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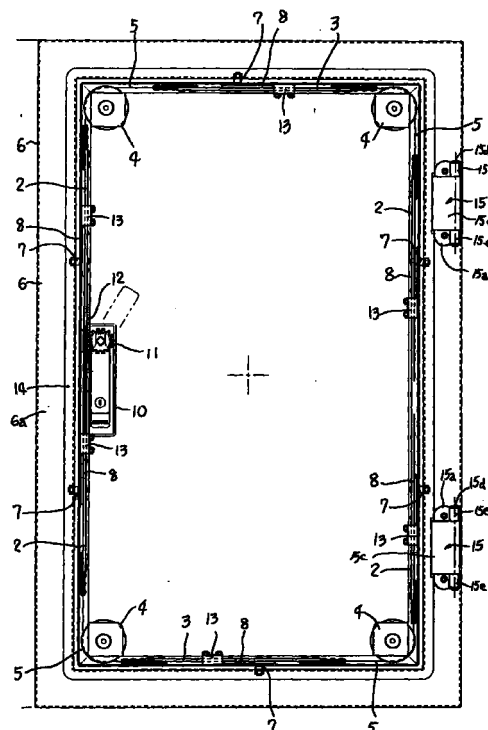
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(54) **Door clamping lock system**

(57) This system is capable of uniformly clamping a packing member (16) over its entire length without deforming vertical rods (2) and lateral rods (3) in a door locking operation in which hook members (8) are not subjected to any shearing force, i.e., are not deformed. Of the hook members (8) fixedly mounted on these rods (2,3): the left and right ones (2) extend along left and right sides of a door (1), respectively; and, the upper and lower rods (3) extend along upper and lower sides of the door (1), respectively. Each of catch rollers (7) fixedly mounted on a box body (6) is drawn aside by a hook portion (8a) of the hook member (8) in the locking operation. Guide rollers (9) fixedly mounted on the door (1) are slidably engaged with slot portions (8b) of the hook members (8). After the door (1) is closed, a lock handle member (10) is operated to move the hook members (8), which causes the packing member (11) to be clamped.

**Fig. 5**



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## Description

**[0001]** The present invention relates to a door clamping lock system used in boxes and like containers for receiving therein electric instruments, communication instruments and like instruments.

**[0002]** It has been known to dispose a packing member between an opening portion of a box body and a door for the purpose of sealing up, i.e. strictly cutting off the interior space, of the box body from the outside space.

**[0003]** In use, however, it is very difficult to uniformly compress the packing member over its entire length. Although it has been proposed to provide a plurality of clamping members along the length of the packing member, this requires simultaneous clamping operations of these clamping members.

**[0004]** When some of these clamping members are ahead of the remaining ones in clamping operations, unclamped portions of the packing member corresponding to such remaining clamping members receive expelled parts of already clamped portions of the packing member, so that the unclamped portions of the packing member bulge out of their positions to prevent the door from being neatly closed, which prevents a latch of the clamping member from engaging with a corresponding socket member of the box

**[0005]** In view of the above, another proposal has been made, in which: a turning-point transmission unit is disposed in each of the corner portions of the door; through these turning-point transmission units, a plurality of vertical and lateral rods are connected with each other to form a chain-like assembly to cover the entire peripheral portion of the door; and a plurality of hook members are fixedly mounted on several portions of the vertical and the lateral rods; whereby, when the door is closed, a plurality of catch roller units fixedly mounted on the box body are simultaneously drawn aside by these hook members to compress the packing member between the door and the box body.

**[0006]** In this proposal, however, a resilient force; exerted by the thus compressed packing member directly acts on the hook members and therefore on both the vertical and the lateral rods on which the hook members are fixed, so that both the hook members and these rods cause considerable deforming resulting in permanent deformations of both the hook members and these rods after several times of use of the door. Such deformations often make it impossible to lock the door.

**[0007]** Further, in the case that the vertical and the lateral rods forming such chain-like assembly are moved forward to reach their locking positions so that the hook members are placed in their locking positions by mistake in a condition in which the door is opened, when the door is closed, the hook members are hit by the catch roller units, which often damages the hook members and the catch roller units themselves.

**[0008]** Consequently, it is an object of the present

invention to provide a door clamping lock system, which is free from any risk that, in a locking operation of a door, a plurality of vertical and lateral rods on which a plurality of hook members are fixedly mounted cause deforming, and also free from any risk that the hook members are subjected to shearing forces, or cause deforming, whereby a packing member is substantially uniformly compressed between the door and a box body.

**[0009]** It is another object of the present invention to provide a door clamping lock system which is capable of holding both the vertical and the lateral rods in their clamping-lock release positions without fail so as to prevent both the catch roller units and the hook members from being damaged.

**[0010]** According to a first aspect of the present invention, the above objects of the present invention are accomplished by providing:

**[0011]** A door clamping lock system comprising:

- a box body on which a catch roller unit is fixedly mounted;
- a door on which a guide roller unit is fixedly mounted;
- a packing member disposed between the box body and the door;
- a right and a left vertical rod disposed in the right and the left side of the door, respectively;
- an upper and a lower lateral rod disposed in the upper and the lower side of the door, respectively;
- a pinion gear interlocked with a lock handle member, the pinion gear engaging with a rack portion provided in at least one of the vertical rods or one of the lateral rods;
- a turning-point transmission unit, which is fixedly mounted on each of corner portions of the door and provided with a connecting bar through which the vertical rods and the lateral rods are connected with each other to form a chain-like assembly; and
- a hook member fixedly mounted on each of the vertical rods and each of the lateral rods, the hook member being provided with a hook portion which has a cam surface capable of drawing aside the catch roller unit when the door is locked, the hook member being further provided with a slot portion which receives the guide roller unit therein;
- wherein, when the pinion gear is rotated in operation to move both the vertical rods and the lateral rods, the catch roller unit is caught and drawn aside by the hook portion of the hook member so that the packing member is compressed between the door and the body box.

**[0012]** According to a second aspect of the present invention, the above objects of the present invention are accomplished by providing:

**[0013]** The door clamping Lock system as set forth in the first aspect of the present invention, further com-

prising:

a stop pin provided in at least one of the vertical rods or one of the lateral rods;  
 a check lever member pivotally mounted on the door by means of a pivot, the check lever member being rotatably biased by a spring so as to have its front end portion abut against the periphery of the stop pin; and  
 a release pin for releasing the check lever member from the stop pin by pushing a side surface of the check lever member at the end of a closing operation of the door, the release pin being fixedly mounted on the box body.

**[0014]** By way of example only, a specific embodiment of the present invention will now be described, with reference to the accompanying drawings, in which:-

Fig. 1 is front view of a door clamping lock system of an embodiment of the present invention.

Fig. 2 is a cross-sectional view of the door clamping lock system of the present invention in a condition in which a door is locked, taken along the line A-A of Fig. 1 ;

Fig. 3 is a cross-sectional view of the door clamping lock system of the present invention in a condition in which a door is just closed but still not clamped nor locked, taken along the line A-A of Fig. 1;

Fig. 4 is a cross-sectional view of the door clamping lock system of the present invention in a condition in which the door is opened, taken along the line A-A of Fig. 1;

Fig. 5 is a cross-sectional view of the door clamping lock system of the present, taken along the line B-B of Fig. 2, illustrating a front view of the box body in a condition in which the door is removed;

Fig. 6 is a cross-sectional view of the door clamping lock system of the present invention in a condition in which the door is clamped and locked, taken along the line C-C of Fig. 1;

Fig. 7 is a cross-sectional view of the door clamping lock system of the present invention in a condition in which the door is just closed but still not clamped nor locked, taken along the line C-C of Fig. 1;

Fig. 8 is a cross-sectional view of the door clamping lock system of the present invention in a condition in which the door is clamped and locked, taken along the line D-D of Fig. 1;

Fig. 9 is a cross-sectional view of the door clamping lock system of the present invention in a condition in which the door is just closed but still not clamped nor locked, taken along the line D-D of Fig. 1;

Fig. 10 is a perspective view of an essential part of the door clamping lock system of the present invention shown in Fig. 1, illustrating the vertical rod, lateral rod, turning-point transmission unit, and the hook member;

Fig. 11 is a perspective view of another essential part of the door clamping lock system of the present invention shown in Fig. 1, illustrating the pinion gear and the rack portion both used in the system;

Fig. 12 is a perspective view of further another essential part of the door clamping lock system of the present invention shown in Fig. 1, illustrating the hinge units used in the system;

Fig. 13 is a perspective view of still further another essential part of the door clamping lock system of the present invention shown in Fig. 1, illustrating the check lever, stop pin and the release pin portions in a condition in which a forward movement of the vertical and the lateral rods toward a door clamping and locking position is restricted; and

Fig. 14 is a view similar to Fig. 13 but illustrating the check lever, stop pin and the release pin portions in a condition in which the forward movement of the vertical and the lateral rods toward the door clamping and locking position is permitted.

**[0015]** Now, the present invention will be described in detail using its preferred embodiments with reference to the accompanying drawings.

**[0016]** According to a first aspect of the present invention, in a door clamping lock system of an embodiment of the present invention: a right and a left vertical rod 2 are disposed in the right and the left side of a door 1, respectively; an upper and a lower lateral rod 3 are disposed in the upper and the lower side of the door 1, respectively; a turning-point transmission unit 4 is fixedly mounted on each of the corner portions of the door 1 and provided with a connecting bar 5 through which the vertical rods 2 and the lateral rods 3 are connected with each other to form a chain-like assembly; and a hook member 8 is fixedly mounted on each of the vertical rods 2 and each of the lateral rods 3.

**[0017]** The hook member 8 is provided with a hook portion 8a. This portion 8a has a cam surface 8c capable of drawing aside a catch roller unit 7 when the door 1 is locked, wherein the catch roller unit 7 is fixedly mounted on a box body 6.

**[0018]** Further, the hook member 8 is provided with a slot portion 8b which receives therein a guide roller unit 9 fixedly mounted on the door 1. Further, a pinion gear 11 is mechanically interlocked with a lock handle member 10, and engages with a rack portion 12 which is provided in at least one of the vertical rods 2 or one of the lateral rods 3.

**[0019]** An operating force is transmitted from the pinion gear 11 of the lock handle member 10 to the rack portion 12 of each of the rods 2, 3. A packing member 16 is disposed between the box body 6 and the door 1.

**[0020]** In a door clamping and locking operation, when the pinion gear 11 is rotated by means of a locking shaft of the lock handle member 10, since the pinion gear 11 is meshed with the rack portion 12 of each of the rods 2, 3 forming the chain-like assembly, these ver-

tical rods 2 and the lateral rods 3 are moved forward to their clamping and locking positions.

**[0021]** At this time, as these rods 2, 3 move forward, the hook members 8 of these rods 2, 3 have their slot portions 8b slidably guided by the guide roller units 9, and move toward the catch roller units 7. At the end of this movement, the catch roller units 7 are drawn aside by the cam surfaces 8c of the hook members 8, so that the catch roller units 7 are deeply engaged with the hook portions 8a of the hook members 8.

**[0022]** As described above, in a process for catching and drawing aside the catch roller units 7 by means of the hook members 8, when the door 1 is pulled so as to move to its locking position parallel to itself relative to the box body 6, the packing member 16 is uniformly compressed over its entire length between the door 1 and the box body 6.

**[0023]** According to a second aspect of the present invention, the door clamping lock system as set forth in the first aspect of the present invention further comprises:

a stop pin 17 provided in at least one of the vertical rods 2 or one of the lateral rods 3;

a check lever member 19 pivotally mounted on the door 1 by means of a pivot 18, the check lever member 19 being rotatably biased by a spring 20 so as to have its front end portion 19a abut against the periphery of the stop pin 17; and

a release pin 21 for releasing the check lever member 19 from the stop pin 17 by pushing a side surface of the check lever member 19 at the end of a closing operation of the door 1, the release pin 21 being fixedly mounted on the box body 6.

**[0024]** In an unlocking operation, the pinion gear 11 is reversed in rotation by means of the lock handle unit 10, so that the vertical rods 2 and the lateral rods 3 are moved rearward to their unclamping and unlocking positions.

**[0025]** At this time, the catch roller units 7 are disengaged from the hook portions 8a of the hook members 3 of these rods 2, 3. When the hook member 8 is separated from the catch roller unit 7 by a predetermined distance, the check lever member 19 is rotatably driven by the spring 20 and has its front end portion 19a abut against the periphery of the stop pin 17, which prevents both the vertical rods 2 and the lateral rods 3 from moving in the direction of the arrow (shown in Fig. 14) toward their locking positions, so that the hook members 8 are held in their unlocking (i.e., lock-release) positions.

**[0026]** In a condition in which the door 1 is opened, the vertical rods 2 and the lateral rods 3 both forming the chain-like assembly are prevented from moving by means of both the stop pin 17 and the check lever member 19.

**[0027]** Under such circumstances, when the door 1

is closed, at the end of this door closing operation, the release pin 21 pushes the side surface of the check lever member 19 to rotate the same member 19 about the pivot 18 against a resilient force exerted by the spring 20. Due to this rotational movement of the check lever member 19, the check lever member 19 is disengaged or released from the stop pin 17, which permits the vertical rods 2 and the lateral rods 3 to move forward to their locking positions, and thereby permitting the lock handle unit 10 to be used.

**[0028]** In the embodiment of the present invention shown in the drawings, the left and the right vertical rods 2 are disposed inside the door 1 together with the upper and the lower lateral rods 3. On the other hand, the lock handle unit 10 is of a pull-out swinging operation type, and embedded and fixedly mounted in a front surface of the door 1.

**[0029]** The pinion gear 11 is mechanically interlocked with the locking shaft of the lock handle unit 10, and meshed with the rack portion 12 of the vertical rod 2, as shown in Fig. 11. The rack portion 12 is constructed of a series of lateral openings or slots provided at predetermined intervals corresponding to the pitch of the pinion gear 11. The slot portion 8b of the hook member 8 assumes an elongated shape extending the length of each of the vertical rods 2 and the lateral rods 3.

**[0030]** The vertical rods 2, lateral rods 3, turning-point transmission units 4 and the connecting bars 5 are connected in series with each other under tension without permitting any slackness. The turning-point transmission units 4 is constructed of a pulley.

**[0031]** On the other hand, the connecting bar 5 is constructed of an inextensible belt such as strips of metal and the like. As shown in Fig. 5, the lateral rod 3 is slidably received by a guide member 13, while the vertical rod 2 is slidably received by a pair of the guide members 13. The guide member 13 is fixedly mounted on an inner surface of the door 1 to stabilize in motion the lateral rods 3 in the vertical direction and the vertical rods 2 in the lateral direction so as to prevent these rods 2, 3 from rattling excessively.

**[0032]** A flange portion 14 extends around the opening portion of a front wall portion 6a of the box body 6 so as to surround the opening portion. As is clear from Fig. 2, the flange portion 14 is formed so as to protrude forward from a front wall portion 6a of the box body 6.

**[0033]** The door 1 assumes a flat box-like shape constructed of: a front wall portion 1a which is the same in both shape and size as a front surface outer contoured area of the box body 6; and, a peripheral bent wall portion 1b which is bent four times along four sides of the front wall portion 1a so as to be integrated with the front wall portion 1a. The door 1 is supported by a pair of hinge members 15 which are vertically spaced apart from each other along a right edge portion of the box body 6 and fixedly mounted thereon.

**[0034]** The hinge member 15 is constructed of: a

base member 15a fixedly mounted on the box body 6; a support axle 15b vertically slidably mounted in the base member 15a; an arm member 15c fixedly mounted on a front end portion of the support axle 15b; a pivot 15d slidably received in a base end sleeve portion of the arm member 15c; a bearing base 15e for supporting the pivot 15d; and, a compression coil spring 15f mounted on the support axle 15b in an insertion manner between the base member 15a and the front end portion of the arm member 15c.

**[0035]** Since the door clamping lock system of the present invention has the above construction, after the door 1 is rotated on the pivot 15d, it is possible for the door 1 to move to its locking position parallel to itself relative to the box body 6 when the catch roller units 7 are drawn aside by the hook members 8.

**[0036]** Adhesively applied and fixed to the entire periphery of a front surface of the end portion of the flange portion 14 is the packing member 16 which is made of rubber. It is also possible to provide the packing member 16 in the side of the door 1.

**[0037]** Each of the box body 6 and the door 1 is constructed of steel plates.

**[0038]** The spring 20 for biasing the check lever member 19 is constructed of a torsion coil spring. The spring 20 has its coiled portion 20a mounted around pin 22. Further, the spring 20 has one 20b of its opposite straight end portions 20b, 20c abut against a spring support portion 24 of the door 1, and the other 20c abut against a spring support pin 23 which is fixedly mounted on the base end portion of the check lever member 19.

**[0039]** The effect of the present invention is as follows. Namely, as described above, in the door clamping lock system according to the first aspect of the present invention, in a condition in which the vertical rods 2 and the lateral rods 3 forming the chain-like assembly are provided with a plurality of the hook members 8 each of which has its slot portion 8b slidably receive therein the guide roller unit 9 fixedly mounted on the door 1, a plurality of the catch roller units 7 provided in the box body 6 are drawn aside by the hook portions 8a of the hook members 8 while being guided by means of the cam surfaces 8c of the hook members 8 in the door locking operation.

**[0040]** Consequently, it is possible to uniformly compress the packing member 16 over its entire length between the door 1 and the box body 6, which ensures that the interior space of the box body 6 is excellent in gas-tight and water-tight properties when closed by the door 1.

**[0041]** Further, the hook member 8 is center-balanced by both of: its hook portions 8a engaging with the catch roller unit 7; and its slot portion 8b engaging with the guide roller unit 9, so that shearing forces to which the vertical rods 2 and the lateral rods 3 are subjected are reduced.

**[0042]** Consequently, it is possible to sufficiently lock the door 1 without causing any deforming of the

vertical rods 2 and the lateral rods 3 and also without any risk that the hook members 8 are subjected to shearing forces and cause deforming.

**[0043]** Further, in the door clamping lock system of the present invention: the stop pin 17 is provided in the vertical rod 2 or in the lateral rod 3; and, the front end portion 19a of the check lever member 19 pivotally mounted on the door 1 abuts against the stop pin 17 to prevent both the vertical rods 2 and the lateral rods 3 from moving forward to their locking positions in a condition in which the door 1 is opened, which makes it possible to prevent the catch roller units 7 from hitting and damaging the hook members 8, without fail.

**[0044]** Further, at the end of the door locking operation, since the release pin 21 pushes the side surface of the check lever member 19 to rotate it 19, the check lever member 19 is disengaged from the stop pin 17, which facilitates the operation of the door clamping lock system of the present invention.

## Claims

### 1. A door clamping lock system comprising:

- a box body (6) on which a catch roller unit (7) is fixedly mounted;
  - a door (1) on which a guide roller unit (9) is fixedly mounted;
  - a packing member (16) disposed between said box body (6) and said door (1);
  - a right and a left vertical rod (2) disposed in the right and the left side of said door (1), respectively;
  - an upper and a lower lateral rod (3) disposed in the upper and the lower side of said door (1), respectively;
  - a pinion gear (11) interlocked with a lock handle member (10), said pinion gear (11) engaging with a rack portion (12) provided in at least one of said vertical rods (2) or one of said lateral rods (3);
  - a turning-point transmission unit (4), which is fixedly mounted on each of corner portions of said door (1) and provided with a connecting bar (5) through which said vertical rods (2) and said lateral rods (3) are connected with each other to form a chain-like assembly; and
  - a hook member (8) fixedly mounted on each of said vertical rods (2) and each of said lateral rods (3), said hook member (8) being provided with a hook portion (8a) which has a cam surface (8c) capable of drawing aside said catch roller unit (7) when said door (1) is locked, said hook member (8) being further provided with a slot portion (8b) which receives said guide roller unit (9) therein;
- wherein, when said pinion gear (11) is rotated in operation to move both said vertical rods (2)

and said lateral rods (3), said catch roller unit (7) is caught and drawn aside by said hook portion (8a) of said hook member (8) so that said packing member (16) is compressed between said door (1) and said body box (6).

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2. A door clamping lock system as claimed in claim 1, further comprising:

a stop pin (17) provided on at least one of said vertical rods (2) or one of said lateral rods (3);  
a check lever member (19) pivotally mounted on said door (1) by means of a pivot (18), said check lever member (19) being rotatably biased by a spring (20) so as to have its front end portion (19a) abut against the periphery of said stop pin (17); and  
a release pin (21) for releasing said check lever member (19) from said stop pin (17) by pushing a side surface of said check lever member (19) at the end of a closing operation of said door (1), said release pin (21) being fixedly mounted on said box body (6).

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Fig. 1

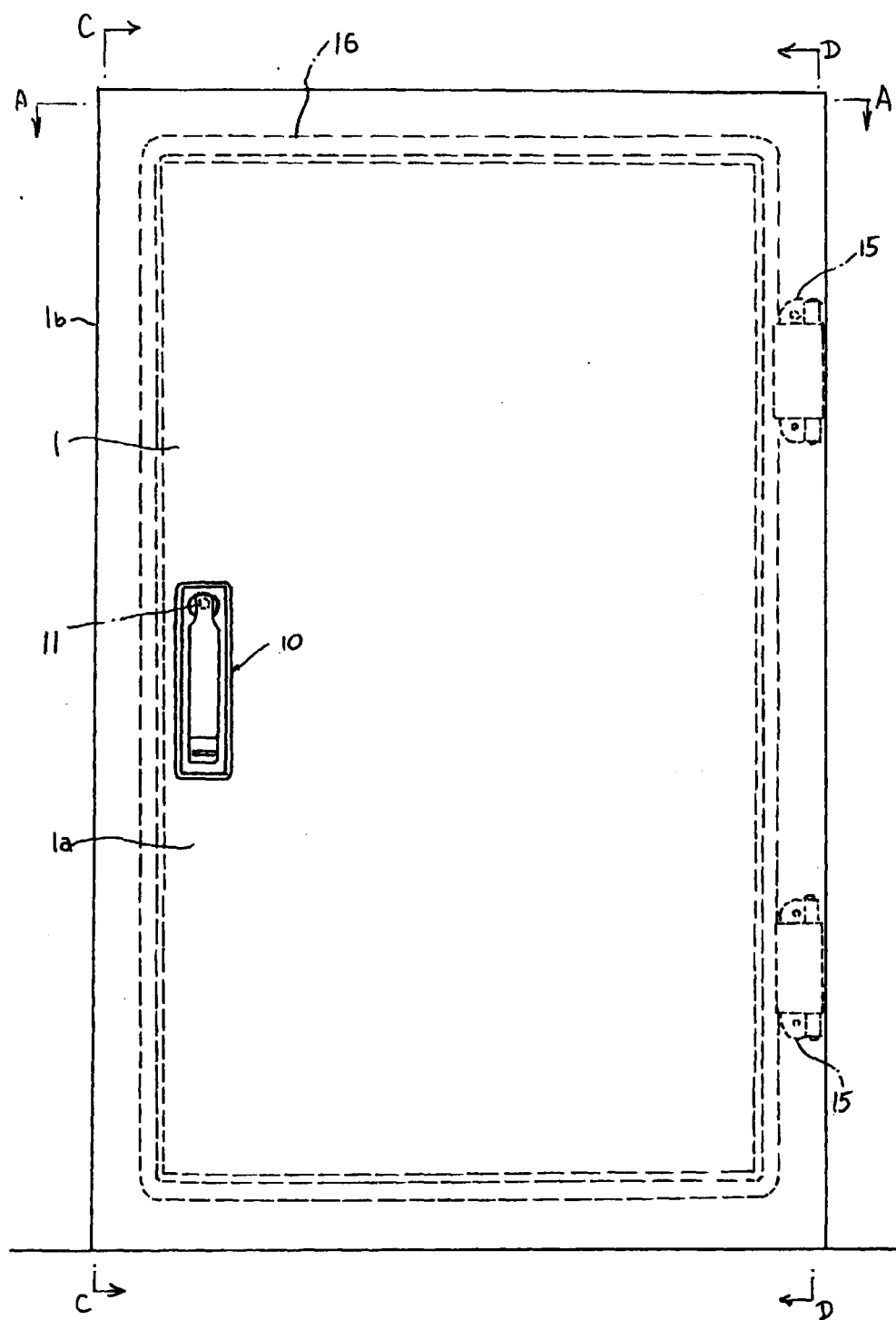


Fig. 2

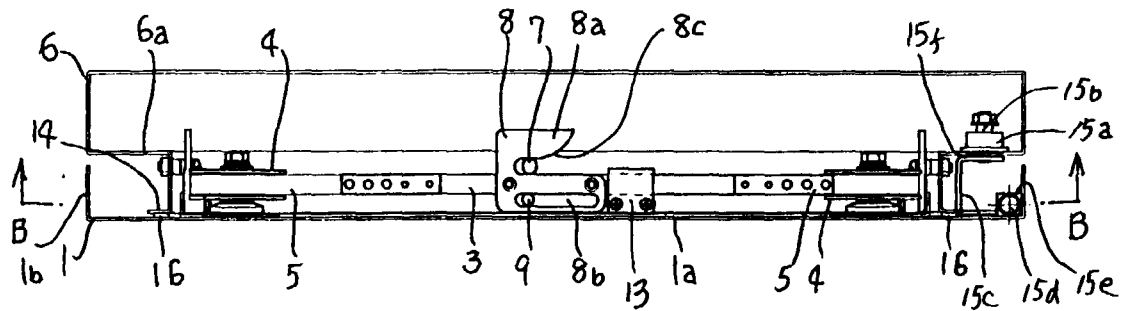


Fig. 3

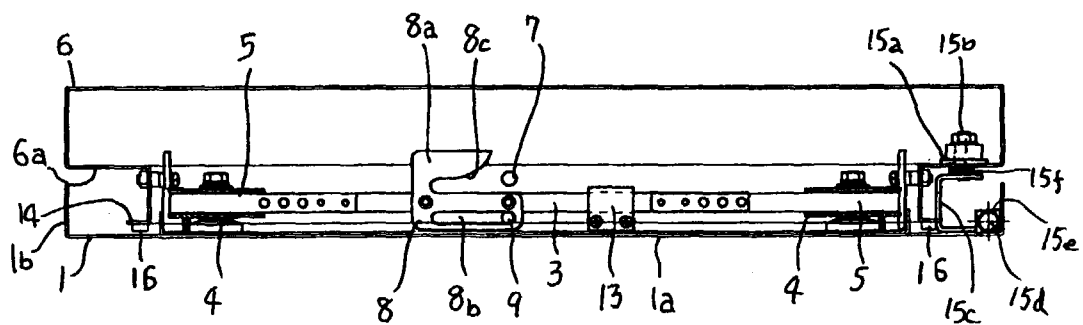


Fig. 4

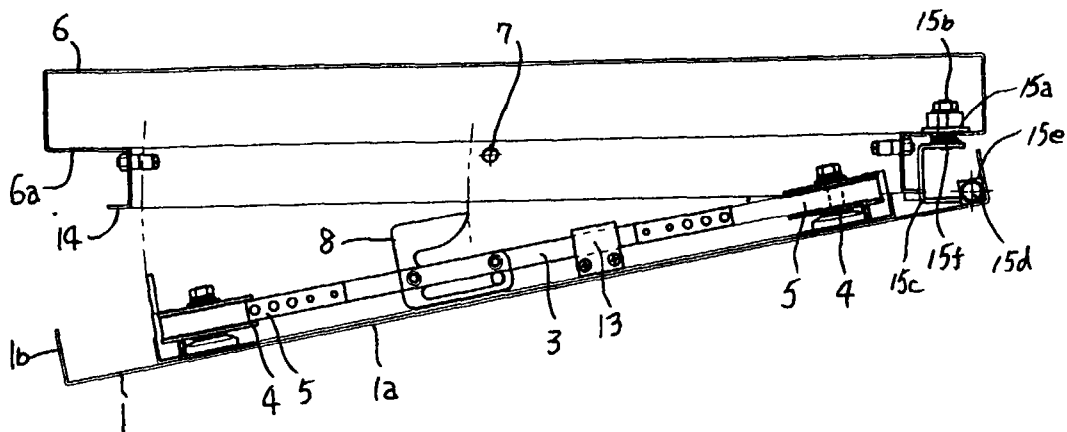




Fig. 5

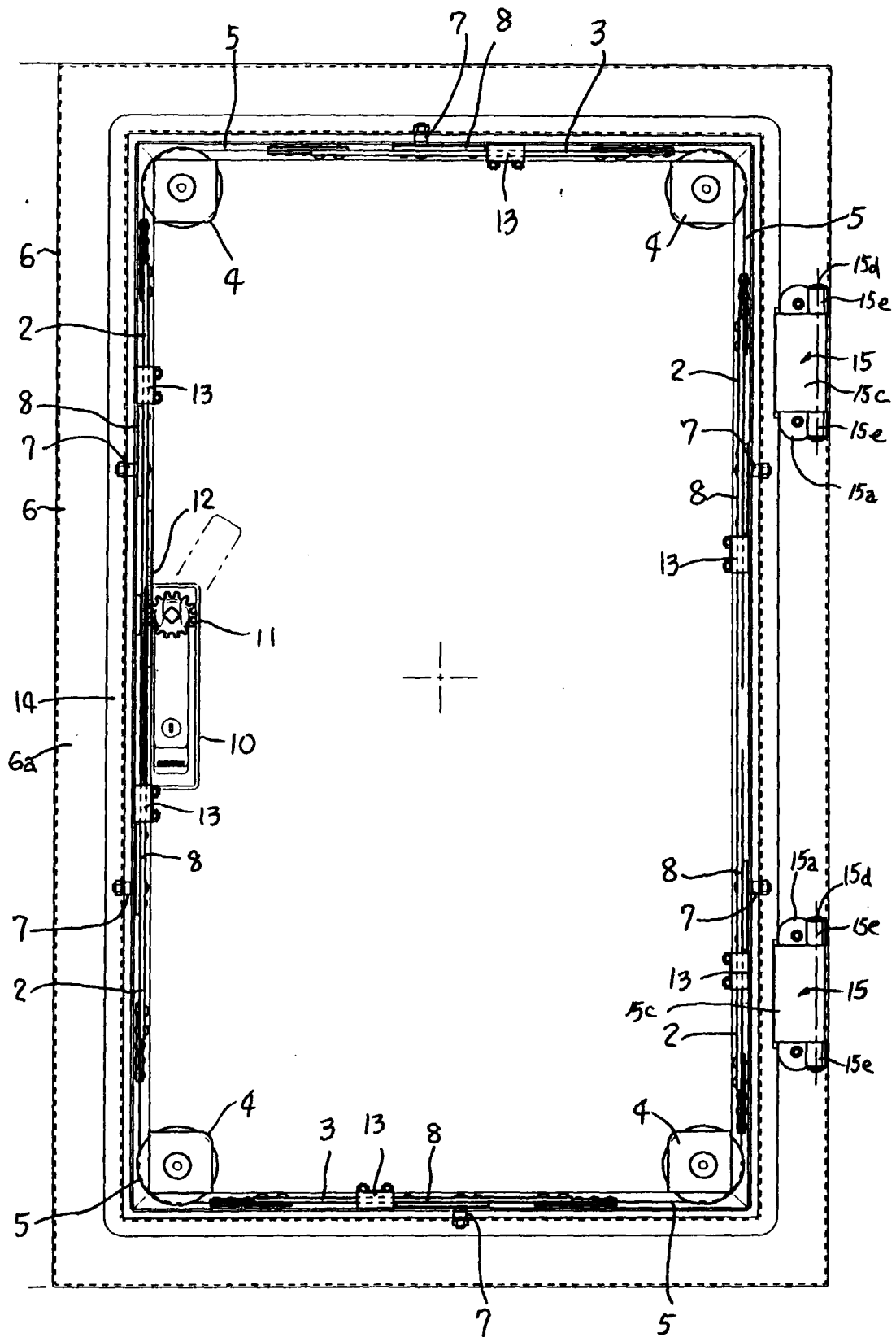


Fig. 6

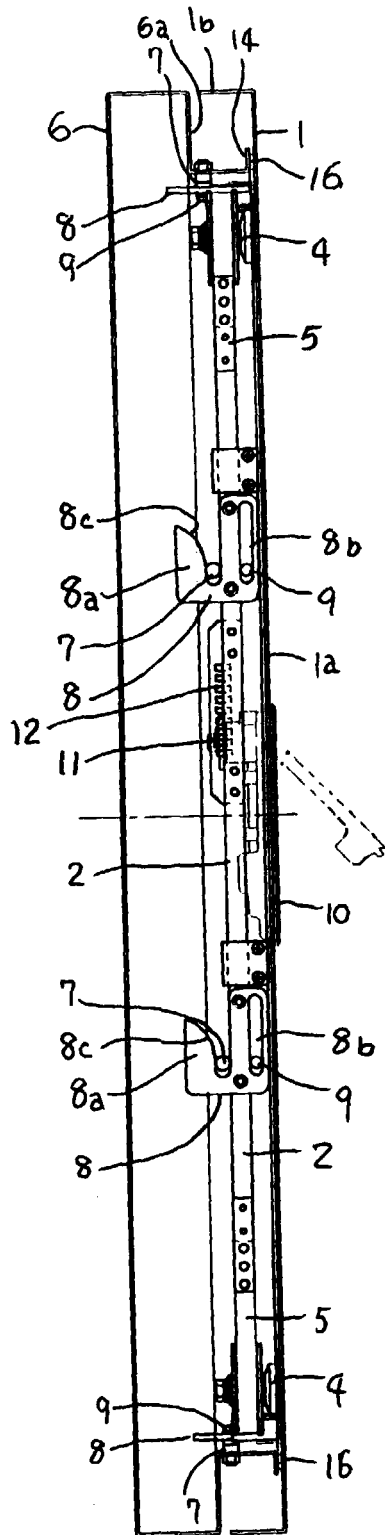


Fig. 7

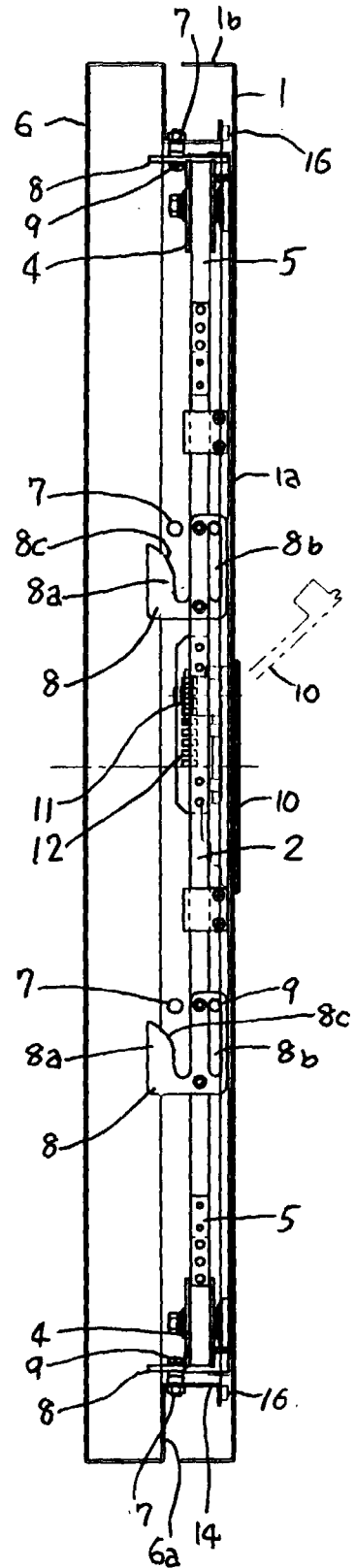


Fig. 8

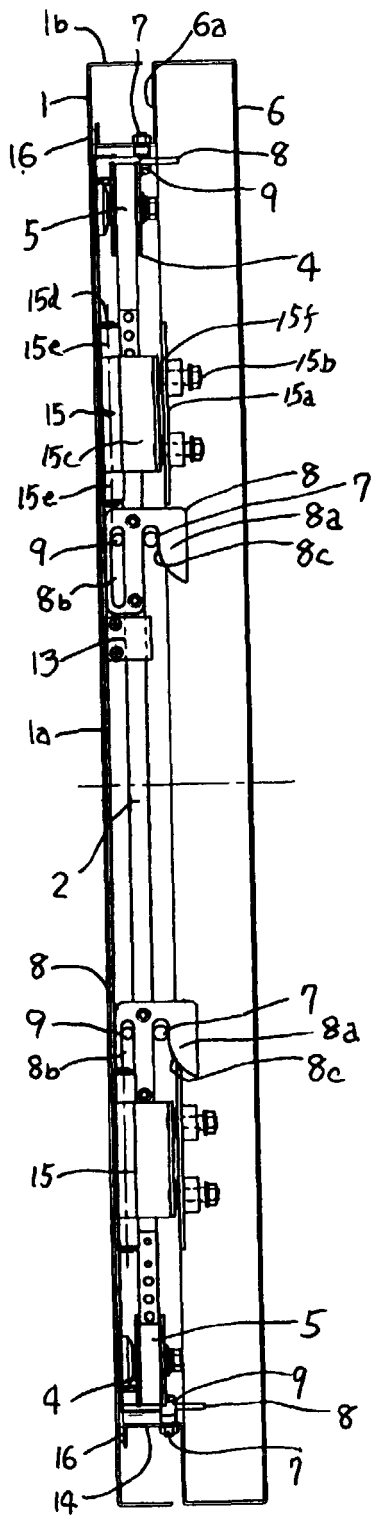


Fig. 9

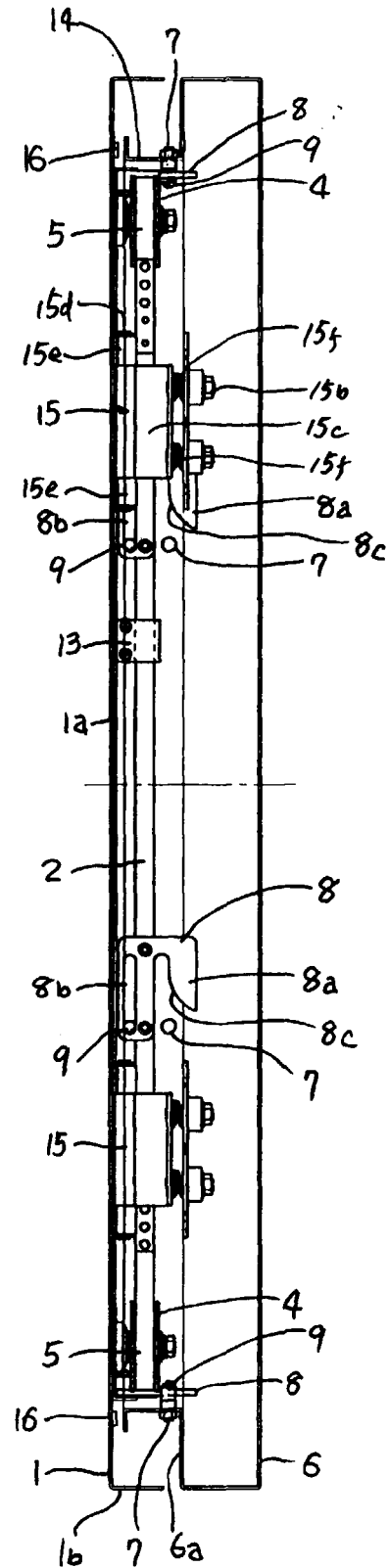
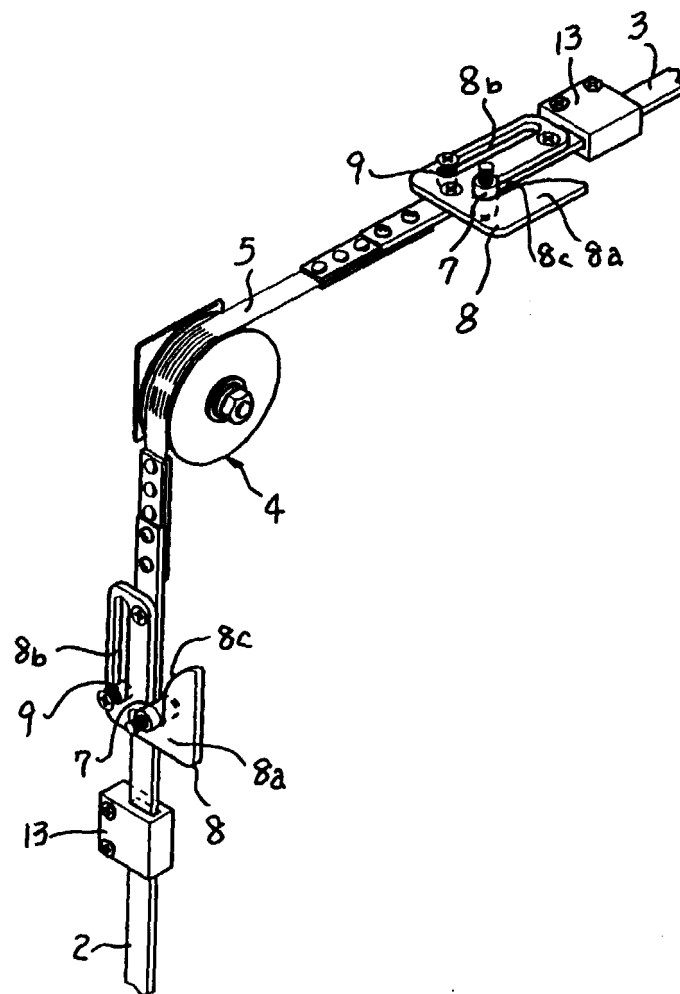
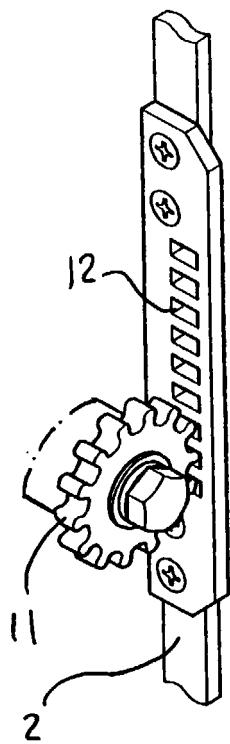


Fig. 10



**Fig. 11**



**Fig. 12**

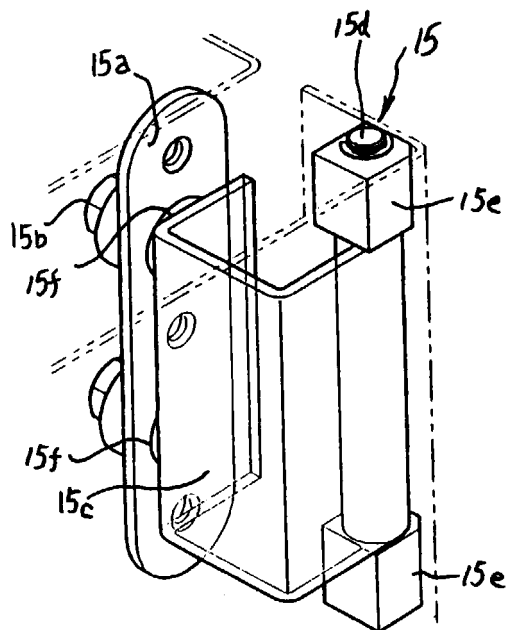


Fig. 13

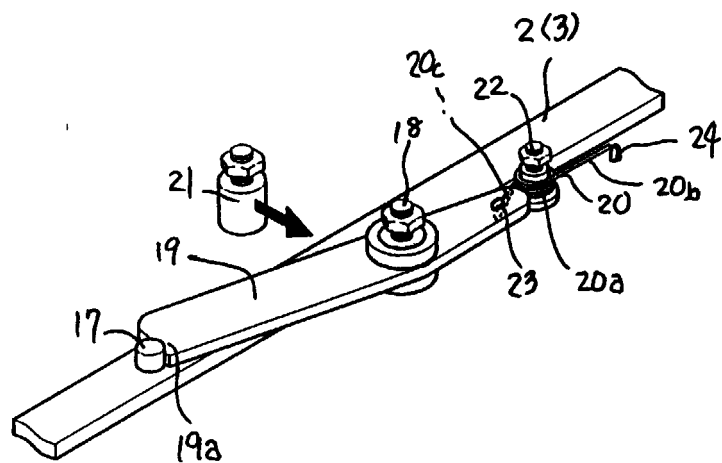
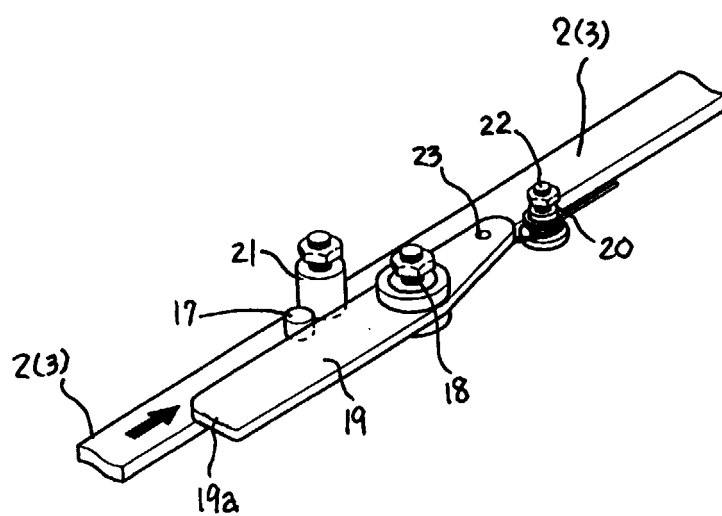


Fig. 14





European Patent  
Office

# EUROPEAN SEARCH REPORT

Application Number  
EP 00 30 1371

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 3 175 873 A (ARTHUR G. BLOMQUIST ET AL.) 30 March 1965 (1965-03-30) * the whole document *	1	E05C9/18 E05B17/00 E05C9/06
X	DE 24 61 887 A (FUHR C FA) 8 July 1976 (1976-07-08) * page 6, line 6 - page 7, line 12; figures 4,5 *	1	
X	CH 325 780 A (GRETSCH-UNITAS GMBH) 15 January 1958 (1958-01-15) * the whole document *	1	
A	DE 195 47 180 A (WERU AG) 19 June 1997 (1997-06-19) * column 3, line 24 - column 4, line 1; figure *	1	
A	DE 12 81 889 B (FERCO SOCIÉTÉ À RESPONSABILITÉ LIMITÉE) 31 October 1968 (1968-10-31) * column 4, line 44 - line 61; figure 1 *	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			E05C E05B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 6 June 2000	Examiner Pieracci, A
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			

EPO FORM 1503 03.82 (P4/C01)

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

EP 00 30 1371

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06-06-2000

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82