209 in the same manner as the first embodiment.

[0023] In the ring-open configuration of the lever arch mechanism shown in Fig.17, by grasping the lever handle 217c to rotate the lever 217 downwards and towards the base, the lever head 217b may rotate clockwise around the fastener 223 from the configuration shown in Fig.17, thereby moving the roller 219 mounted onto the joint between the lever body 217a and the lever head 217b to the protrusion 205d along the bending portion 205c of the ring assembly 205 in a direction away from the lever handle 217c (i.e. moving the roller 219 from the recess 205e to the protrusion 205d), and pressing the connecting portion 205b onto the base 201 against the upward pushing force of the leaf spring 225. As a result, two second ring members 205a of the ring assembly 205 move together to a position where they contact with two opposite first ring members 203 to form two closed loops for retaining loose-leaf pages, as shown in Fig.13.

[0024] In contrast, in the ring-closed configuration of the lever arch mechanism shown in Fig.13, by grasping the lever handle 217c to rotate the lever 217 upwards and away from the base, the lever head 217b may rotate counterclockwise around the fastener 223 from the configuration shown in Fig.13, thereby moving the roller 219 mounted onto the joint between the lever body 217a and the lever head 217b from the protrusion 205d along the bending portion 205c of the ring assembly 205 in a direction towards the lever handle 217c, and releasing the pressing of the connecting portion 205b onto the base 201. As a result, the connecting portion 205b moves away from the base 201 under the action of the upward pushing force of the leaf spring 225 so that two second ring members 205a of the ring assembly 205 move from two first ring members 203 to form two open loops for accessing loose-leaf pages.

[0025] Figs.23 to 33 show the lever arch mechanism 300 according to a third embodiment of the invention. The structure of the lever arch mechanism 300 according to the third embodiment of the invention is substantially similar to that of the lever arch mechanism 200 according to the second embodiment of the invention except that one recess 305e is formed at one side of the protrusion 305d facing away from the lever handle, the lever 317 is attached rotatably onto the projection 309 at a joint between the lever body 317a and the lever head 317b by a fastener 323 such as a rivet and the roller (the abutting portion) 319 is attached onto the free end of the lever head 317b. Parts of the lever arch mechanism 300 according to the third embodiment corresponding to parts of the lever arch mechanism 200 according to the second embodiment are indicated by the same reference numerals, plus "100". The description for the same parts will be omitted.

[0026] In the ring-closed configuration of the lever arch

mechanism shown in Fig.24, by grasping the lever handle 317c to rotate the lever 317 downwards and towards the base, the lever head 317b may rotate clockwise around the fastener 323 from the configuration shown in Fig.24, thereby moving the roller 319 mounted onto the free end of the lever head 317b to the recess 305e along the bending portion 305c of the ring assembly 305 in a direction away from the lever handle 317c (i.e. moving the roller 319 from the protrusion 305d to the recess 305e), and releasing the connecting portion 305b. As a result, the connecting portion 305b moves away from the base 301 under the action of the upward pushing force of the leaf spring 325 so that two second ring members 305a of the ring assembly 305 move from two first ring members 303 to form two open loops for accessing loose-leaf pages.

[0027] In contrast, in the ring-open configuration of the lever arch mechanism shown in Fig.27, by grasping the lever handle 317c to rotate the lever 317 upwards and away from the base, the lever head 317b may rotate counterclockwise around the fastener 323 from the configuration shown in Fig.27, thereby moving the roller 319 mounted onto the free end of the lever head 317b from the recess 305e along the bending portion 305c of the ring assembly 305 in a direction toward the lever handle 317c (i.e. moving the roller 319 from the recess 305e to the protrusion 305d), and pressing the connecting portion 305b onto the base 301 against the upward pushing force of the leaf spring 325. As a result, two second ring members 305a of the ring assembly 305 move together to a position where they contact with two opposite first ring members 303 to form two closed loops for retaining loose-leaf pages, as shown in Fig.27.

[0028] Compared with the conventional lever arch mechanisms, since the recesses 205e, 305e are formed on the bending portion 205c of the lever arch mechanism of the second embodiment and the bending portion 305c of the lever arch mechanism of the third embodiment respectively, the rotational angle of the lever handles 217c, 317c from the ring-open configuration to the ring-closed configuration becomes much less than that of the conventional lever arch mechanisms. Thus, the lever handles 217c, 317c do not interfere with pages retained by the lever arch mechanism. Preferably, according to the invention, the depth of the recesses 205e, 305e is sized so that a distance A between the peak of the protrusions 205d, 305d and the valley of the recesses 205e, 305e is equal to or lager than the diameter D of the steel wire from which the ring members are made (as shown in Fig. 20B, 20C, 31B and 31C). Furthermore, the depth of the recesses 205e, 305e is preferably sized so that the distance A between the peak of the protrusions 205d, 305d and the valley of the recesses 205e, 305e is equal to or lager than 4.5 mm.

[0029] Moreover, according to the present invention, the inclined angle of the lever handle with respect to the lever body is as small as possible so that the lever handle does not extend to a too high position.

[0030] Although the preferred embodiments of the invention were described in detail taken in conjunction of the accompanying drawings in a non-limiting sense, it should be understood that various changes and modifications could be made without departing from the scope defined by accompanying claims of the invention. For example, a cam rather than the roller may be mounted at the end of the lever. Further, a concave part and a convex part may be provided on the opposite free ends of the ring members for preventing the engagement of the ring members from disengaging. It is intended that all of the changes and modifications should fall into the protection scope of the invention.

Claims

1. A lever arch mechanism comprising:

a flat base;

two first ring members attached fixedly onto the base at one end, two first ring members being separated from and parallel with each other;

a ring assembly attached movably onto the base, the ring assembly comprising two second ring members separated from and parallel with each other, two second ring members connecting integrally with each other by a connecting portion, the connecting portion comprising a bending portion bent toward the center of the base, the middle of the bending portion projecting upwards to form a protrusion, two first ring members and two second ring members being disposed in such a way that they face to each other respectively so that the respective ring members facing to each other form a closed loop when the ring assembly moves;

an elastic member with one end attached onto the base and the other end abutting against the ring assembly, the elastic member pushing the ring assembly away from the base by its elastic force;

a projection extending upwards from the base; and

a lever mechanism attached rotatably onto the projection for contacting the ring assembly, the lever mechanism being used to press the ring assembly onto the base or move the ring assembly away from the base for closing or opening the lever arch mechanism;

wherein a recess is formed on the bending portion at least at one side of the protrusion.

2. The lever arch mechanism according to claim 1, wherein the depth of the recess is sized so that a distance between the peak of the protrusion and the valley of the recess is equal to or lager than the diameter of the steel wire from which the ring members are made.

3. The lever arch mechanism according to claim 2, wherein the lever mechanism comprises a lever and an abutting portion attached onto the lever and contacting the ring assembly, the abutting portion moves from the recess on the bending portion towards the protrusion when closing the lever arch mechanism, and the abutting portion moves from the protrusion towards the recess on the bending portion when opening the lever arch mechanism.

4. The lever arch mechanism according to claim 3, wherein the lever comprises a lever body, a lever head extending upwards from one end of the lever body, and a lever handle extending upwards from other end of the lever body, and wherein the lever mechanism is disposed to open the lever arch mechanism by rotating the lever handle upwards and away from the base to move the abutting portion from the protrusion to the recess on the bending portion, and to close the lever arch mechanism by rotating the lever handle downwards and towards the base to move the abutting portion from the recess on the bending portion to the protrusion.

5. The lever arch mechanism according to claim 4, wherein the lever is attached rotatably onto the projection at the free end of the lever head.

6. The lever arch mechanism according to claim 3, wherein the abutting portion is attached onto a joint between the lever body and the lever head.

7. The lever arch mechanism according to claim 2, wherein one stopper is formed on the projection for limiting the rotating ranges of the lever head when opening the lever arch mechanism.

8. The lever arch mechanism according to claim 2, wherein two stoppers are formed on the projection for limiting the rotating ranges of the lever head respectively when closing the lever arch mechanism and opening the lever arch mechanism.

9. The lever arch mechanism according to claim 3, wherein the abutting portion is a cam.

10. The lever arch mechanism according to claim 3, wherein the abutting portion is a roller.

11. The lever arch mechanism according to claim 2, wherein the elastic member is a leaf spring.

12. The lever arch mechanism according to claim 2, wherein the elastic member is a spring wire.

13. The lever arch mechanism according to claim 2, wherein a convex or a concave is formed at the free end of one of two ring members facing to each other, and a mating concave or a mating convex is formed at the free end of the other one of two ring members facing to each other.

14. The lever arch mechanism according to claim 2, wherein the lever comprises a lever body, a lever head extending downwards from one end of the lever body, a lever handle extending from other end of the lever body, and an abutting portion attached onto the lever and contacting the ring assembly, and wherein the lever mechanism is disposed to open the lever arch mechanism by rotating the lever handle downwards and towards the base to move the abutting portion from the protrusion to the recess on the bending portion, and to close the lever arch mechanism by rotating the lever handle upwards and away from the base to move the abutting portion from the recess on the bending portion to the protrusion.

15. The lever arch mechanism according to claim 14, wherein the lever is attached rotatably onto the projection at a joint between the lever body and the lever head, and the abutting portion is attached onto the free end of the lever head.

16. A lever arch mechanism comprising:

a flat base;
two first ring members attached fixedly onto the base at one end, two first ring members being separated from and parallel with each other;
a ring assembly attached movably onto the base, the ring assembly comprising two second ring members separated from and parallel with each other, two second ring members connecting integrally with each other by a connecting portion, the connecting portion comprising a bending portion bent toward the center of the base, the middle of the bending portion projecting upwards to form a protrusion, two first ring members and two second ring members being disposed in such a way that they face to each other respectively so that the respective ring members facing to each other form a closed loop when the ring assembly moves;
an elastic member with one end attached onto the base and the other end abutting against the ring assembly, the elastic member pushing the ring assembly away from the base by its elastic force;
a projection extending upwards from the base; and
a lever mechanism attached rotatably onto the projection for contacting the ring assembly, the lever mechanism being used to press the ring assembly onto the base or move the ring assembly away from the base for closing or opening the lever arch mechanism;

wherein a recess is formed on the bending portion at least at one side of the protrusion, and the depth of the recess is sized so that a distance between the peak of the protrusion and the valley of the recess is equal to or lager than 4.5 mm.

17. The lever arch mechanism according to claim 16, wherein the lever mechanism comprises a lever and an abutting portion attached onto the lever and contacting the ring assembly, the abutting portion moves from the recess on the bending portion towards the protrusion when closing the lever arch mechanism, and the abutting portion moves from the protrusion towards the recess on the bending portion when opening the lever arch mechanism.

18. The lever arch mechanism according to claim 17, wherein the lever comprises a lever body, a lever head extending upwards from one end of the lever body, and a lever handle extending upwards from other end of the lever body, and wherein the lever mechanism is disposed to open the lever arch mechanism by rotating the lever handle upwards and away from the base to move the abutting portion from the protrusion to the recess on the bending portion, and to close the lever arch mechanism by rotating the lever handle downwards and towards the base to move the abutting portion from the recess on the bending portion to the protrusion.

19. The lever arch mechanism according to claim 18, wherein the lever is attached rotatably onto the projection at the free end of the lever head.

20. The lever arch mechanism according to claim 17, wherein the abutting portion is attached onto a joint between the lever body and the lever head.

21. The lever arch mechanism according to claim 16, wherein one stopper is formed on the projection for limiting the rotating ranges of the lever head when opening the lever arch mechanism.

22. The lever arch mechanism according to claim 16, wherein two stoppers are formed on the projection for limiting the rotating ranges of the lever head respectively when closing the lever arch mechanism and opening the lever arch mechanism.

23. The lever arch mechanism according to claim 17, wherein the abutting portion is a cam.

24. The lever arch mechanism according to claim 17, wherein the abutting portion is a roller.

25. The lever arch mechanism according to claim 16, wherein the elastic member is a leaf spring.

26. The lever arch mechanism according to claim 16, wherein the elastic member is a spring wire.

27. The lever arch mechanism according to claim 16, wherein a convex or a concave is formed at the free end of one of two ring members facing to each other, and a mating concave or a mating convex is formed at the free end of the other one of two ring members facing to each other.

28. The lever arch mechanism according to claim 16, wherein the lever comprises a lever body, a lever head extending downwards from one end of the lever body, a lever handle extending from other end of the lever body, and an abutting portion attached onto the lever and contacting the ring assembly, and wherein the lever mechanism is disposed to open the lever arch mechanism by rotating the lever handle downwards and towards the base to move the abutting portion from the protrusion to the recess on the bending portion, and to close the lever arch mechanism by rotating the lever handle upwards and away from the base to move the abutting portion from the recess on the bending portion to the protrusion.

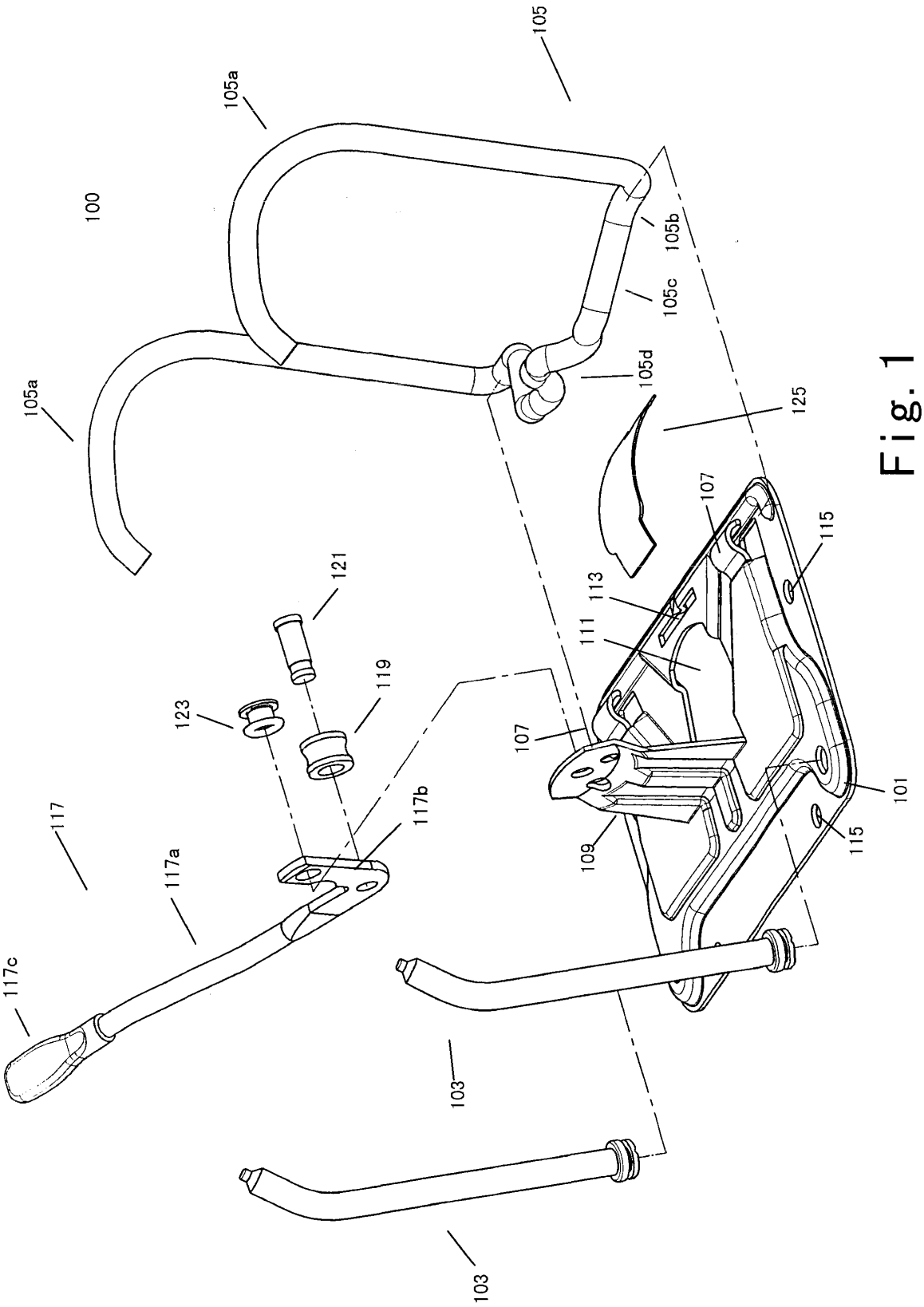
105
105a
100
105a
105b
105c
105d
125
107
115
113
111
121
119
123
107
101
115
109
117
117b
117a
117c
103
103

Fig. 1

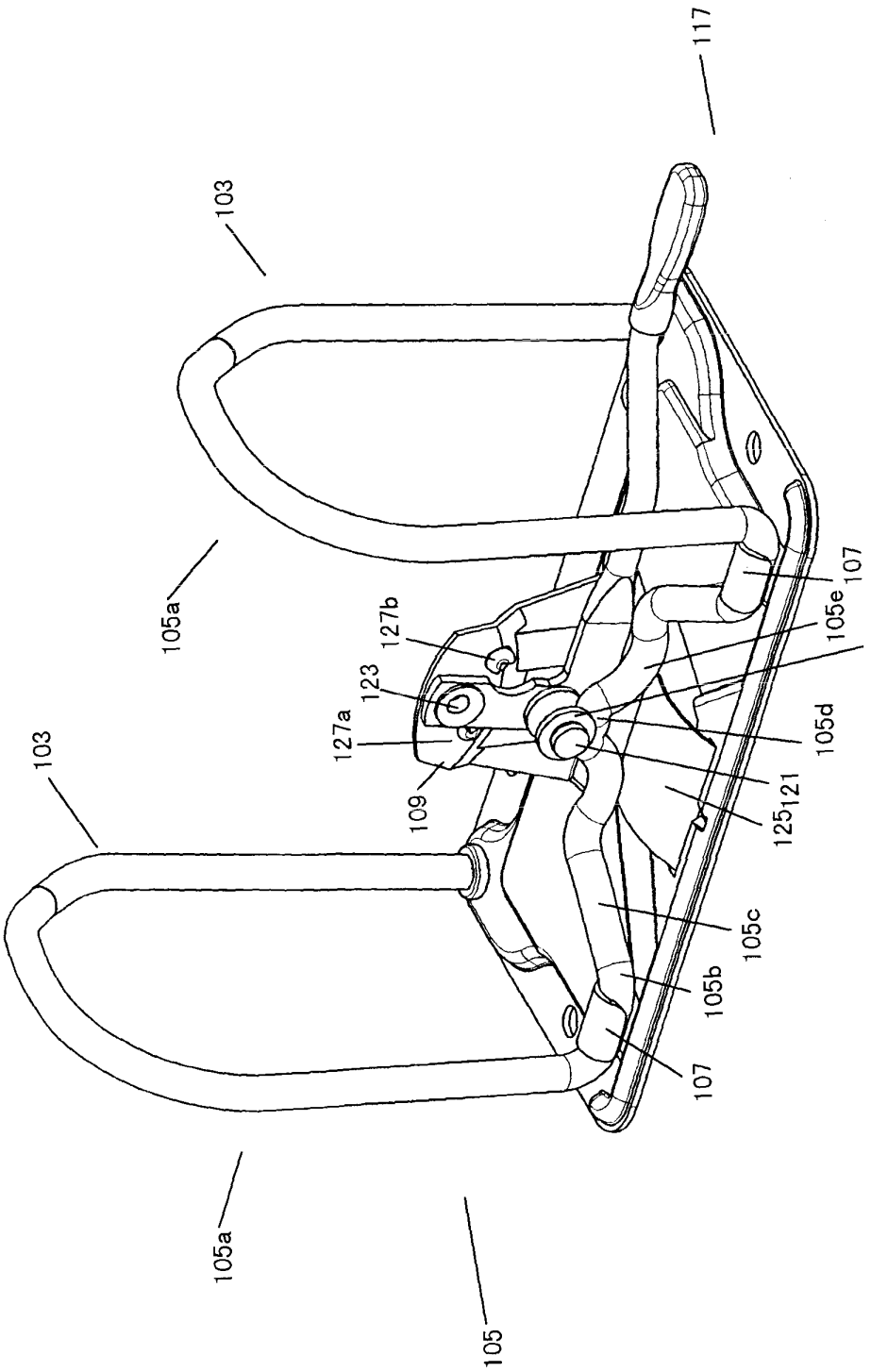
117
103
105a
127b
123
127a
109
103
105a
105
107
105e
119
105d
121
125
105c
105b
107

Fig. 2

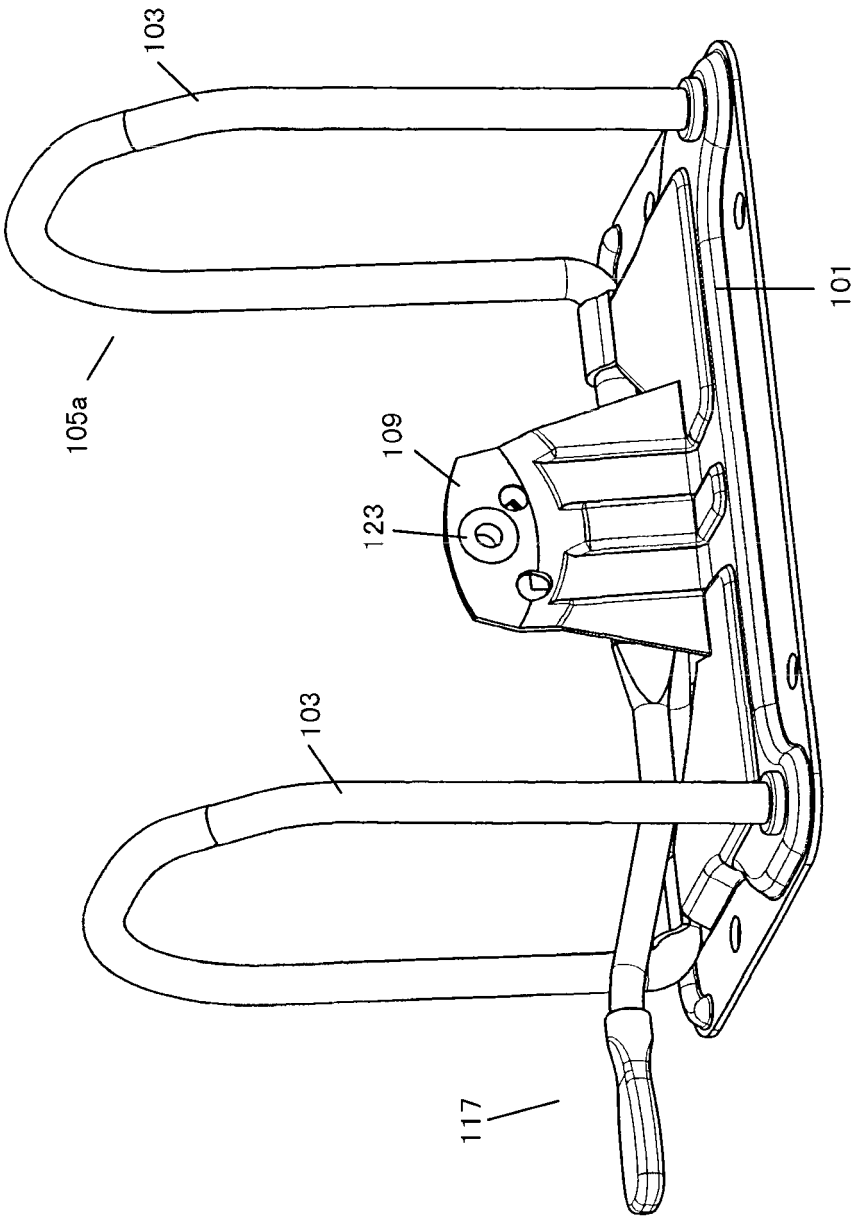

Fig. 3

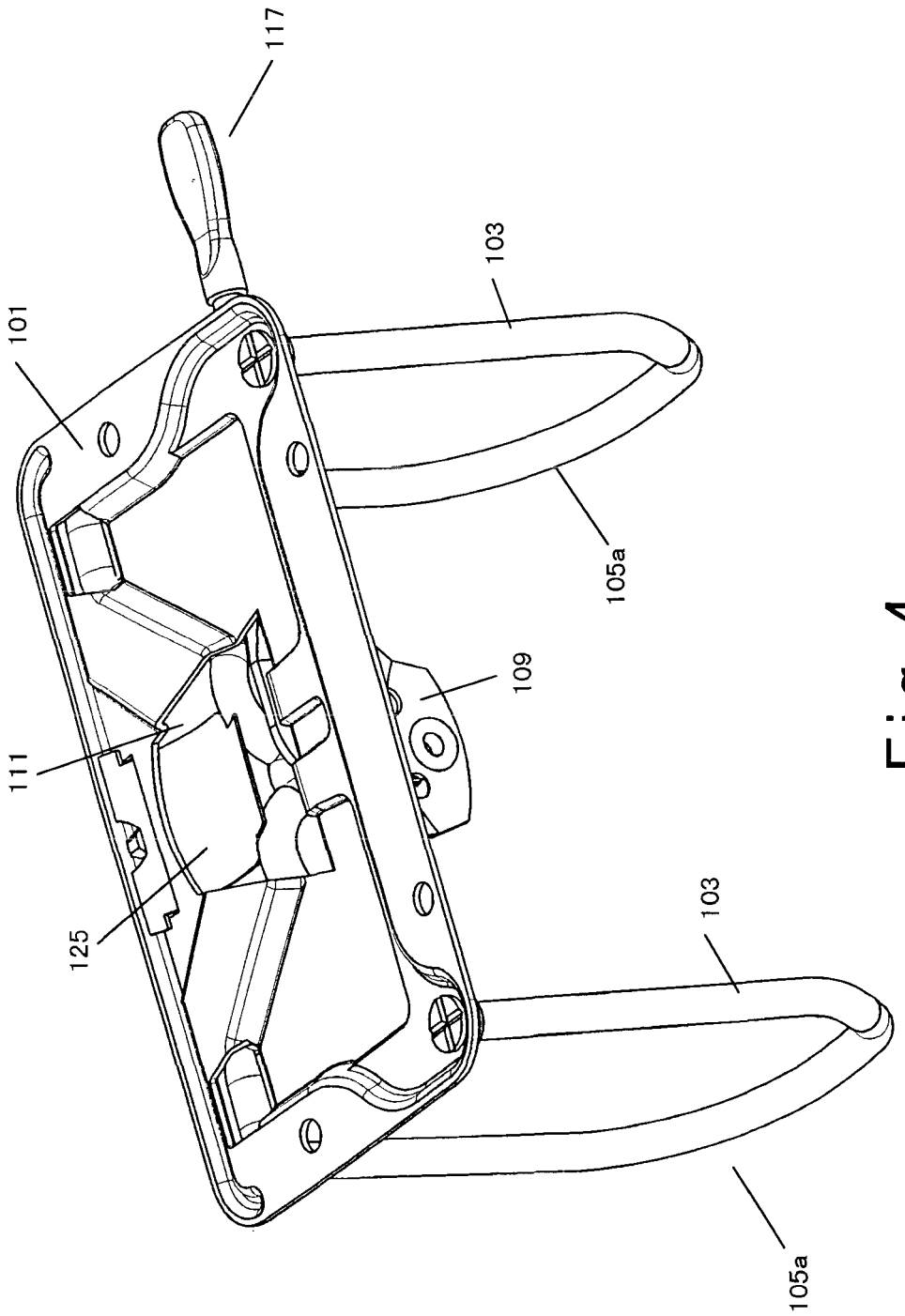

Fig. 4

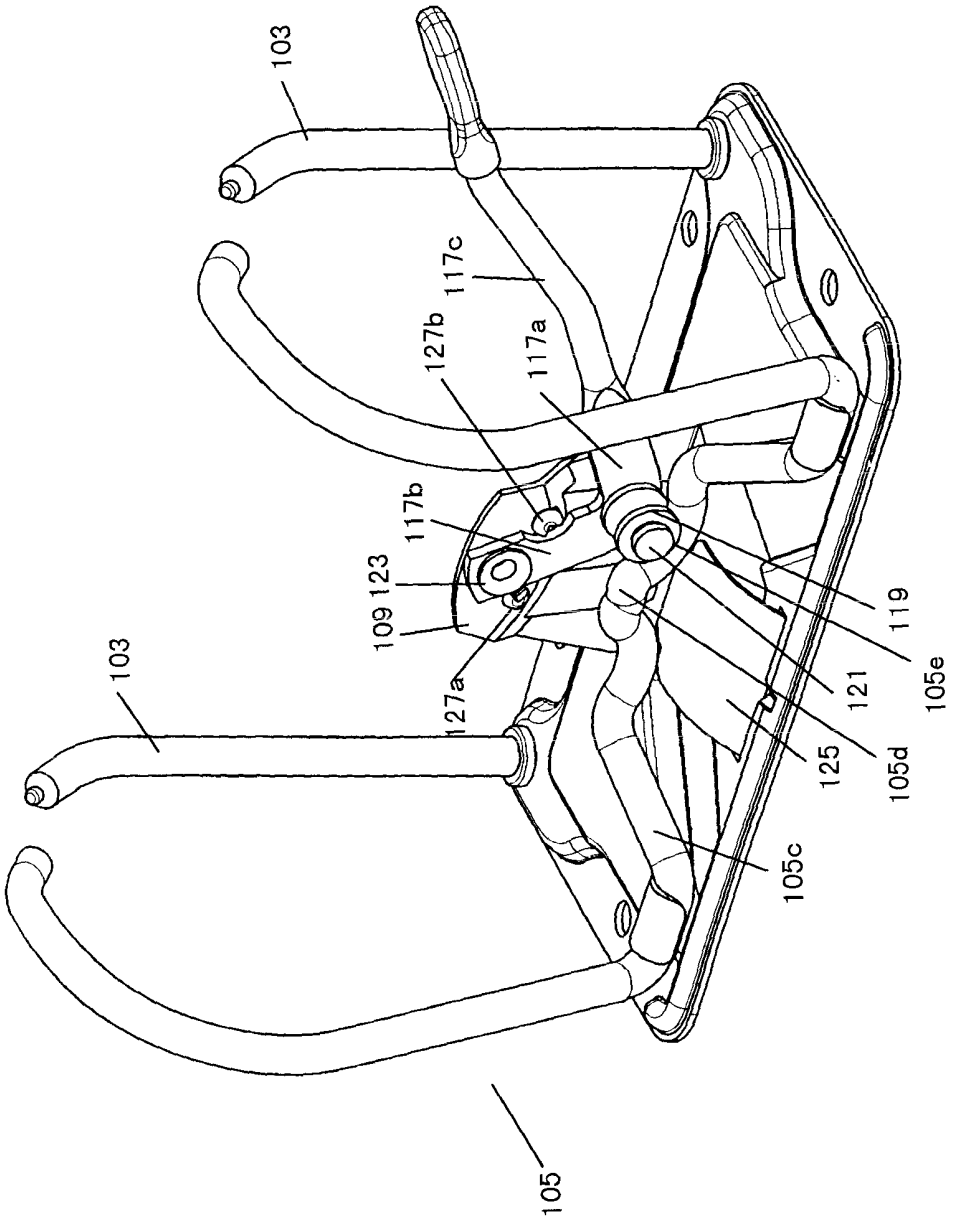
103
117c
127b
117a
117b
109 123
127a
103
119
121
105e
125
105d
105c
105

Fig. 5

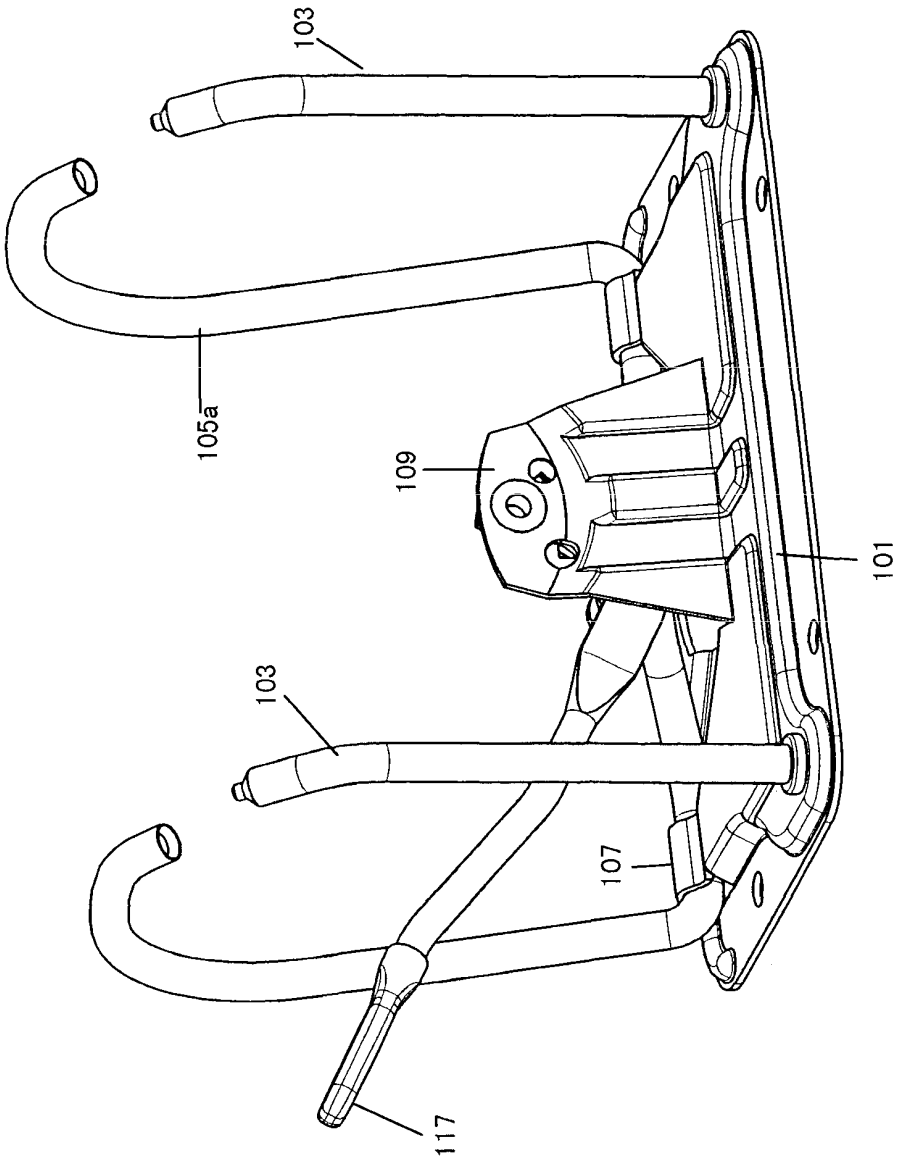

Fig. 6

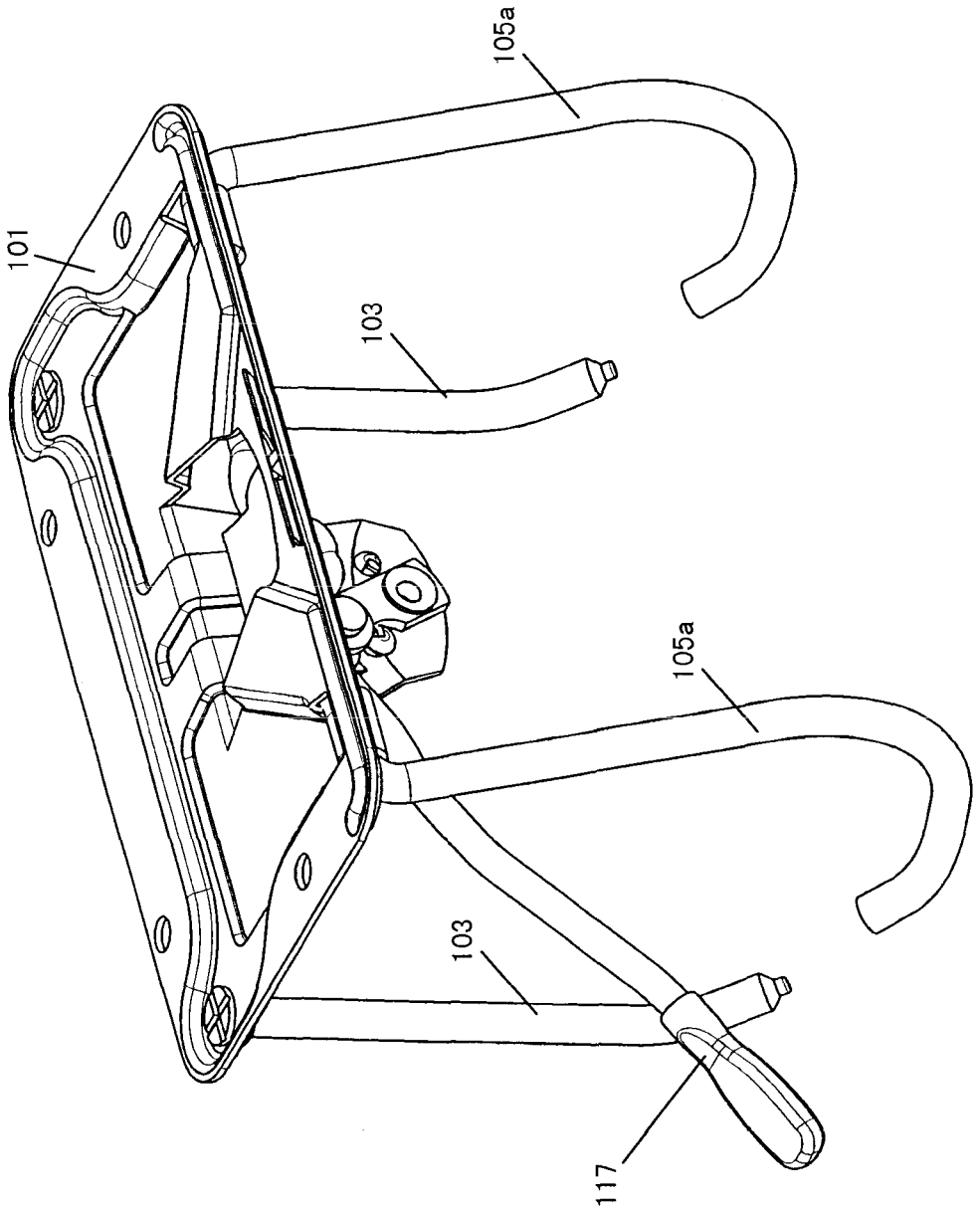

Fig. 7

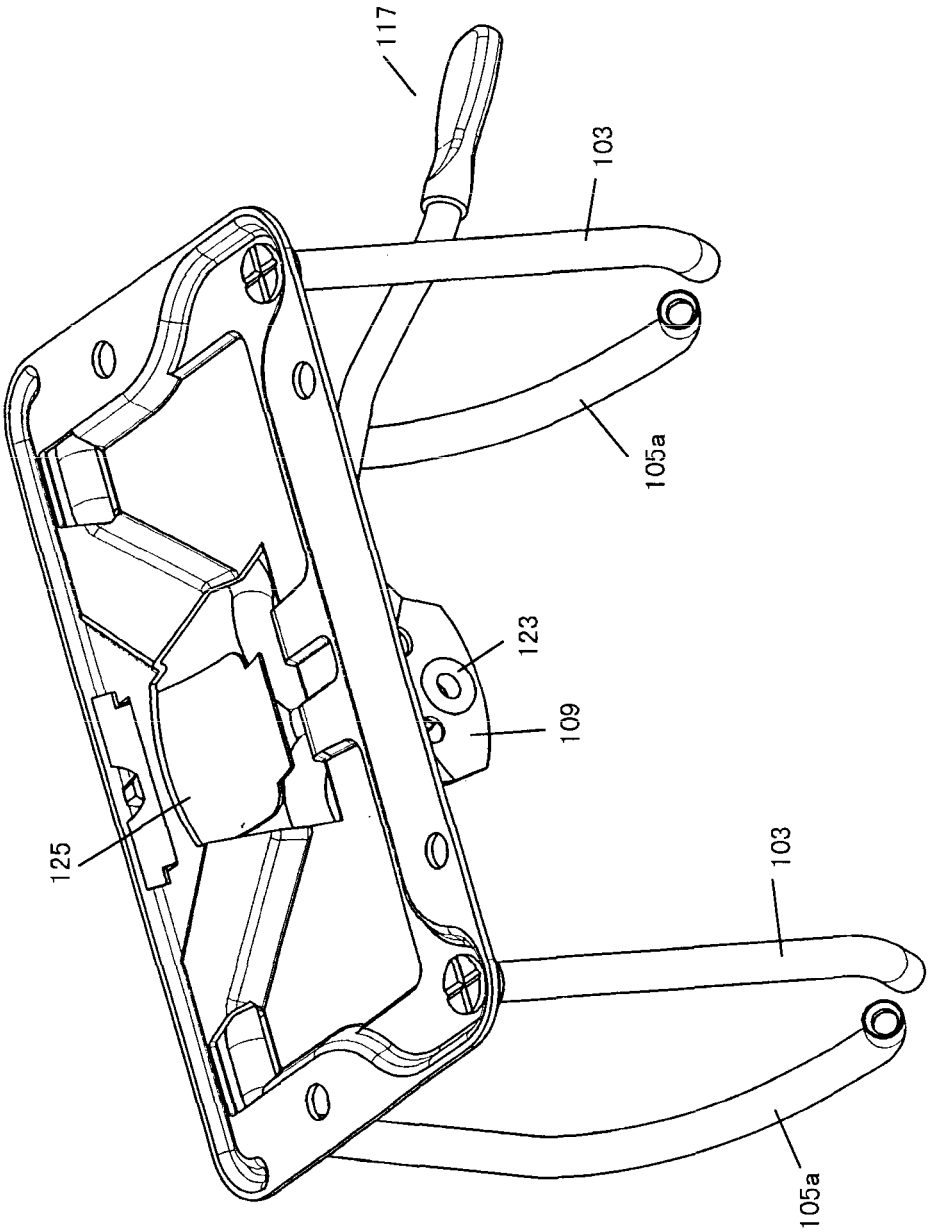

Fig. 8

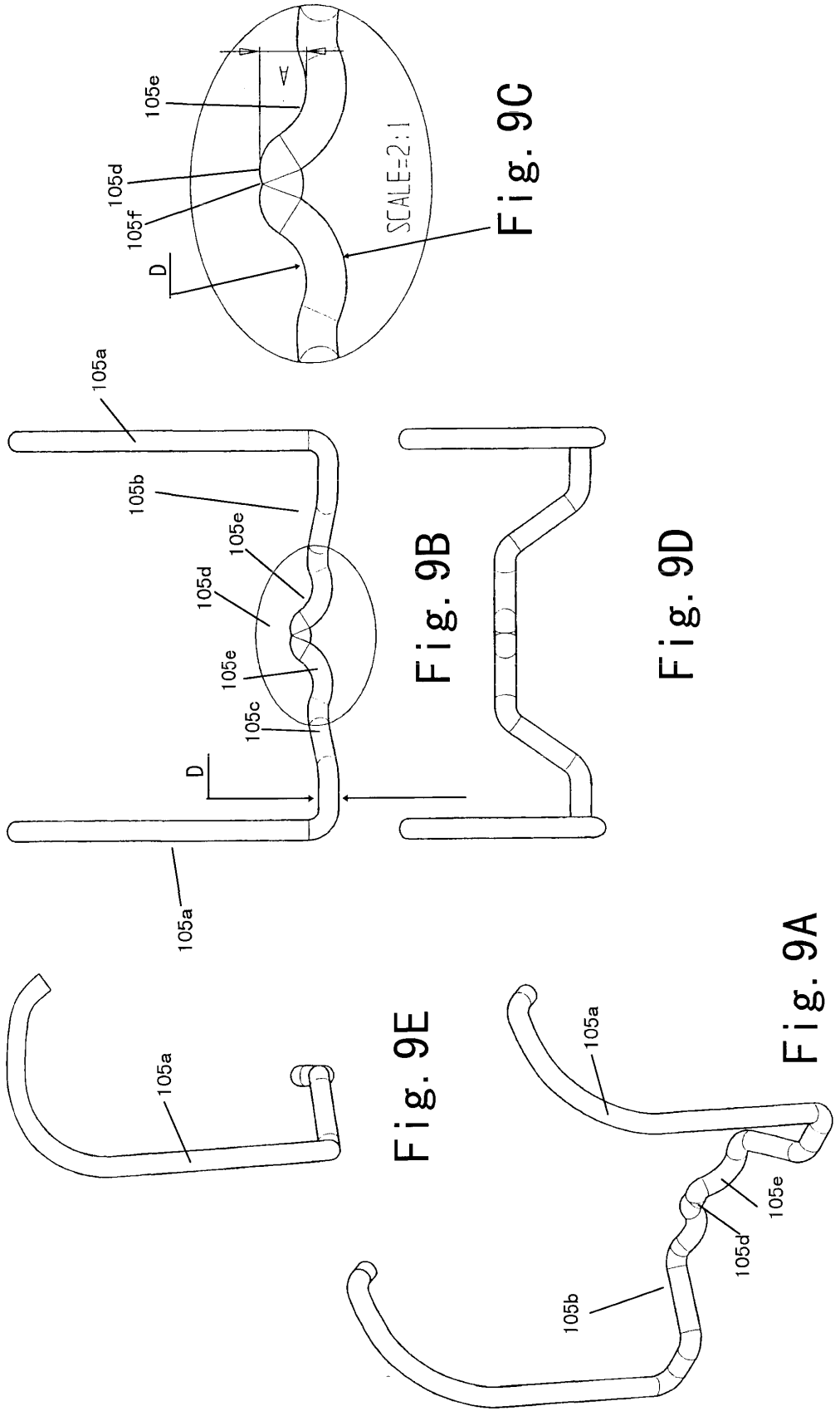

Fig. 9C

Fig. 9B

Fig. 9D

Fig. 9E

Fig. 9A

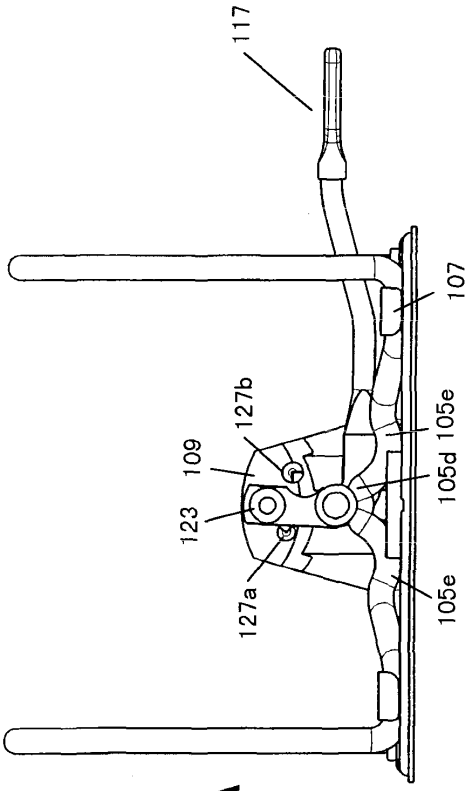

Fig. 10A

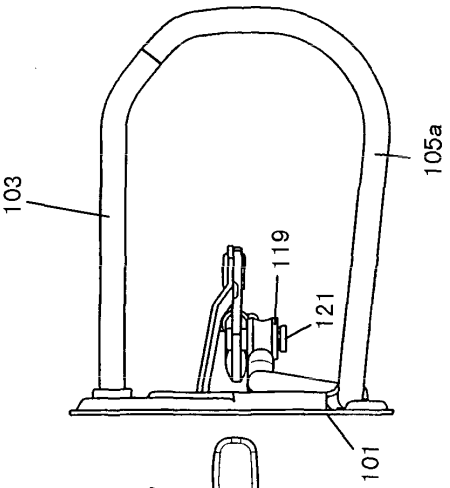

Fig. 10D

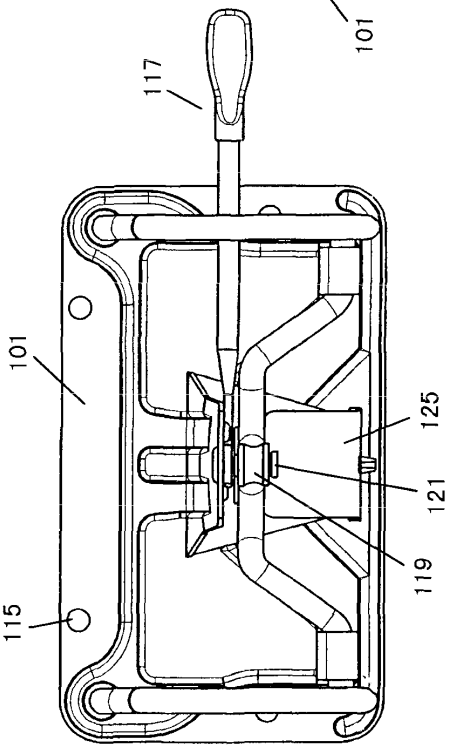

Fig. 10B

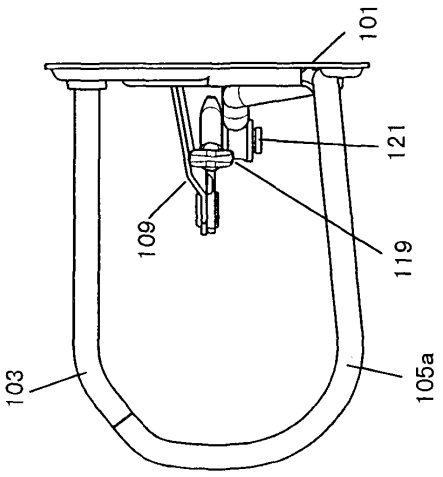

Fig. 10C

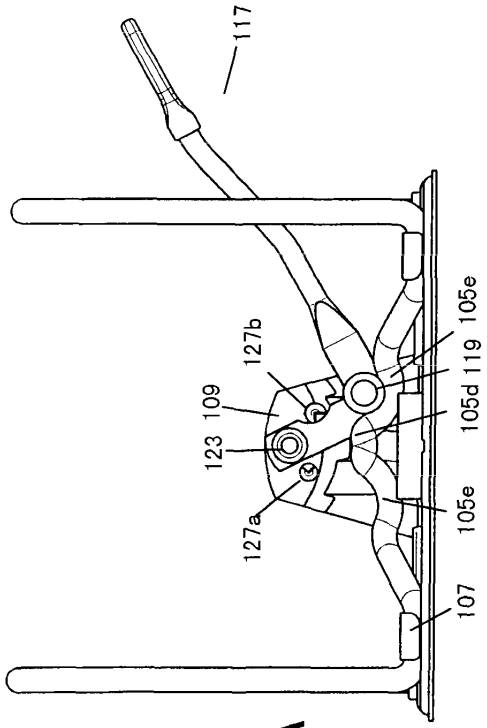

Fig. 11A

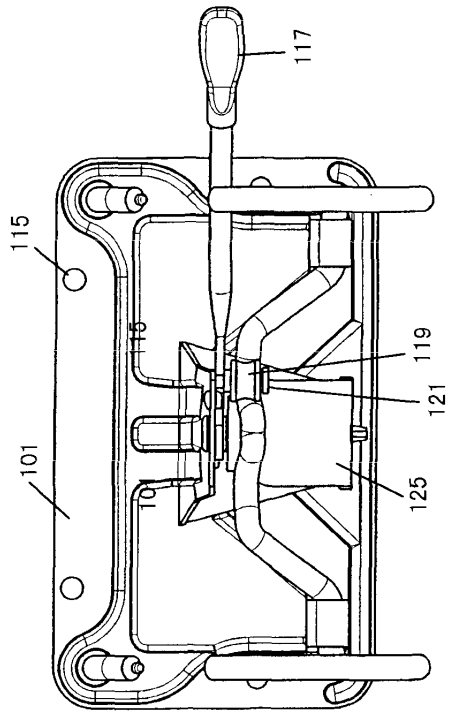

Fig. 11B

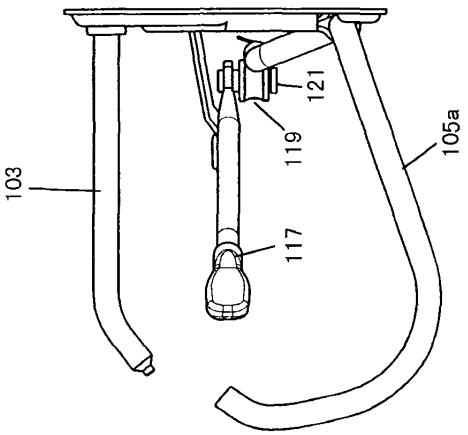

Fig. 11C

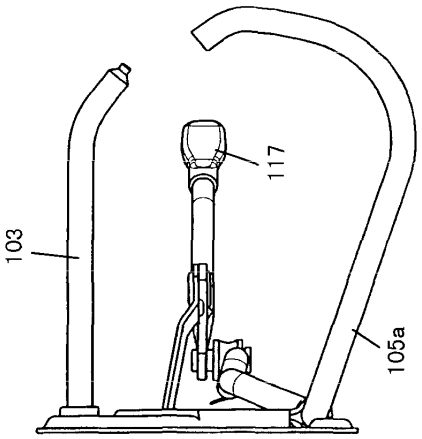

Fig. 11D

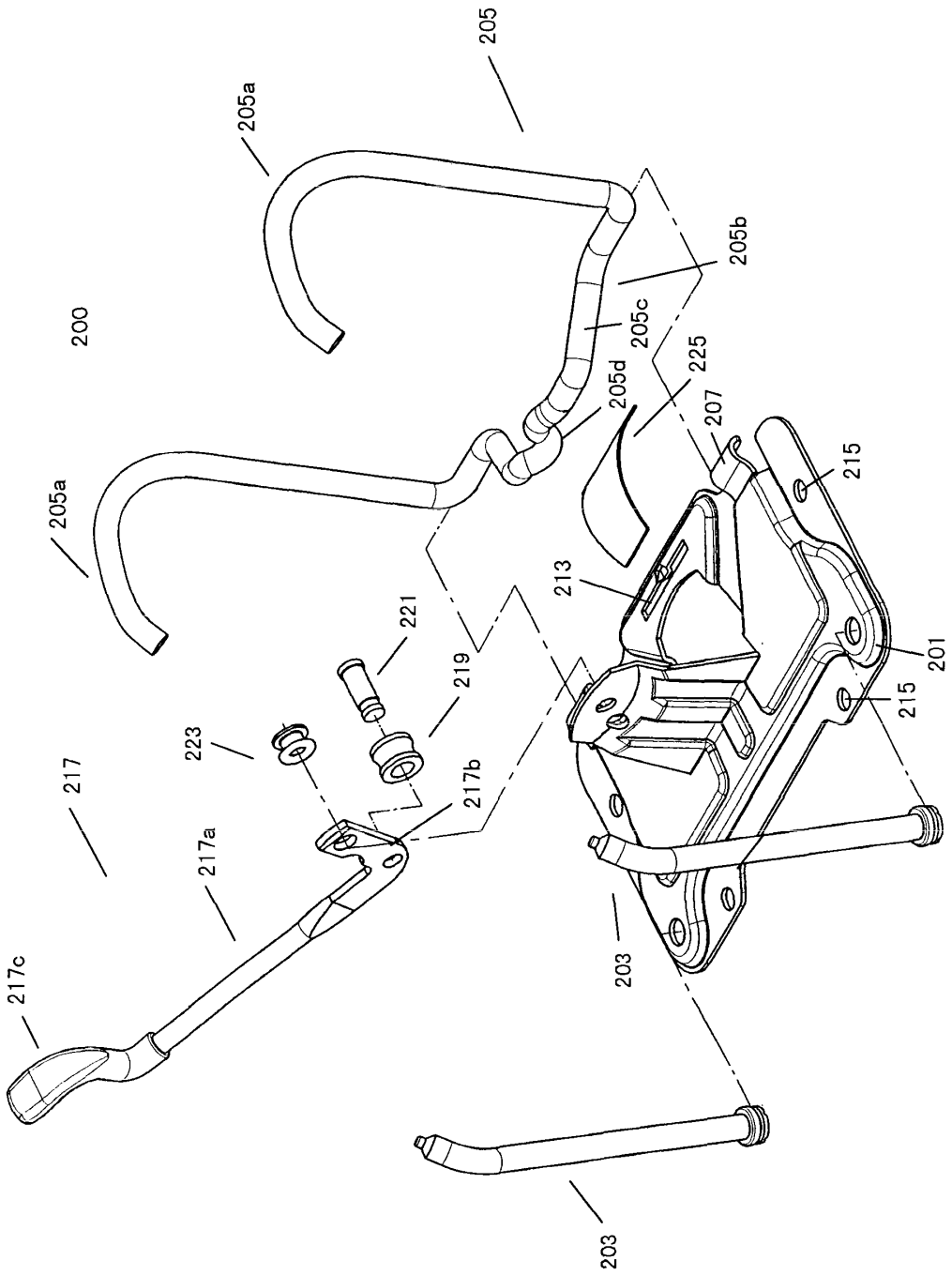
205
205a
205b
205c
205d
200
225
207
215
205a
213
221
219
201
215
223
217
217b
217a
217c
203
203

Fig. 12

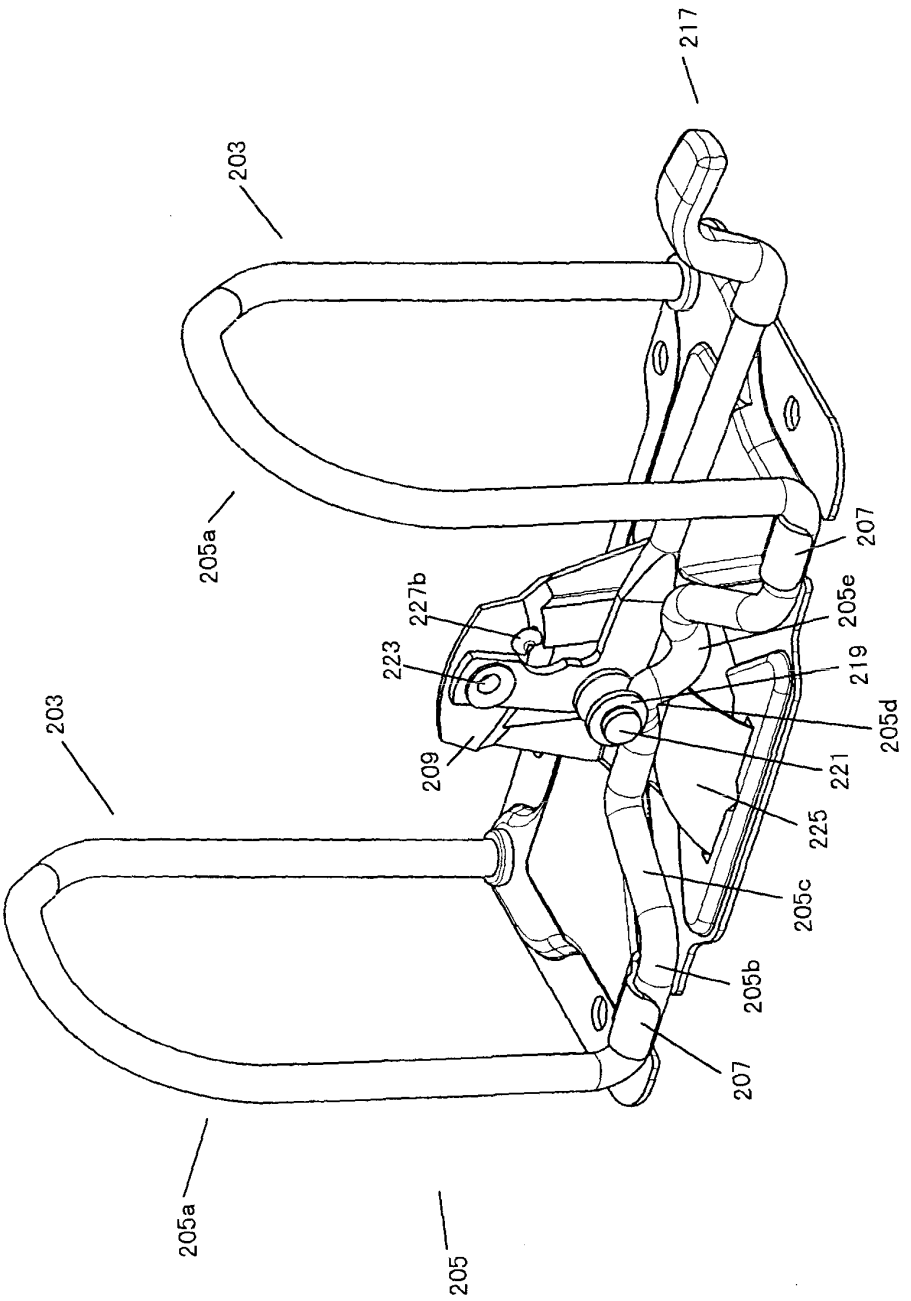
217
203
205a
227b
223
207
205e
219
205d
209
221
225
205c
205b
207
203
205a
205

Fig. 13

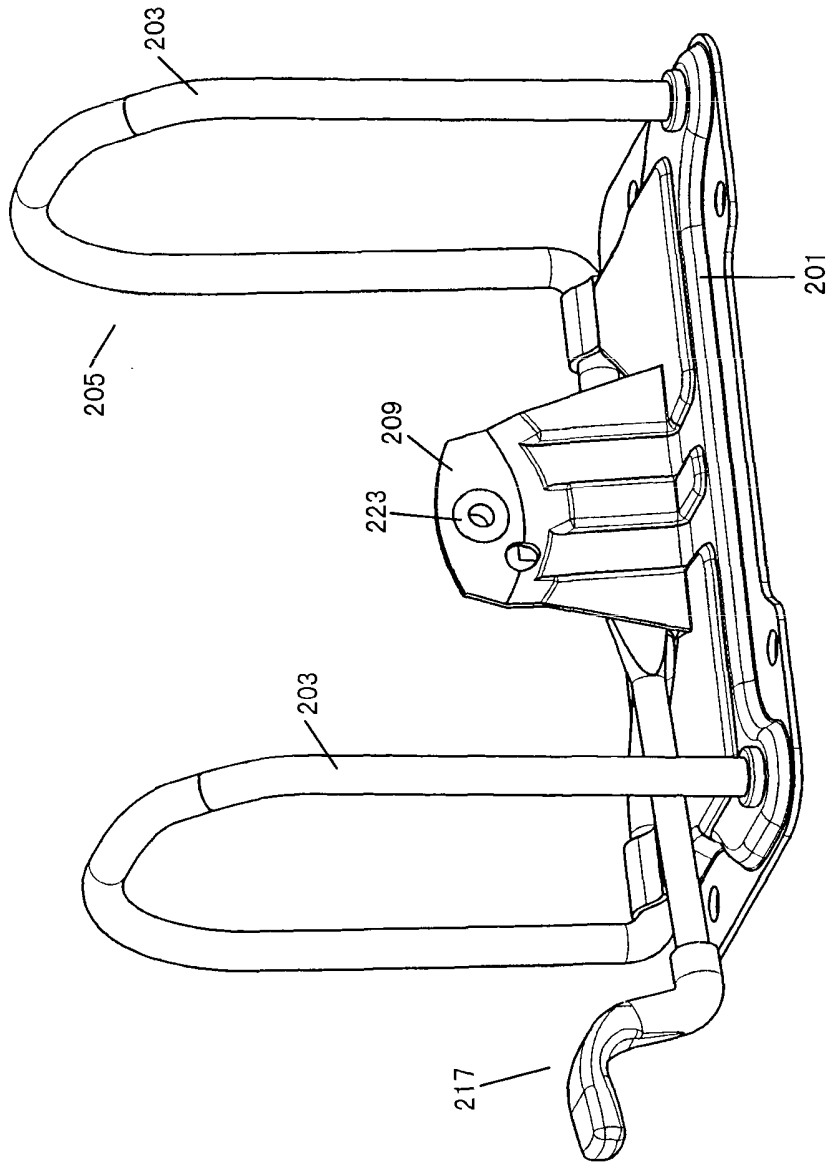

Fig. 14

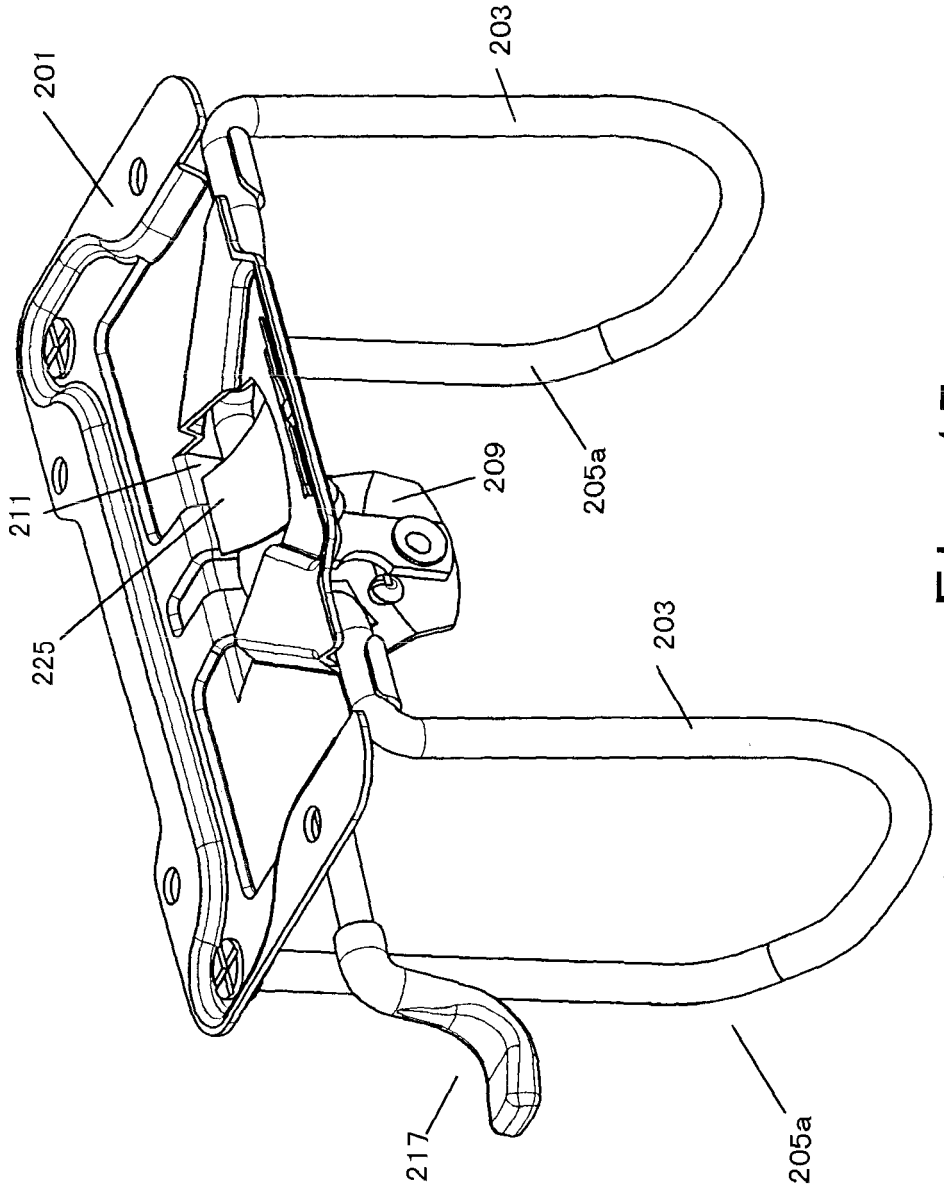

Fig. 15

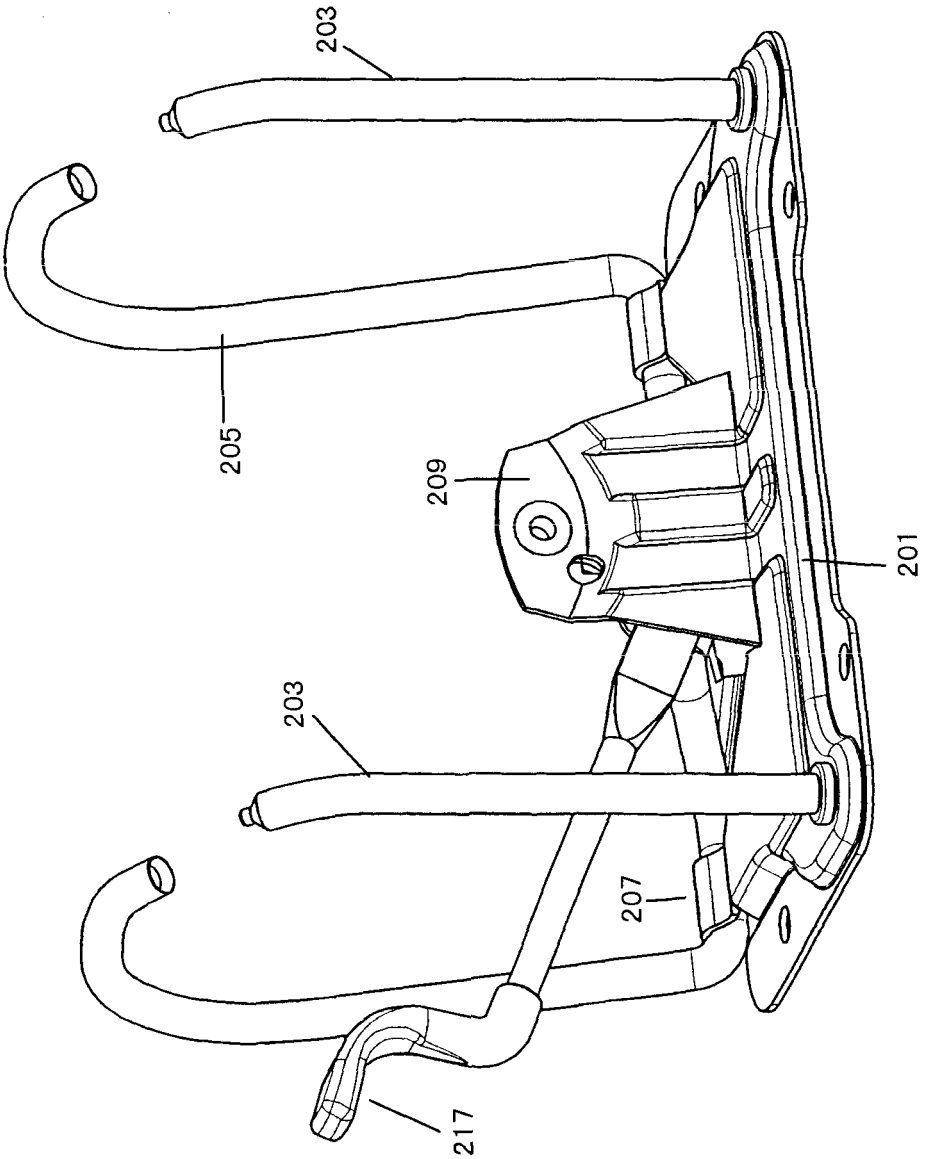

Fig. 16

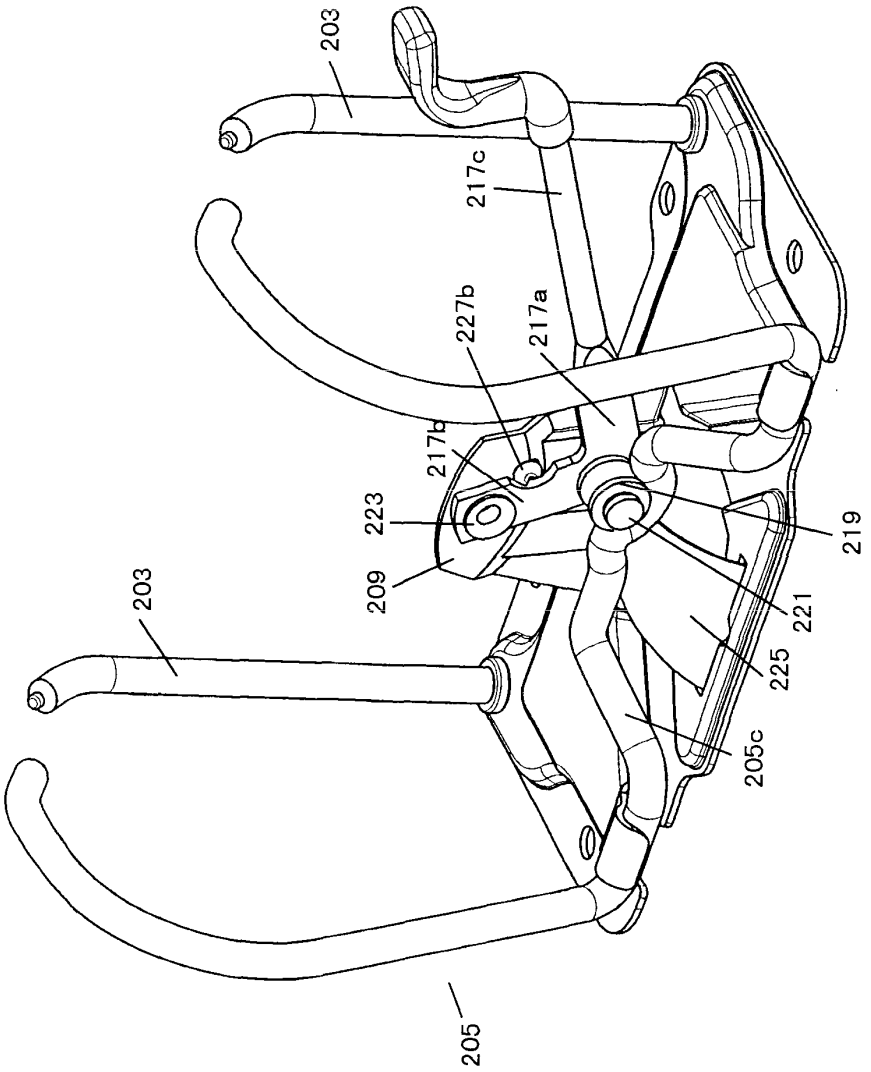

Fig. 17

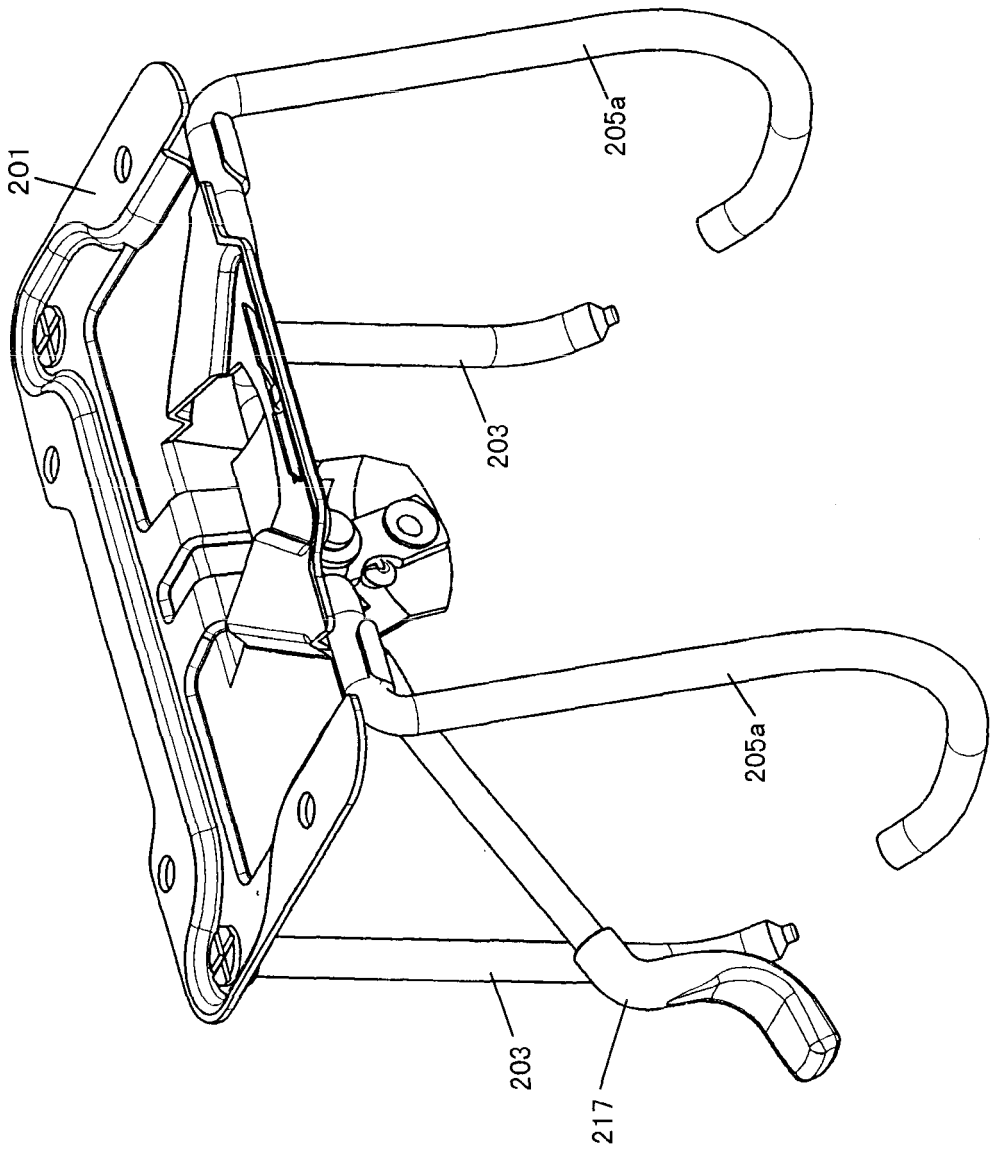

Fig. 18

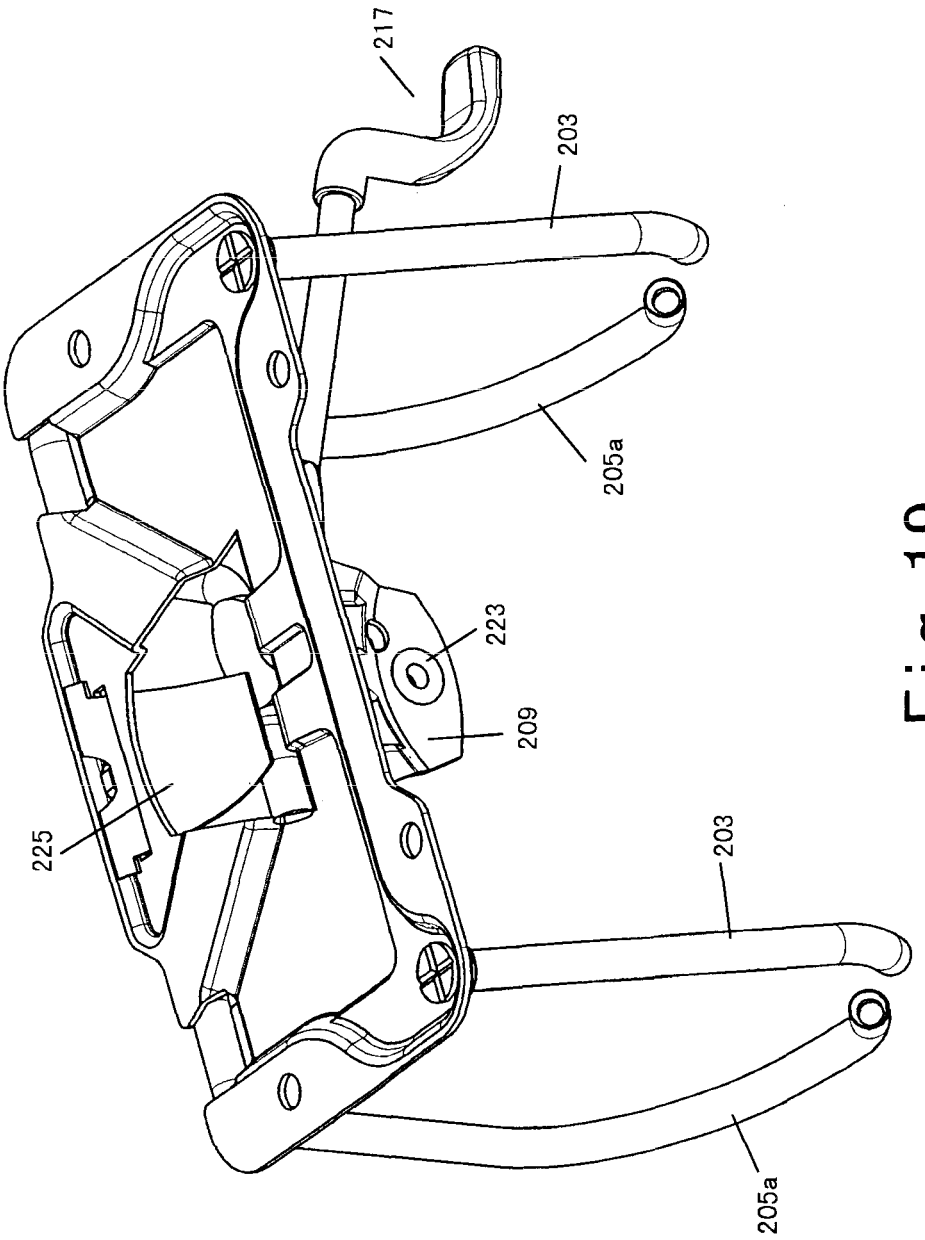

Fig. 19

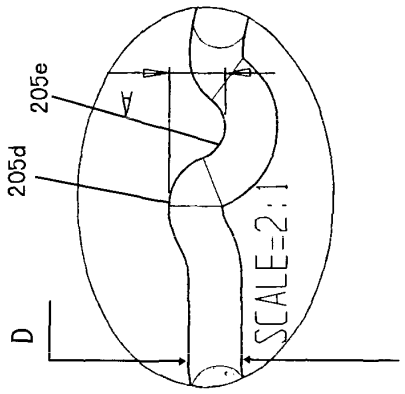

Fig. 20C

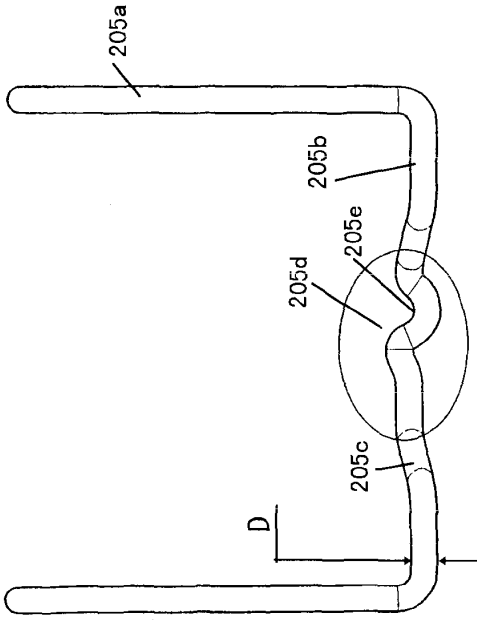

Fig. 20B

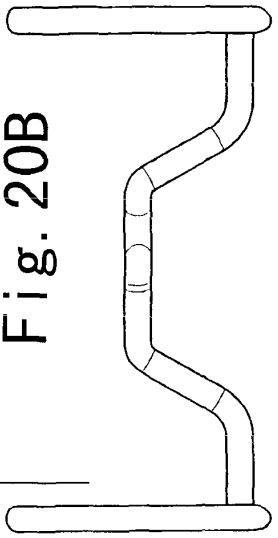

Fig. 20D

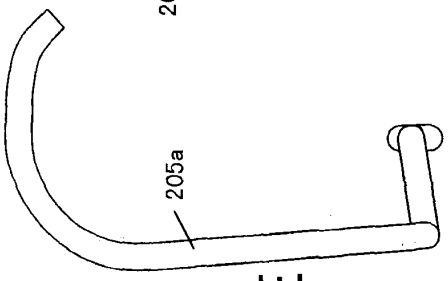

Fig. 20E

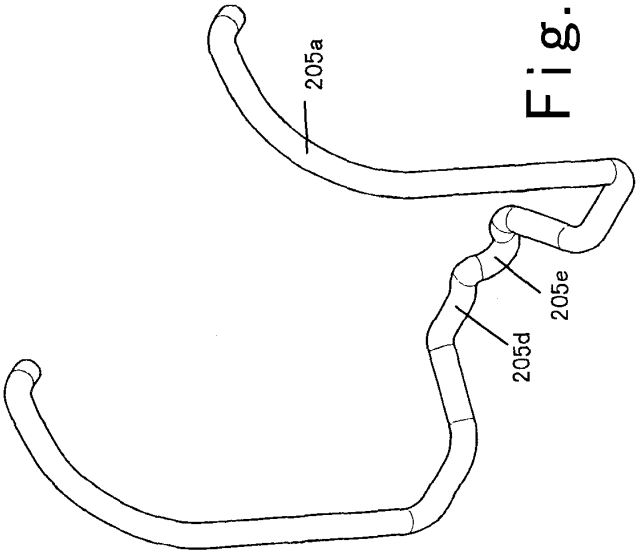

Fig. 20A

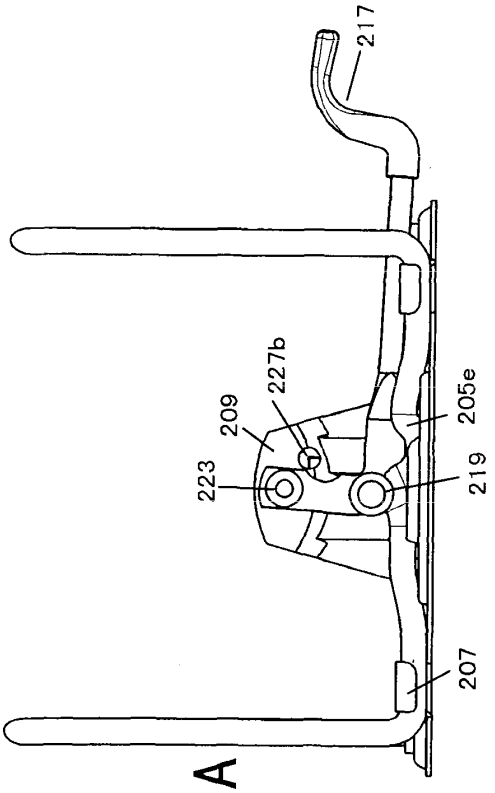

Fig. 21A

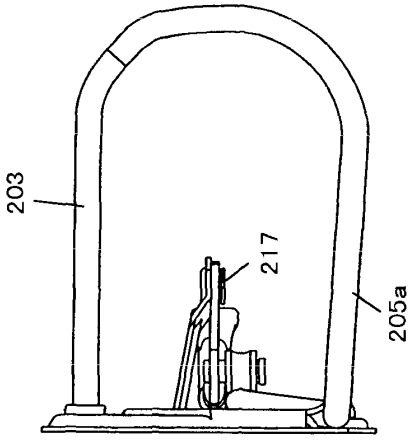

Fig. 21D

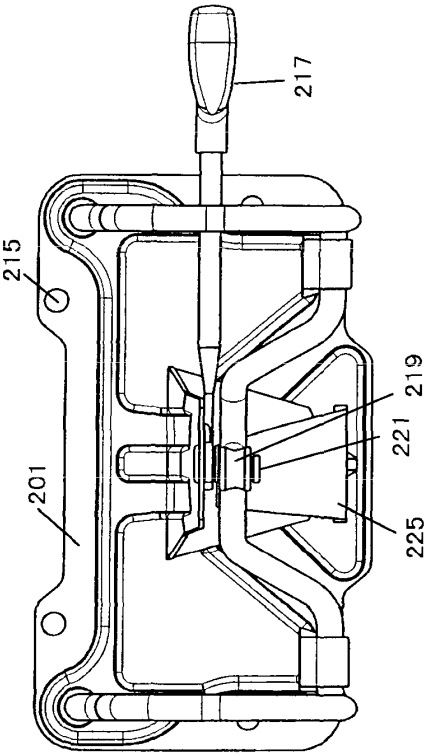

Fig. 21B

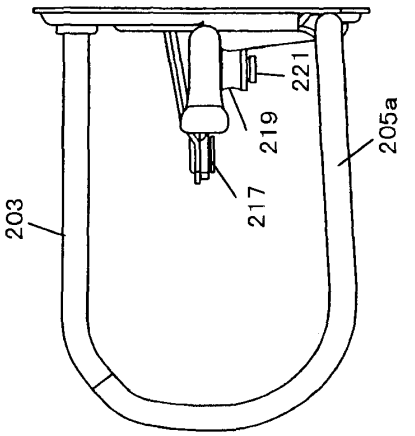

Fig. 21C

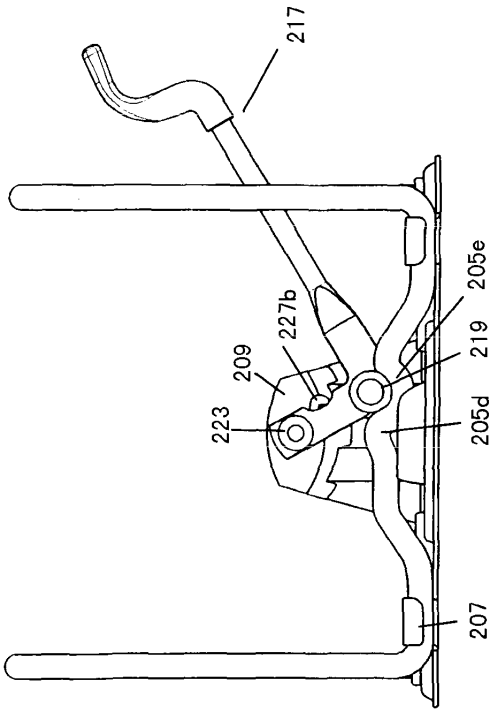

Fig. 22A

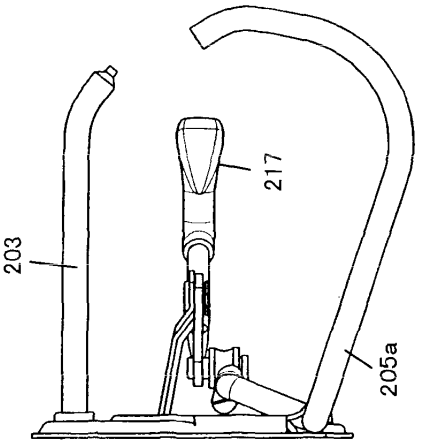

Fig. 22D

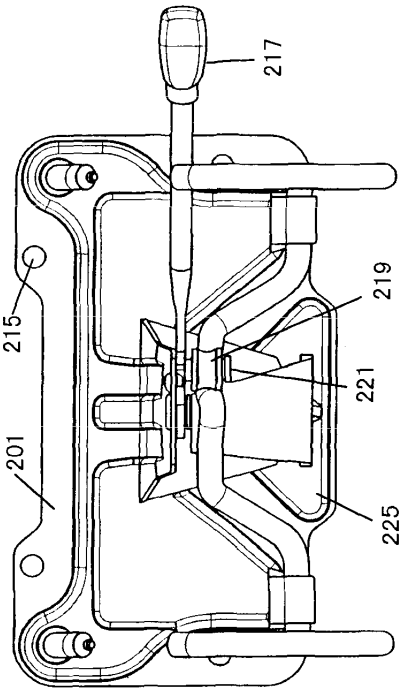

Fig. 22B

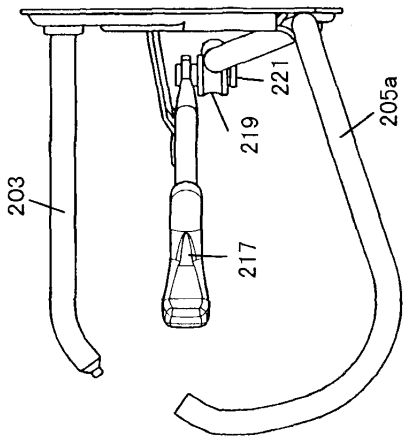

Fig. 22C

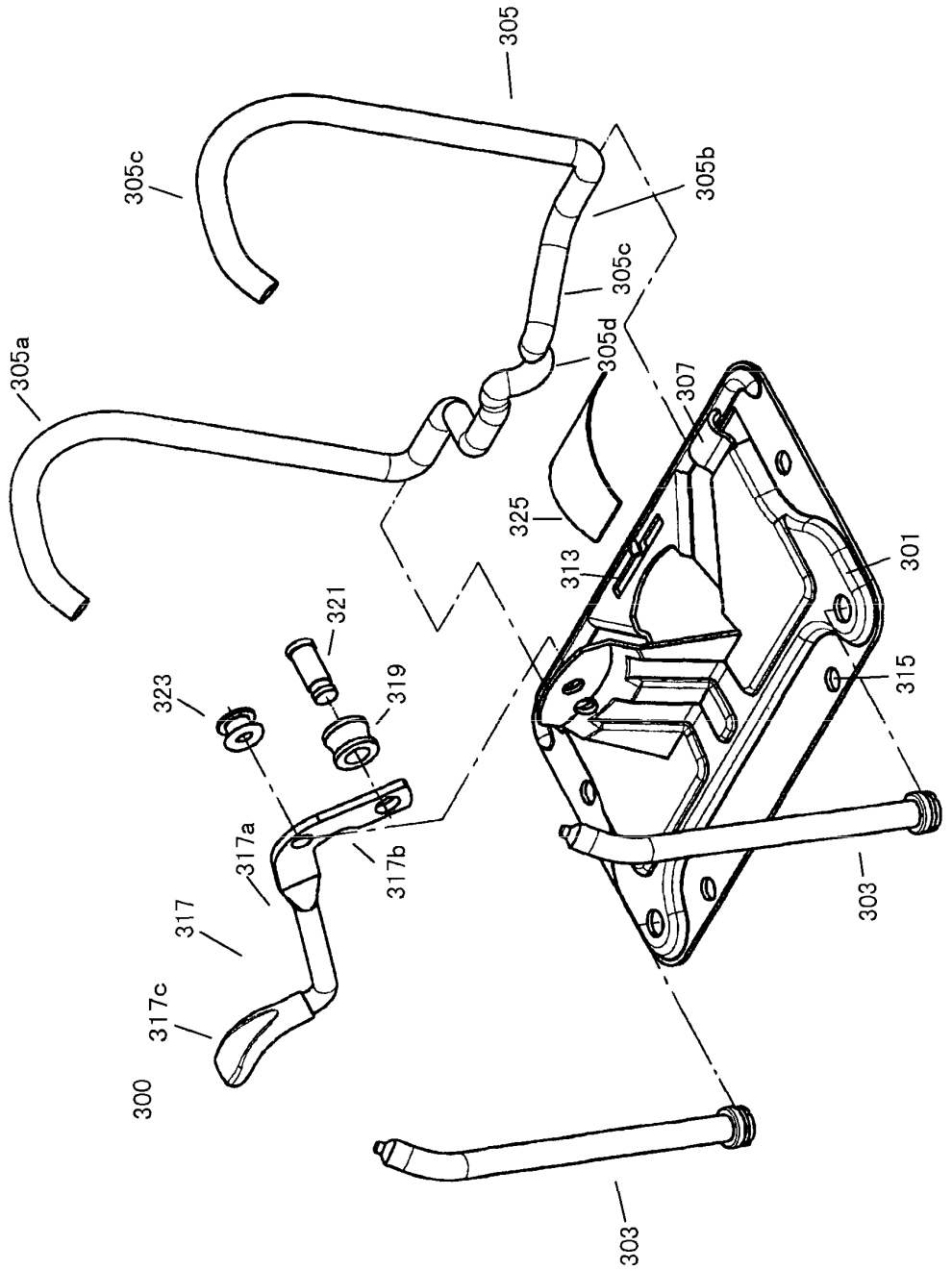
305
305c
305b
305c
305d
305a
307
325
313
301
321
323
319
315
317a
317b
317
317c
300
303
303

Fig. 23

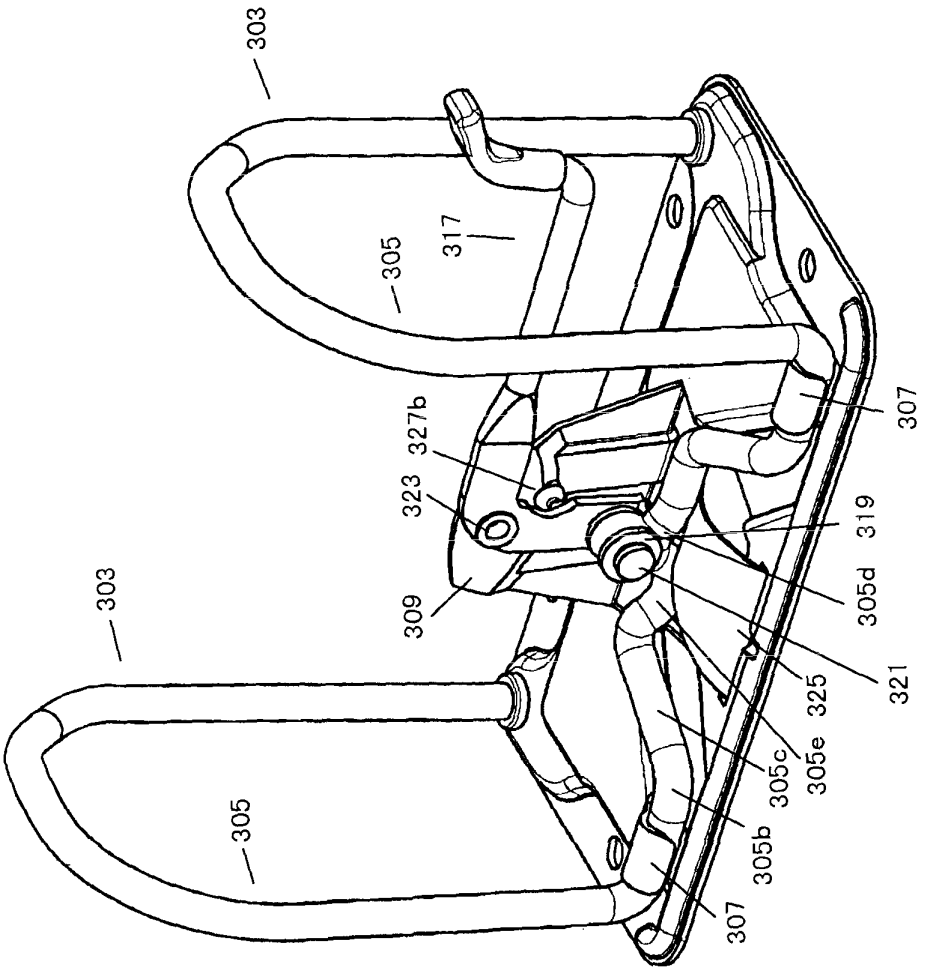
303
305
317
307
327b
323
319
309
305d
321
325
305e
305c
305b
307
303
305

Fig. 24

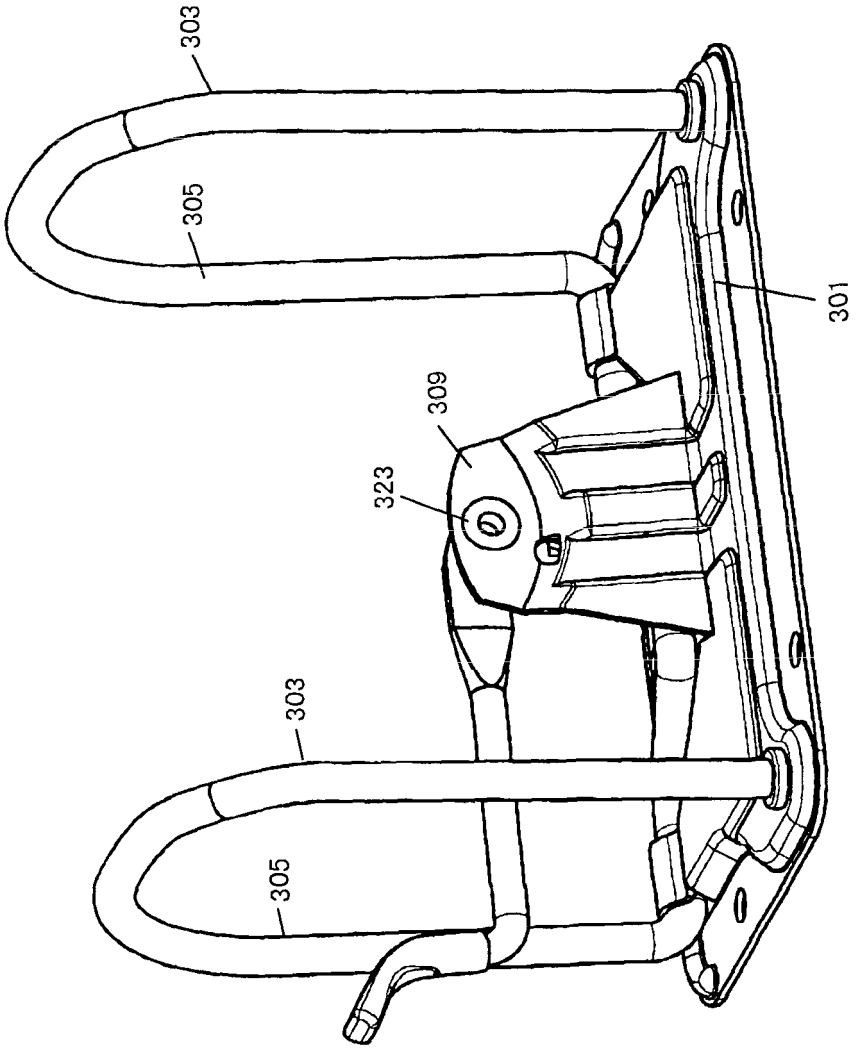

Fig. 25

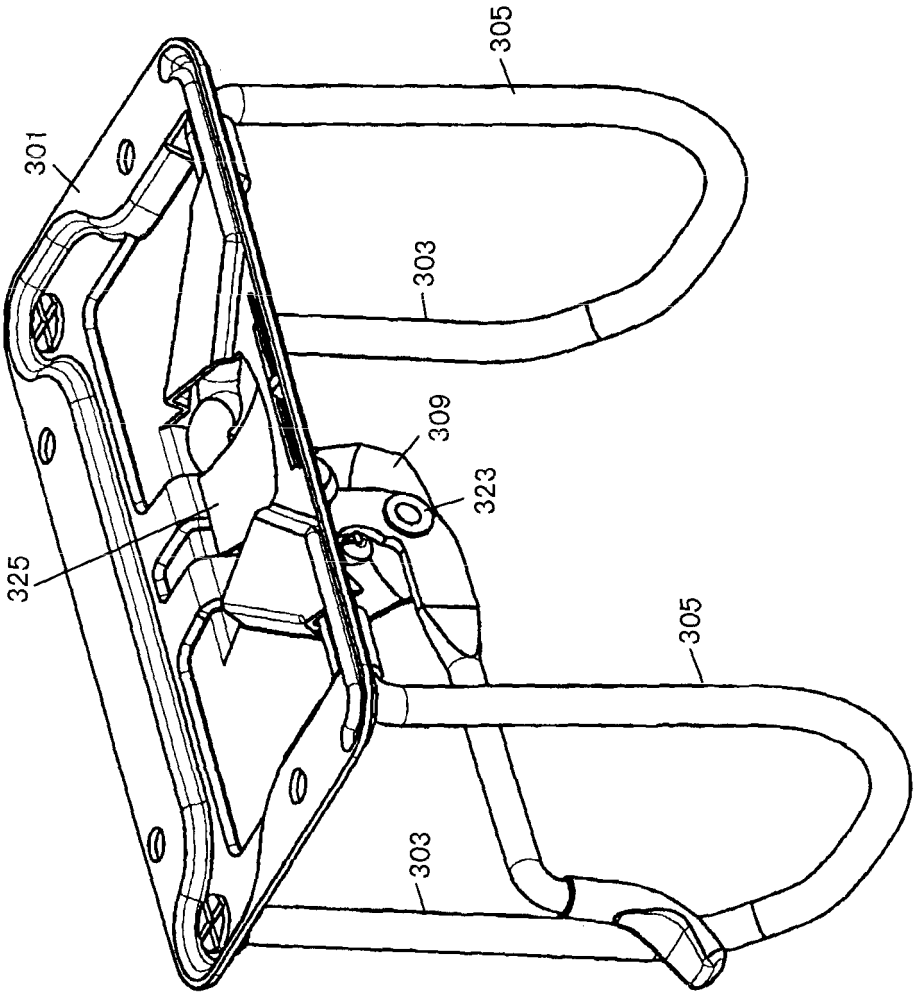

Fig. 26

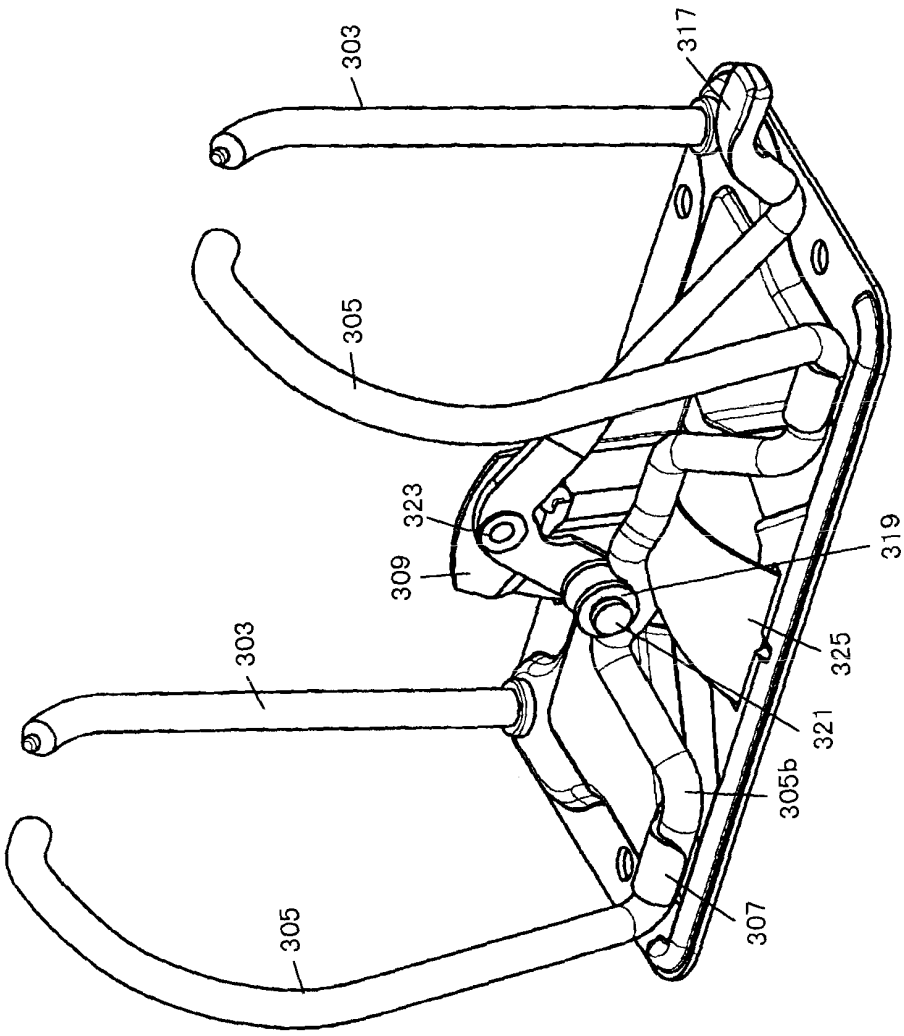

Fig. 27

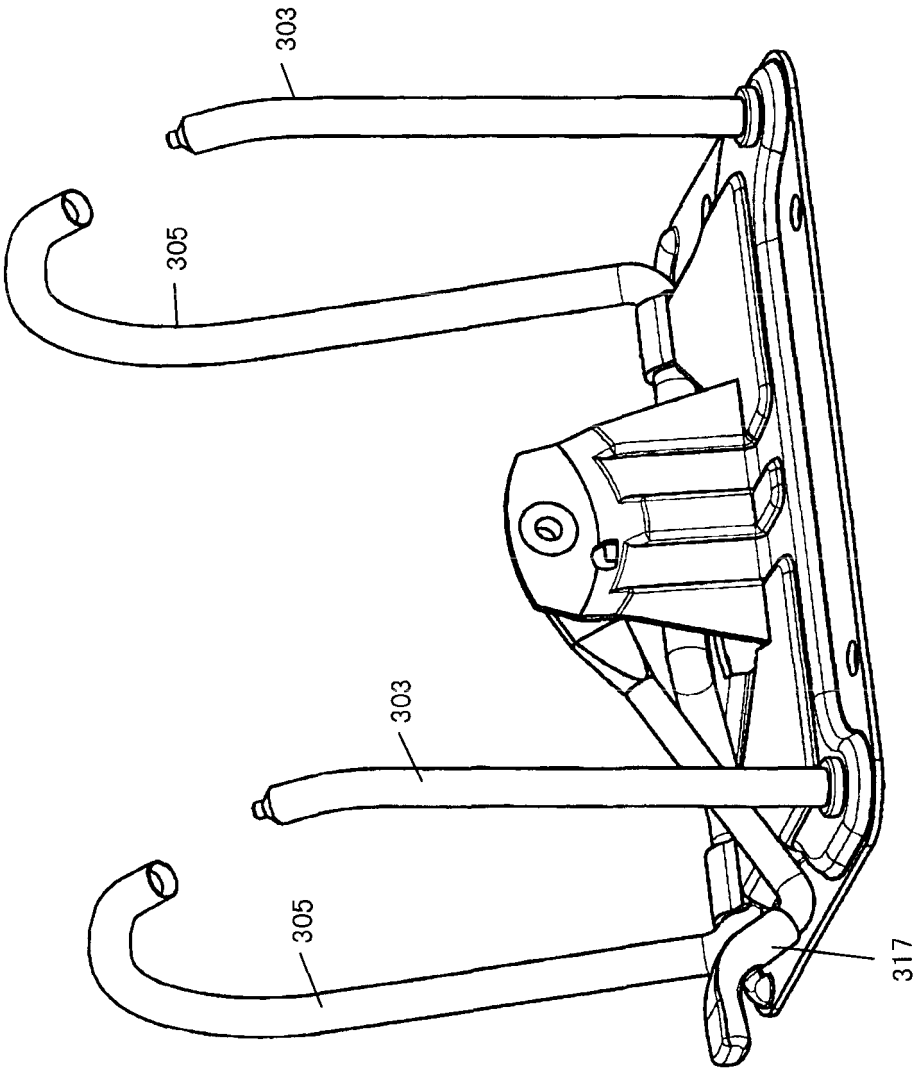

Fig. 28

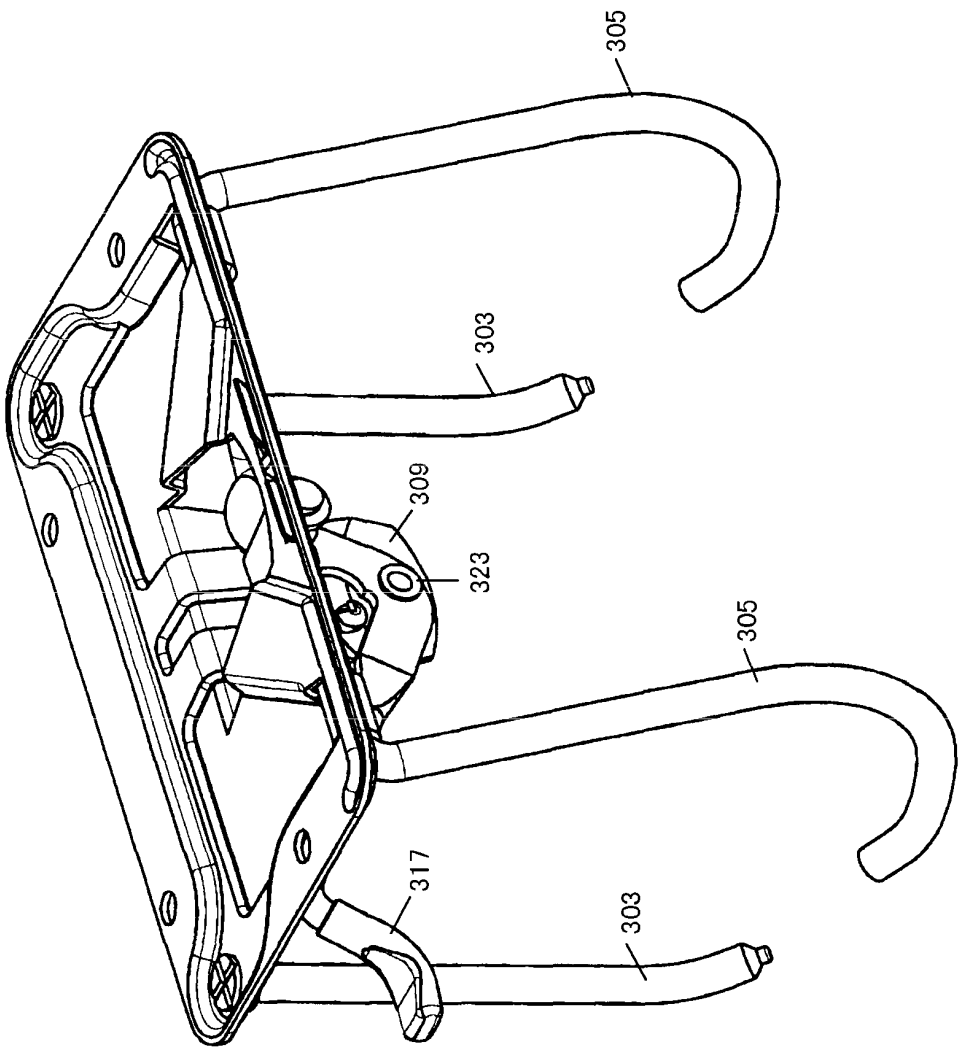

Fig. 29

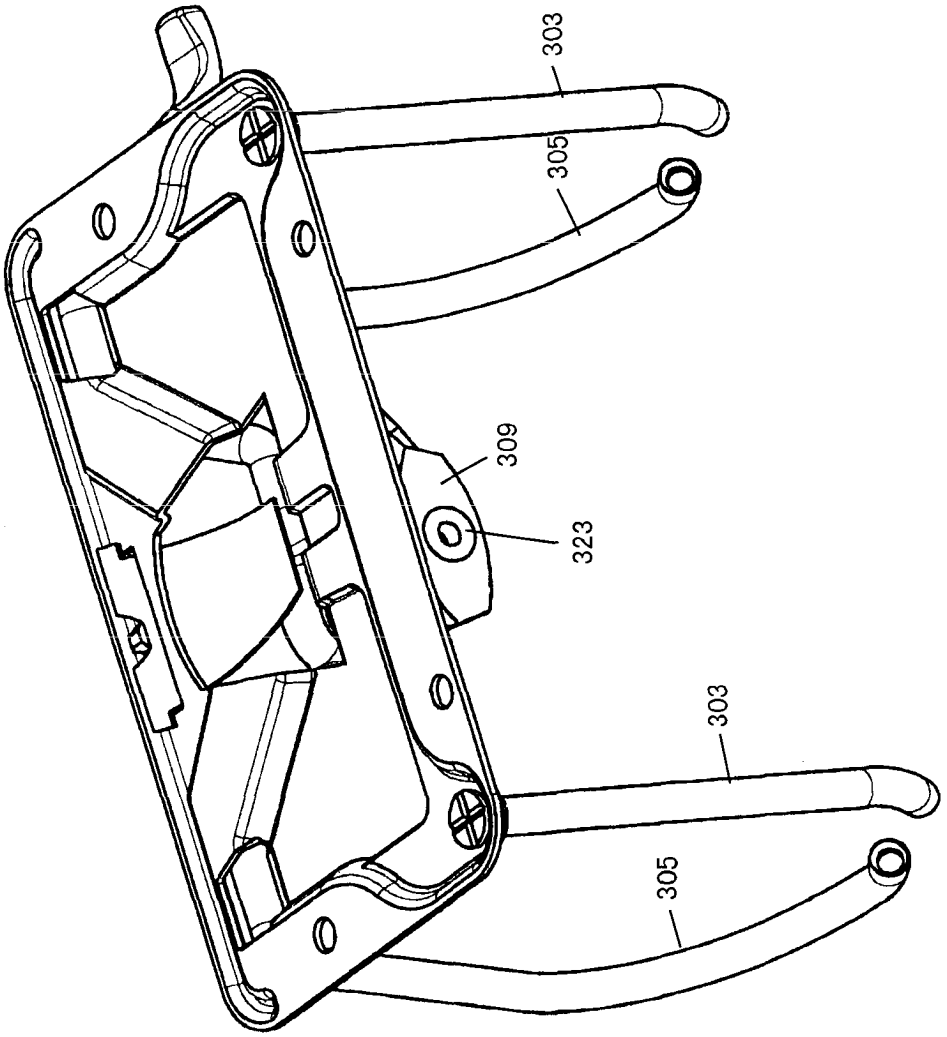

Fig. 30

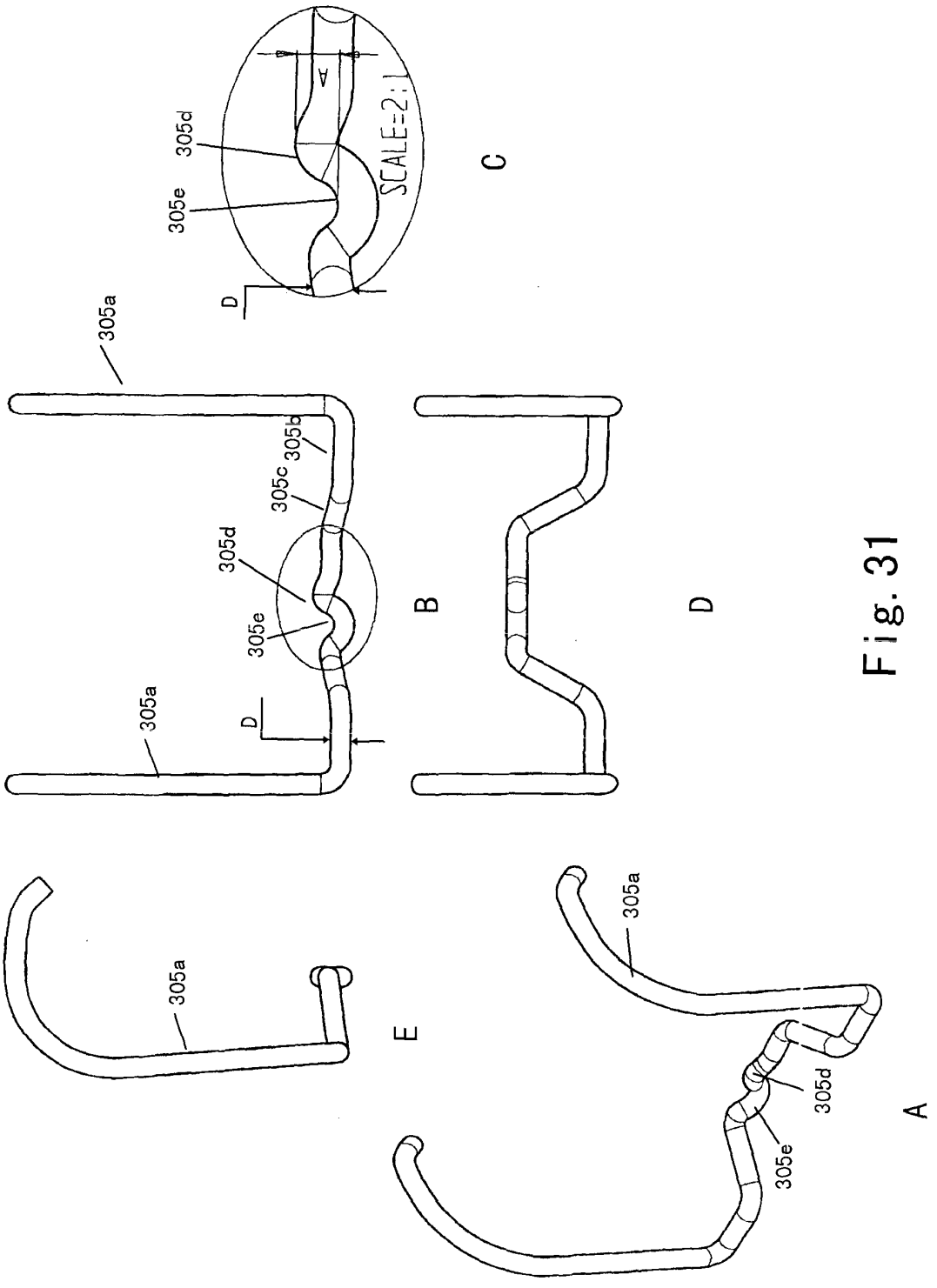

Fig. 31

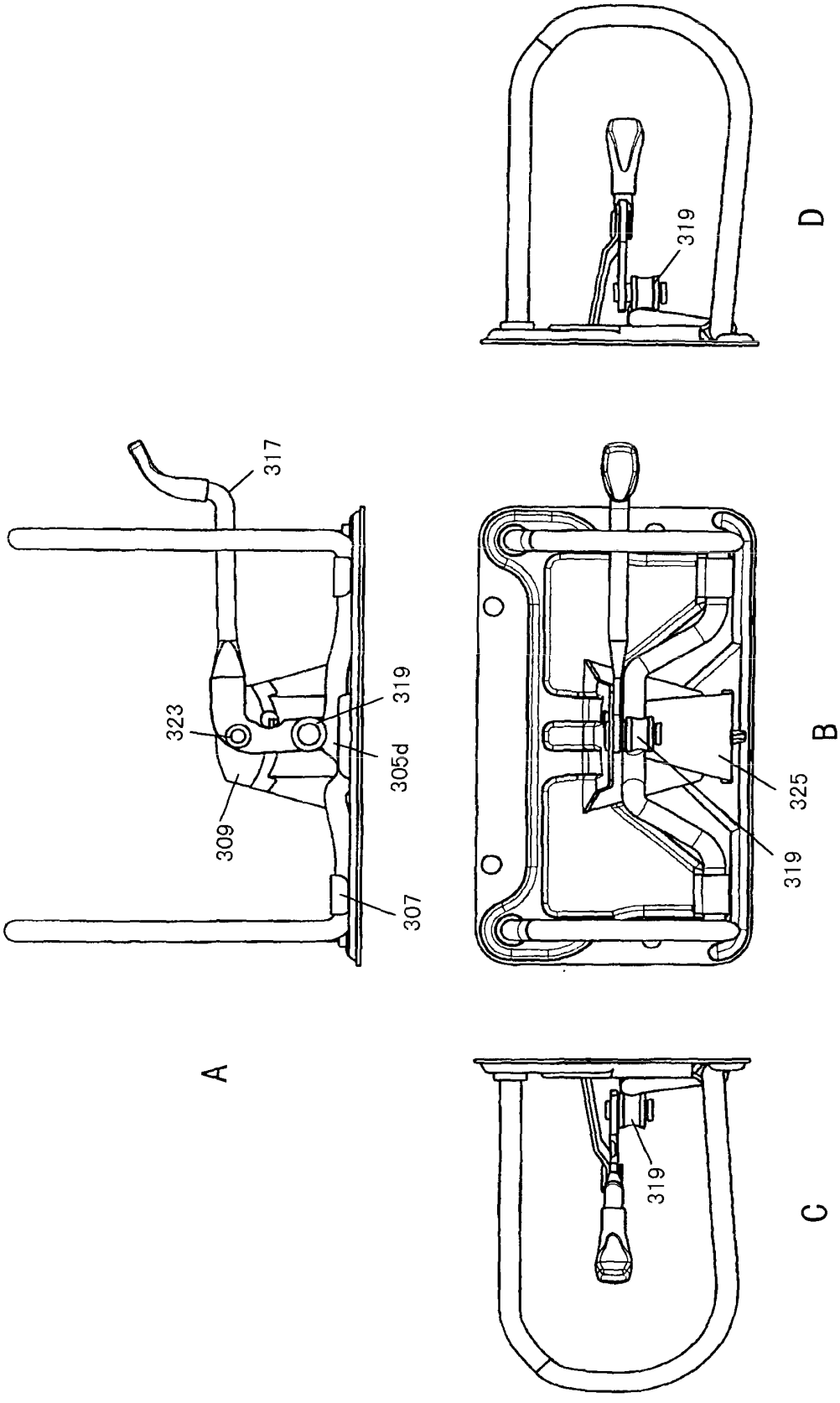

Fig. 32

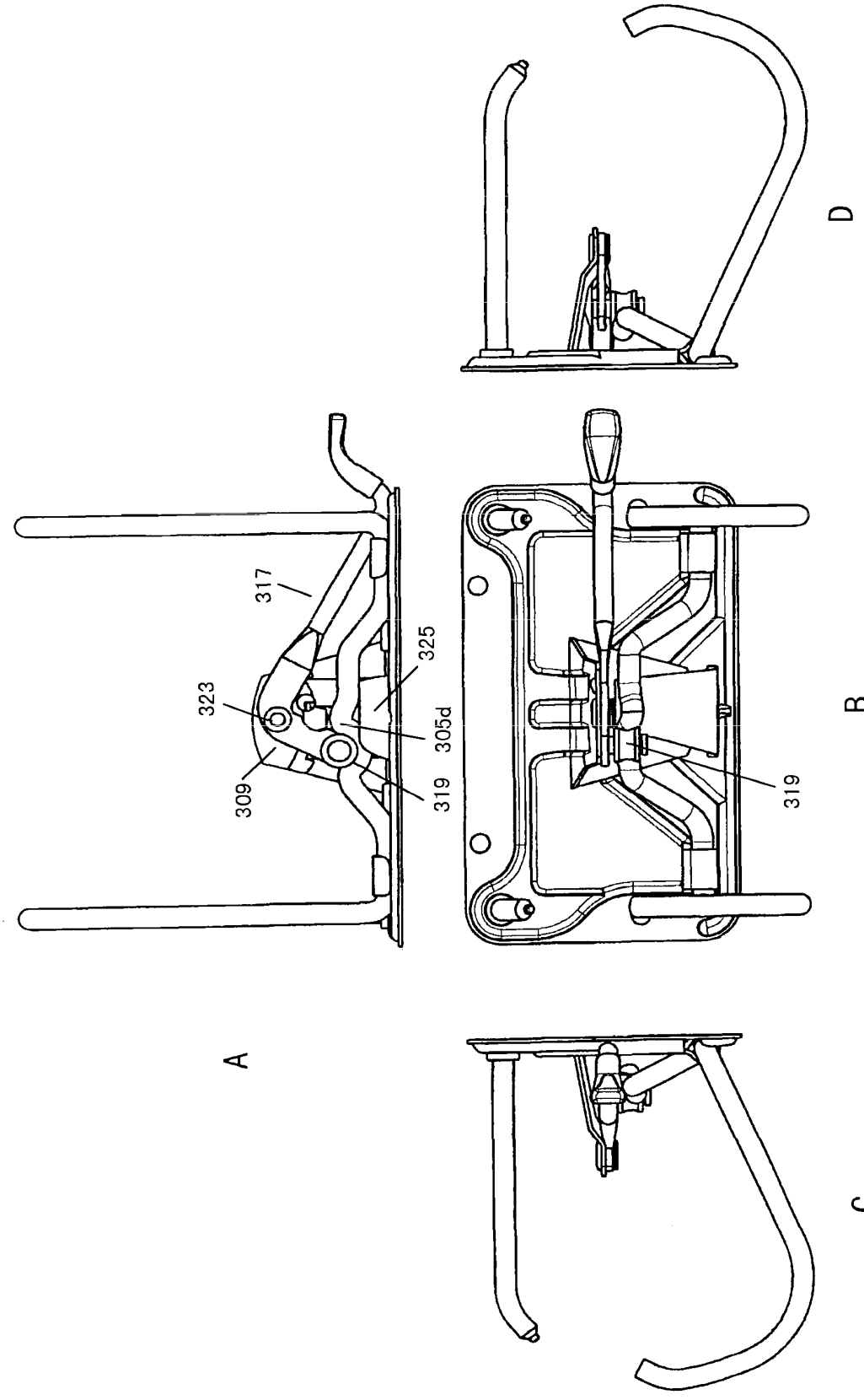

Fig. 33

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2007/000717

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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)

IPC: B42F13+, B42F3+

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC, WPI, PAJ, CNPAT: plate, ring, loop, bend, curve, flex, bending, curving, flexing, depressed, project+, extrud+, angle, lever, bar, rod

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	CN2609763Y (LECO STATIONERY MFG CO LTD) 7 Apr. 2004 (07.04.2004) see the whole document	1-28
A	CN1358144A (LECO STATIONERY MFG CO LTD)10 Jul. 2002 (10.07.2002) see the whole document	1-28
A	CN1311106A (LECO STATIONERY MFG CO LTD) 5 Sep. 2001 (05.09.2001) see the whole document	1-28
A	CN1337317A (LECO STATIONERY MFG CO LTD)27 Feb. 2002 (27.02.2002) see the whole document	1-28
A	CN1146182A (LEITZ KG LOUIS) 26 Mar. 1997 (26.03.1997) see the whole document	1-28
A	CN1678463A (SCHNEIDER G K et al.) 5 Oct. 2005 (05.10.2005) see the whole document	1-28
A	WO9605070A1 (LEITZ KG LOUIS) 22 Feb. 1996 (22.02.1996) see the whole document	1-28

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&"document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 Jul. 2007 (26.07.2007)	**09 Aug. 2007 (09.08.2007)**
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer XU, Zhiqing Telephone No. (86-10)62085454

Form PCT/ISA /210 (second sheet) (April 2007)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2007/000717

Patent Documents referred in the Report	Publication Date	Patent Family	Publication Date
CN2609763Y	07.04.2004	None	
CN1358144A	10.07.2002	WO0166363A1	13.09.2001
		EP1138524A2	04.10.2001
		AU2343301A	17.09.2001
		NO20015451A	07.01.2002
		JP2003525787T	02.09.2003
		CN1154579C	23.06.2004
		PL351031A	10.03.2003
CN1311106A	05.09.2001	EP1129865A2	05.09.2001
		GB2359784A	05.09.2001
CN1337317A	27.02.2002	WO0211998A2	14.02.2002
		AU1677902A	18.02.2002
		KR20020038935A	24.05.2002
		EP1254030A2	06.11.2002
		ZA200202005A	29.10.2003
		JP2004505806T	26.02.2004
		CN1174873C	10.11.2004
		CN2492390Y	22.05.2002
		EP1254030A	06.11.2002
		PL353959A	15.12.2003
CN1146182A	26.03.1997	WO9529816A1	09.11.1995
		DE4415371A1	09.11.1995
		EP0758298A1	19.02.1997
CN1678463A	05.10.2005	WO2004018225A1	04.03.2004
		AT12652002A	15.05.2004
		AU2003243808A1	11.03.2004
		AT412266B	15.11.2004
		EP1532004A1	25.05.2005
		BRPI0313691A	21.06.2005
		US2005141952A1	30.06.2005
		JP2005536374T	02.12.2005
		MXPA05002058A	01.09.2005
WO9605070A1	22.02.1996	DE4428112A1	15.02.1996

Form PCT/ISA /210 (patent family annex) (April 2007)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/CN2007/000717

In case **the space in any of the preceding boxes is not sufficient.**

Continuation of : A. CLASSIFICATION OF SUBJECT MATTER

B42F 13/22 (2006.01) i
B42F 3/04 (2006.01) i

Form PCT/ISA /210 (extra sheet) (April 2007)