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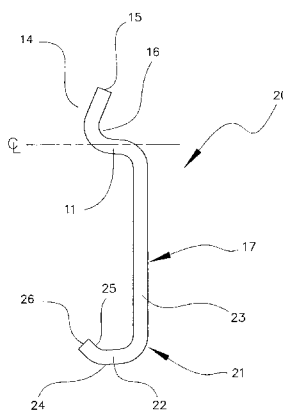
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(54) Title: A LOCKING DEVICE



(57) Abstract: A locking device (10, 20, 30, 40) for a racking system (100) is disclosed that is arranged to resist upward move-
ment of a first component (typically a racking beam 103) relative to a second component (typically an upright 105). The device
comprises a leading portion (14), a trailing portion (17), and a cross member (11) extending generally along a longitudinal axis CL
and interconnecting the leading and the trailing portions (14, 17). The leading portion (14) extends from the cross member (11) in a
direction transverse to the longitudinal axis CL and is configured to be able to be inserted through aligned holes (108, 109) disposed
in respective ones of the components (103, 105) and, once inserted, the device (10, 20, 30, 40) is arranged to be subsequently moved
to an installed position where the cross member (11) extends through the holes (108, 109) and the leading and trailing portions (14,
17) inhibit removal of the device from the holes with the leading portion extending generally upwardly.

WO 2007/134398 A1

- 1 -

A LOCKING DEVICE

Field of the Invention

5 The present invention relates to a racking system and more particularly to a locking device used in the racking system to resist upward movement of one component (typically a racking beam) relative to a second component (typically a racking upright). The locking device has
10 particular application in adjustable pallet racking and the invention is herein described in that context.

Background of the Invention

15 Storage racking systems are widely used in warehousing and other industrial facilities. These systems typically include multiple levels of metal racking beams arranged to support cartons or pallets and which are supported by vertical load bearing members commonly referred to as
20 uprights. These uprights are typically made from a profile steel section and metal bracing is provided which extends between adjacent uprights.

One form of racking system is referred to as adjustable
25 pallet racking where rather than bolting the racking beams to the uprights, the ends of the beams have "tangs" which wedge into slots in the upright, thus providing a rigid connection which can be engaged and disengaged quickly and easily. The gravity load of the stored goods generally
30 keeps the tangs properly seated in position, but it is still necessary to provide some form of locking device against accidental upward forces, which can occur if the pallet under the beam is lifted too high whilst it is being removed. Whilst various forms of safety devices
35 have been provided, these exhibit various limitations and as such there is an ongoing demand for devices that are both easy to install and less prone to fail, particularly

- 2 -

under repeated upward loading as often occurs in harsh warehouse environments.

Summary of the Invention

5 According to a first aspect, the present invention provides a locking device for a racking system to resist upward movement of a first component relative to a second component of the system, the device comprising a leading
10 portion, a trailing portion, and a cross member extending generally along a longitudinal axis and interconnecting the leading and the trailing portions, the leading portion extending from the cross member and being configured to be able to be inserted through aligned holes disposed in
15 respective ones of the components and, once inserted, the device is arranged to subsequently be moved to an installed position where the cross member extends through the holes and the leading and trailing portions inhibit removal of the device from the holes with the leading
20 portion extending generally upwardly.

In use, the leading portion is configured to be able to be inserted through the aligned holes and is designed to be unable to be withdrawn from those holes when in the installed position. Further the locking device is
25 arranged to be inserted with the first component (which is typically the racking beam) being the outermost facing component. With this arrangement, the leading portion is disposed inwardly of the connection adjacent the second component (typically an upright).

30 With the above arrangement, on upward movement of the first component relative to the second component, a wedging action is induced as the second component is driven into the bend between the cross member and the

- 3 -

leading portion. Because the leading portion extends upwardly, the device can only fail in shear as distinct from disengaging from one or other of the components.

In a particular arrangement, the leading portion extends
5 back over the cross-member to form a re-entrant bend between the cross-member and the leading position.

In a particular embodiment, the trailing portion is configured to maintain the locking device in the installed position. In one form, the trailing portion is of a
10 sufficient mass to bias the locking pin into the installed position. In a particular application of this arrangement, the trailing portion projects from the cross-member in a direction transverse to the longitudinal axis of the cross-member and is angularly displaced from the
15 leading portion about the longitudinal axis by approximately 180°. In a particular form, the trailing portion projects generally perpendicular to the longitudinal axis. With this arrangement the device tends to self-align under gravity into the installed position
20 where the leading portion extends generally upwardly.

In one form, the first and second components include multiple sets of aligned holes when interconnected. In such an arrangement, in one embodiment of the locking device, the trailing portion is operative to locate in a
25 further set of aligned holes so as to maintain the device in the installed position. In a particular form, the trailing portion incorporates a locking formation at its distal margin to secure the trailing portion in the further set of aligned holes.

30 This arrangement has the advantage that it provides a positive retention mechanism to maintain the locking

- 4 -

device in the installed position. Furthermore, the strength of the locking device can be significantly increased as it provides a second shear element into the locking device, the first being the cross-member, the
5 second being the component of the trailing portion extends through the further set of aligned holes.

In a particular form, the locking formation incorporates a downwardly facing arcuate engagement surface that is arranged to move across an edge region of at least one of
10 the components on movement of the device to the installed position, and wherein when in the installed position, the engagement surface is arranged to bear against that edge region to inhibit release of the trailing portion from the further set of aligned holes.

15 Furthermore, in a particular embodiment, the trailing portion includes an upwardly directed end that is forced into engagement with the component edge to induce a wedging action between the first and second components as it is inserted into the further set of aligned holes.
20 This wedging action operatively biases those components into proper alignment.

In yet a further aspect, the invention relates to a locking device for an adjustable racking system to resist upward movement of a first component relative to a second
25 component of a racking system, the components each including a plurality of holes and are arranged to be interconnected in an arrangement where first and second sets of aligned holes are provided, the device comprising a first locking formation to extend through the first set
30 of aligned holes, and a second locking formation to extend through the second set of aligned holes.

- 5 -

The locking device in accordance with this further aspect may be configured to include the locking formation as described in the earlier embodiment on one or both of the first and second locking formations.

- 5 A locking device, according to any form described above, may be formed as an integral item. Whilst it may be made from any suitable material such as high-strength or reinforced plastic, in a particular form the device is formed from a single length of metal wire. Such a locking
10 device is inexpensive and easy to manufacture while still having the requisite strength.

- In yet a further aspect, the invention provides a connection between first and second components of a racking system; the first component including downwardly
15 facing tangs that are seated in slots formed in the second components to form a rigid connection therebetween; at least one set of aligned holes that extend through the components are formed when the tangs are properly seated in the slots and wherein the connection further comprises
20 a locking device to resist upward movement of the first component relative to the second component, the device comprising a cross-member extending through the holes; a leading portion extending from the cross member in a direction transverse to a longitudinal axis of the cross
25 member and being disposed adjacent the second component; and a trailing portion extending from the cross member adjacent the first component, the leading and trailing portions inhibiting removal of the device from the holes, and the leading portion extends generally upwardly.
- 30 In yet a further aspect, the invention provides a connection between first and second components of a

- 6 -

racking system; the first component including downwardly facing tangs that are seated in slots formed in the second components to form a rigid connection therebetween; at least two sets of aligned holes that extend through the components when the tangs are properly seated in the slots and wherein the connection further comprises a locking device to resist upward movement of the first component relative to the second component, and comprising a first locking formation extending through a first set of the aligned holes, and a second locking formation extending through a second set of the aligned holes.

In yet a further aspect, the invention relates to a racking system incorporating a connection in any form described above. In one form, the first component is a racking beam and the second component is an upright.

Brief Description of the Drawings

Embodiments of the present invention are hereinafter described with reference to the accompanying drawings. It is to be appreciated that the particularity of the drawings and the related description is to be understood as not limiting the preceding broad description of the invention.

In the drawings:

Fig. 1 is a schematic view of an adjustable racking system;

Fig. 2 is an assembly view of a connection between a racking beam and upright in the racking system of Fig. 1;

Fig. 3 is a side view of a first embodiment of a locking device for the racking system of Fig. 1;

- 7 -

Fig. 4 is a front elevation of the locking device of Fig. 3;

Fig. 5a-d is an installation sequence for installing the locking device of Fig. 3 into the racking system of Fig.

5 1;

Fig 6 is a side elevation of a second embodiment of the locking device for the racking system of Fig. 1;

Fig. 7 is a front elevation of the locking device of Fig. 6;

10 Fig. 8a-d is an installation assembly of the locking device of Fig. 6;

Fig. 9 is a side elevation of a third embodiment of the locking device for the racking system of Fig. 1;

Fig. 10 is a front elevation of the locking device of Fig.

15 9;

Fig. 11a-d is an installation sequence for the locking device of Fig. 9;

Fig. 12 is a side elevation of a fourth embodiment of the locking device for the racking system of Fig. 1;

20 Fig. 13 is a front elevation of the locking device of Fig. 12; and

Figs. 14a-d is an installation sequence for the locking device of Fig. 12.

Detailed Description of Embodiments

25 Fig. 1 illustrates a storage racking system 100 that includes multiple levels 101, 102 of metal racking beams

- 8 -

103 which support cartons or pallets 104 that are supported by vertical members 105 that are commonly referred to as uprights. These uprights 105 are typically made from a profiled steel section and metal bracing (not
5 shown) extends between adjacent uprights. The metal racking beams 103 include connectors 106 at opposite ends which connect the beams to adjacent uprights 105.

In the illustrated form, the racking system 100 is of a type referred to as adjustable racking. As best
10 illustrated in the assembly view of Fig. 2, the term "adjustable" refers to the fact that rather than bolting the beams 103 to the uprights 105, a connection 110 is provided where the connectors 106 are provided with a series of tangs 107 which wedge into slots 108 in the
15 uprights, thus providing a rigid connection which can be engaged and disengaged quickly and easily. Whilst the gravity load of the pallets 104 generally keeps the tangs 107 properly seated in position, the connection 110 further comprises a locking device 10 (with the
20 illustrated version being the second embodiment described in detail below with reference to Figs. 6, 7 and 8a to 8d) to protect against accidental upward forces, which can occur if a pallet 104 under a beam is lifted too high whilst it is being removed. As will be explained in more
25 detail below, the locking device 10 extends through two holes 109 formed in the connector 106 and through the respective slots 108.

A first embodiment of the locking device 10 is disclosed with reference to Figs. 3 and 4 and the installation
30 sequence shown in Figs. 5a-d.

Turning firstly to Figs. 3 and 4, the locking device is

- 9 -

made as an integral item which in the illustrated form is made from a single length of metal wire. Typically the wire is formed from mild steel having a gauge of 3-6 mm. The device includes an intermediate cross-member 11 which
5 extends generally along a longitudinal axis CL between notional ends 12 and 13. The device 10 further includes a leading portion 14 which projects from the first end 12 in a direction transverse to the longitudinal axis CL to a terminal end 15 of the device. In the illustrated form,
10 the leading portion 15 is inclined to extend back over the cross-member 11 so as to form a re-entrant angle at the bend 16 between the cross-member 11 and the leading portion 14.

The device 10 further includes a trailing portion 17 which
15 extends from the second end 13 of the cross-member to the other terminal end 18 of the device 10. In the first embodiment, this trailing portion 17 is made up of a straight section of wire that extends substantially perpendicular from the longitudinal axis CL of the cross-
20 member. Further as best illustrated in Fig. 4, the trailing portion 17 is angularly spaced about the longitudinal axis CL from the leading portion by 180° so that the locking device is formed substantially in plane. However, it is to be appreciated that the locking device
25 could still function with some variation in this angular displacement.

Figs. 5a-d show the installation sequence of the locking device 10. As best illustrated in Fig. 5a, the device 10 is presented to the connection 110 in an orientation
30 wherein the terminal end 15 can be inserted through the aligned holes (108, 109) so that at least part of the leading portion 14 is disposed in the holes (108, 109).

- 10 -

The device 10 is then rotated as shown in Figs. 5b-d through approximately 100° which causes the leading portion 14 to locate fully within the upright 105, the cross member 11 is positioned within the aligned holes 108, 109 and the trailing portion 17 rests against an the outer face 111 of the connector 106. Because of the size of the trailing portion 17 relative to the leading portion 14, the trailing portion will move under gravity to the installed position as shown in Fig. 5b where the trailing portion extends downwardly whilst the leading portion extends upwardly.

With the above arrangement, on upward movement of the beam 103 relative to the upright 105, a wedging action is induced as the upright 105 is driven into the bend 16 between the cross member 11 and the leading portion 14. Because the leading portion 14 extends upwardly, the device 10 can only fail in shear as distinct from disengaging from one or other of the components 103, 105

A second embodiment 20 of the locking device is disclosed with reference to Figs. 6 and 7 and the installation sequence shown in Figs. 8a-d. As the locking device 20 of the second embodiment includes many of the features of the first embodiment, like features have been given like reference numerals.

The locking device 20 includes a variation in the trailing portion 17. Rather than being a straight section, the trailing portion includes a locking formation 21 that is arranged to interfit in a second set of aligned holes (108¹, 109¹).

The locking formation 21 is formed as an arcuate section 22 that is turned out of a straight mid region 23 of the

- 11 -

trailing portion 17. The arcuate section 22 includes a downwardly facing generally convex bearing surface 24 and an upwardly turned end portion 25 which extends to the terminal end 26 of the device 20.

5 By including the locking formation 21, the device 20 is arranged to be positively retained in the installed position. Further, the locking device 20 is arranged to introduce a biasing force onto the beam 103 to cause it to locate properly in position on the upright 105. This is
10 best illustrated with reference to the installation sequence of Figs. 8a to 8d.

As shown in Figs. 8a and 8b, the leading portion 14 is inserted in a similar manner to the earlier embodiment. As the device 20 is being rotated to the installed
15 position, the upturned end portion 25 is caused to abut a lower edge 112 of the hole 109 in the beam 103. The locking device 20 needs to be forced to move to the installed position as the upturned end 25 rides over the edge 112. This induces a wedging action as the cross
20 member 11 bears against an upper edge 113 of the upright 105 which forces the beam 103 downwardly into tighter engagement with the upright 105. Once in the installed position, as shown in Fig. 8d, the bearing surface 24 is biased into engagement with the lower edge 112, thereby
25 forming a "tight fit" connection for the locking device 20.

A third embodiment 30 of the locking device is disclosed with reference to Figs. 9 and 10 and the installation sequence shown in Figs. 11a-d. As the locking device 30
30 of the third embodiment includes many of the features of the earlier embodiments, like features have been given

- 12 -

like reference numerals.

The locking device 30 functions in a similar manner to the second embodiment of the device 20 and in particular is arranged to engage with two sets of aligned holes. As
5 such the trailing portion 17 includes a locking formation 21. However the locking formation 21 is formed as a downwardly facing shallow hook 31 which in use is designed to locate in behind the aligned holes (108¹, 109¹) (see Fig.11 d). In this embodiment, rather than be in a tight
10 fit arrangement as in the second embodiment, the locking device 30 allows some vertical movement whilst being disposed in the sets of aligned holes.

A fourth embodiment 40 of the locking device is disclosed with reference to Figs. 12 and 13 and the installation
15 sequence shown in Figs. 14a-d. In the locking device 40, the connection is similar to the second and third embodiments as the device locates in the two sets of aligned holes. Further in this embodiment, the locking formation 21 is of the same design as the second
20 embodiment, but the leading portion 41 varies from the earlier embodiments as it is formed as a downwardly directed hook. This arrangement does provide a shear element at the leading portion 41 which is effective in resisting upward movement of the beam 103 relative to the
25 upright 105. However, this configuration does not provide the wedging action which was a feature of the earlier embodiments.

The installation of the locking device 40 as shown in Figs. 14a-d is slightly different from the second and
30 third embodiments in that the device needs to be rotated about the axis CL of the cross member 11 as well as being

- 13 -

pivoted horizontally to engage the lower locking formation
21.

In the claims which follow and in the preceding
description of the invention, except where the context
5 requires otherwise due to express language or necessary
implication, the word "comprise" or variations such as
"comprises" or "comprising" is used in an inclusive sense,
i.e. to specify the presence of the stated features but
not to preclude the presence or addition of further
10 features in various embodiments of the invention.

It is to be appreciated that various alterations and/or
additions may be made to the parts previously described
without departing from the spirit or ambit of the present
15 invention.

- 14 -

CLAIMS:

1. A locking device for a racking system to resist upward movement of a first component relative to a second component of the system, the device comprising a leading portion, a trailing portion, and a cross member extending generally along a longitudinal axis and interconnecting the leading and the trailing portions, the leading portion extending from the cross member in a direction transverse to the longitudinal axis; and being configured to be able to be inserted through aligned holes disposed in respective ones of the components and, once inserted, the device is arranged to be subsequently moved to an installed position where the cross member extends through the holes and the leading and trailing portions inhibit removal of the device from the holes with the leading portion extending generally upwardly.
2. A locking device according to claim 1, wherein the leading portion extends back over the cross-member to form a re-entrant bend with the cross-member.
3. A locking device according to claim 1 or 2, wherein the trailing portion is configured to maintain the locking device in its installed position.
4. A locking device according to claim 3, wherein the trailing portion is weighted to bias the locking pin into the installed position under gravity.
5. A locking device according to claim 4, wherein the trailing portion extends from the cross-member in a direction transverse to the longitudinal axis of the cross-member and is angularly displaced from the leading portion about the longitudinal axis by approximately 180°.

- 15 -

6. A locking device according to claim 5, wherein the trailing portion extends generally perpendicular to the longitudinal axis.

7. A locking device according to claim 3, wherein the first and second components include at least one further set of aligned holes and the trailing portion is operative to locate in that further set of aligned holes so as to maintain the device in the installed position.

8. A locking device according to claim 7, wherein the trailing portion incorporates a locking formation at its distal margin to securely locate the trailing portion in the further set of aligned holes.

9. A locking device according to claim 8, wherein the locking formation incorporates a downwardly facing arcuate engagement surface that is arranged to move across an edge region of at least one of the components on movement of the device to the installed position, and wherein when in the installed position, the engagement surface is arranged to bear against that edge region to inhibit release of the trailing portion from the further set of aligned holes.

10. A locking device according to claim 8 or 9, wherein the trailing portion includes an upwardly directed end region that is arranged to engage with the components on movement of the device to the installed position to induce a wedging action between the first and second components so as to bias those components into proper alignment.

11. A locking device for an adjustable racking system to resist upward movement of a first component relative to a second component of a racking system, the components each including a plurality of holes and are arranged to be

- 16 -

interconnected in an arrangement where first and second sets of aligned holes are provided, the device comprising a first locking formation to extend through the first set of aligned holes, and a second locking formation to extend
5 through the second set of aligned holes.

12. A locking device according to any preceding claim, when formed as an integral item.

13. A locking device according to claim 13, wherein the device is formed from a single length of metal wire.

10 14. A connection between first and second components of a racking system; the first component including downwardly facing tangs that are seated in slots formed in the second components to form a rigid connection therebetween; at least one set of aligned holes that extend through the
15 components are formed when the tangs are properly seated in the slots and wherein the connection further comprises a locking device to resist upward movement of the first component relative to the second component, the device comprising a cross-member extending through the holes; a
20 leading portion extending from the cross member in a direction transverse to a longitudinal axis of the cross member and being disposed adjacent the second component; and a trailing portion extending from the cross member adjacent the first component, the leading and trailing
25 portions inhibiting removal of the device from the holes, and the leading portion extends generally upwardly.

15. A connection between first and second components of a racking system; the first component including downwardly facing tangs that are seated in slots formed in the second
30 components to form a rigid connection therebetween; at least two sets of aligned holes that extend through the

- 17 -

components when the tangs are properly seated in the slots and wherein the connection further comprises a locking device to resist upward movement of the first component relative to the second component, and comprising a first
5 locking formation extending through a first set of the aligned holes, and a second locking formation extending through a second set of the aligned holes.

16. A racking system incorporating first and second components and a connection according to either claim 14
10 or 15 joining those components together.

17. A racking system according to claim 16, wherein the first component is a racking beam and the second component is an upright.

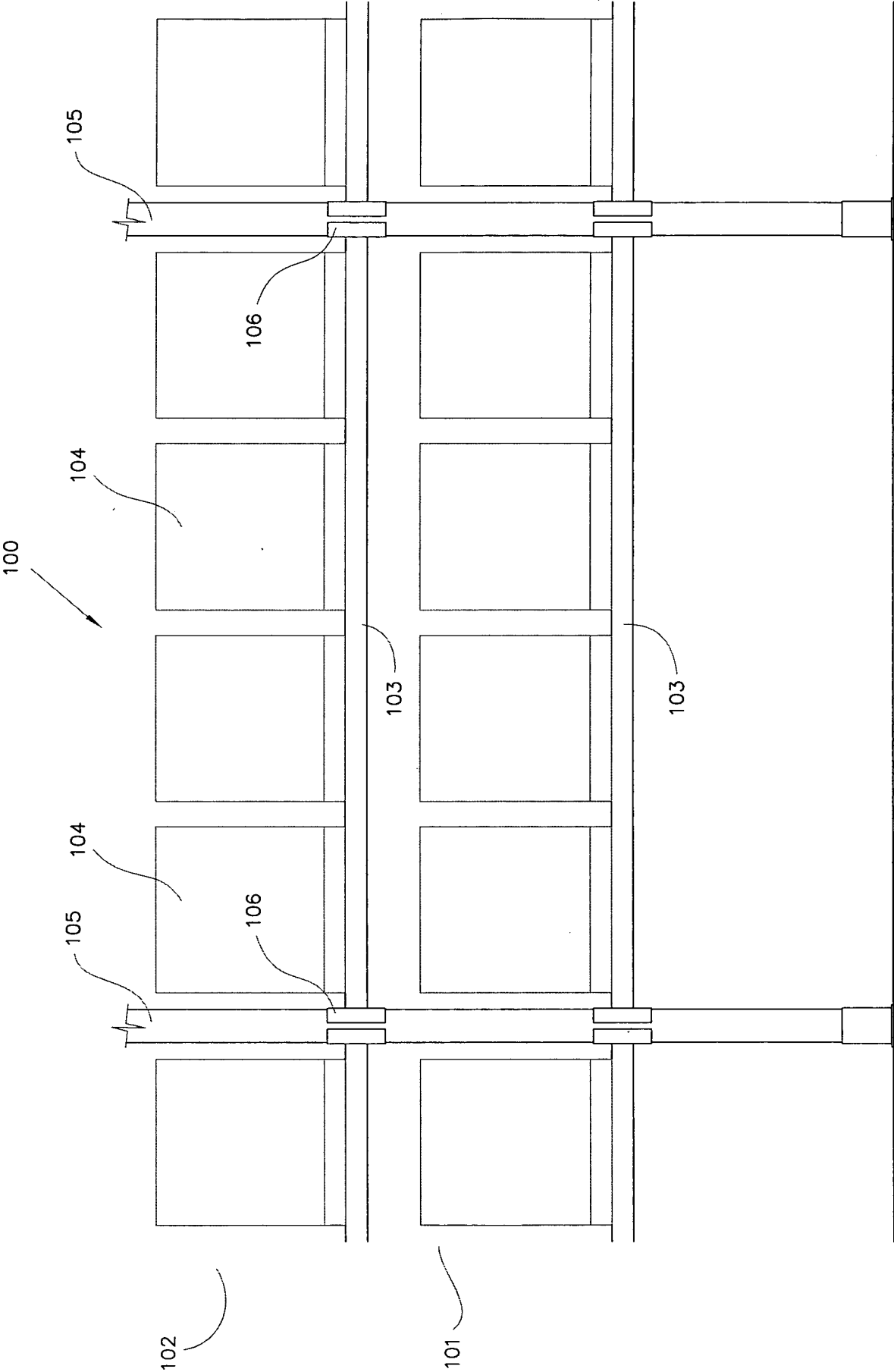


FIG 1

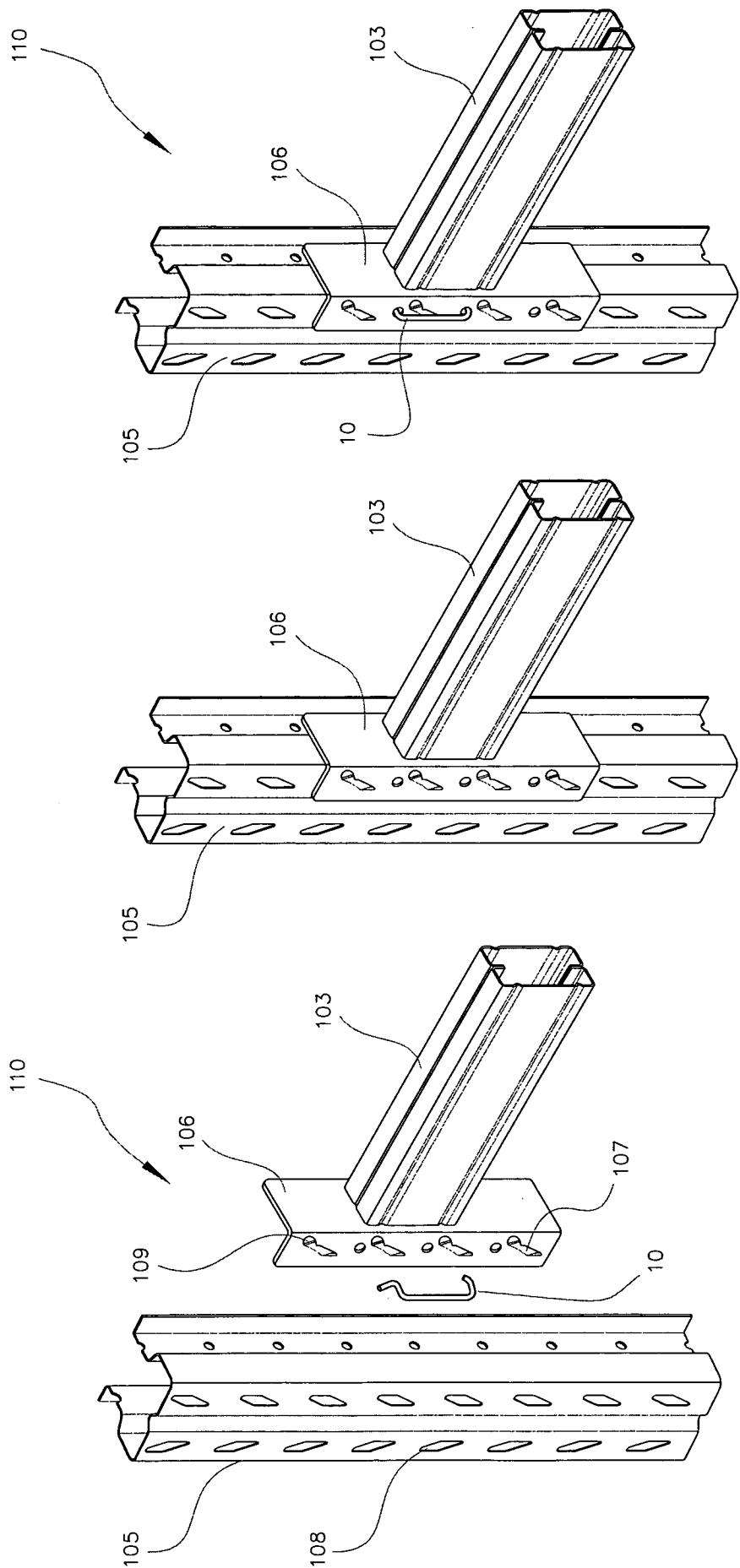
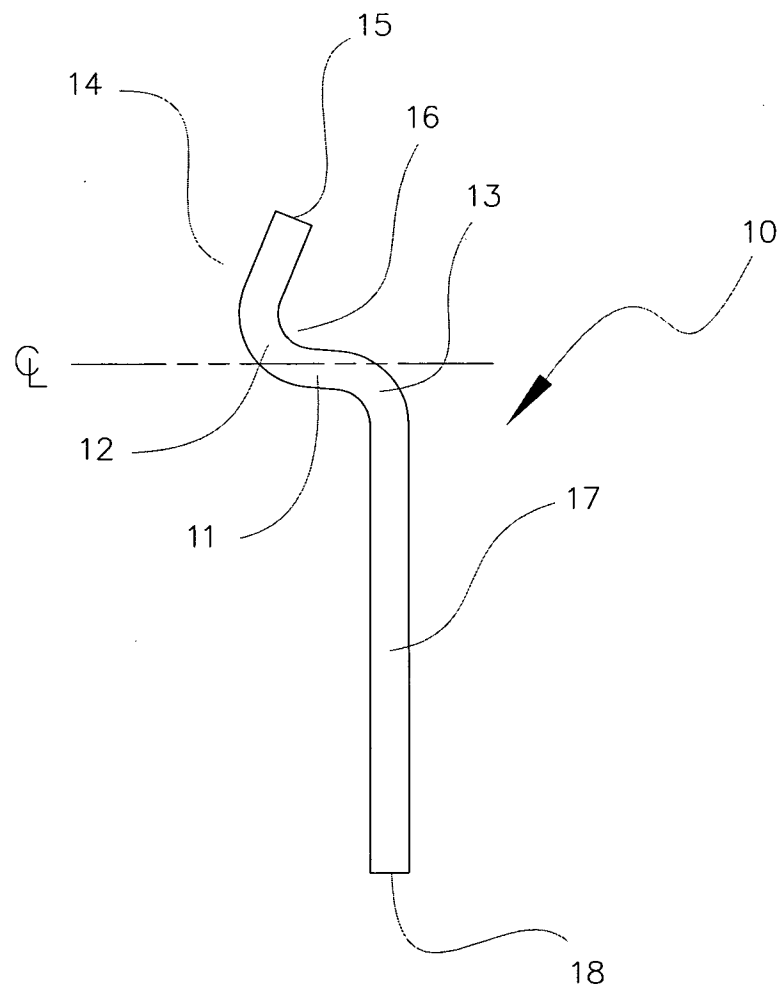


FIG 2

**FIG 3**

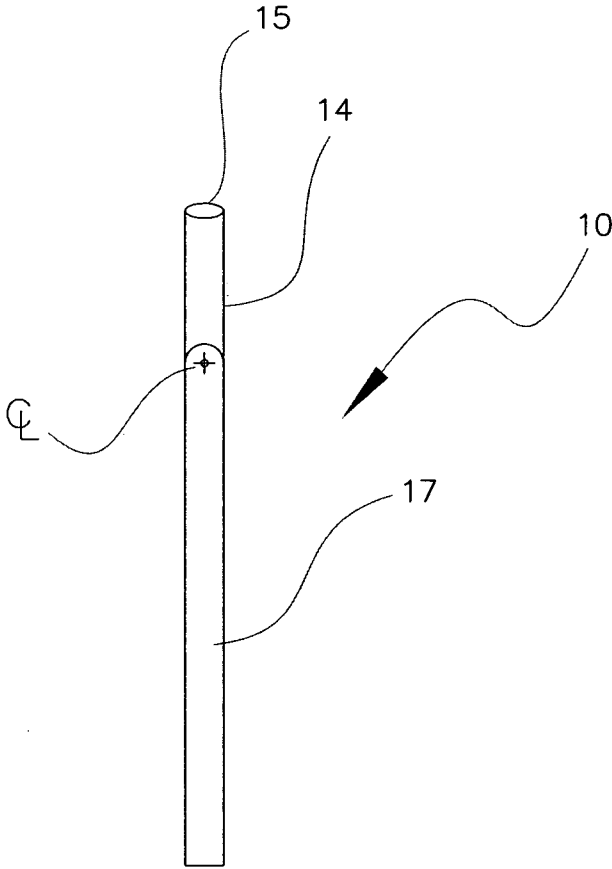


FIG 4

5/14

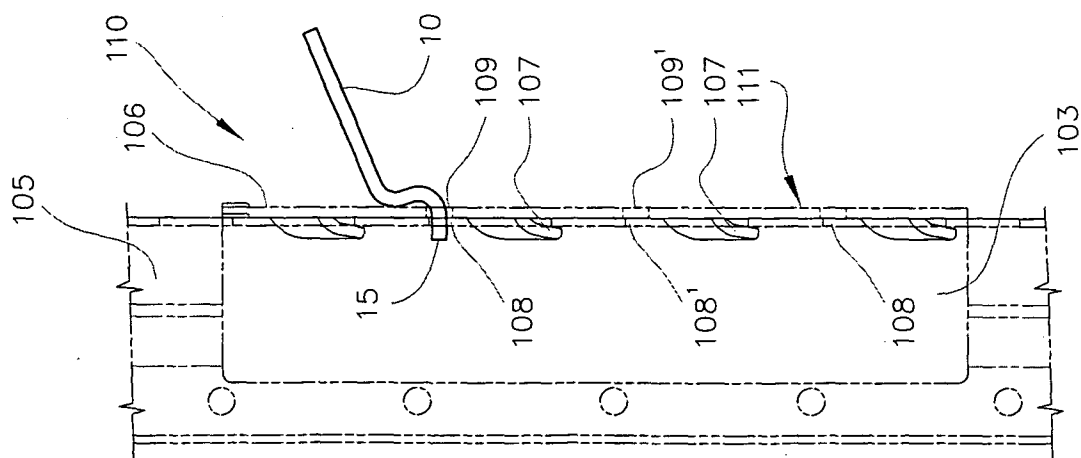


FIG 5a

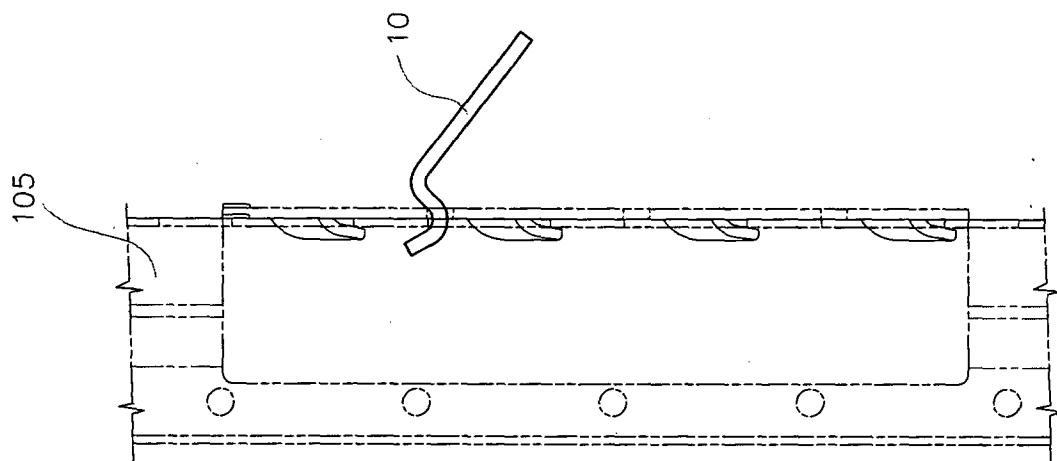


FIG 5b

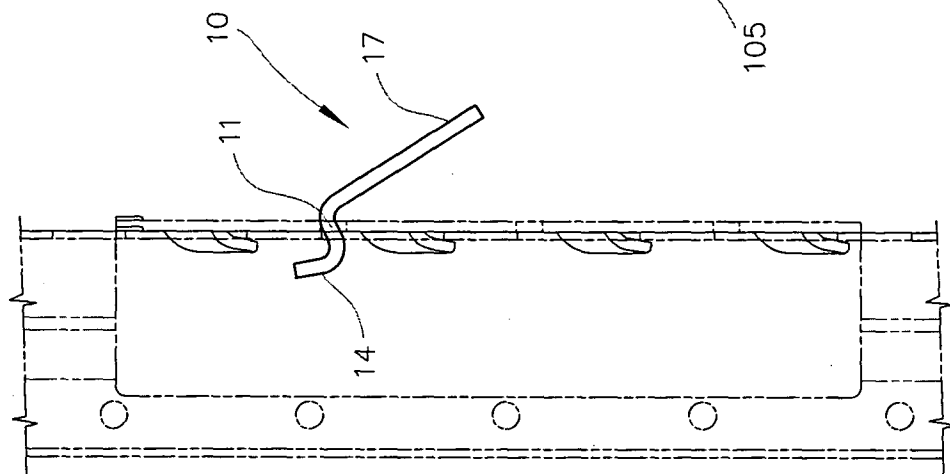


FIG 5c

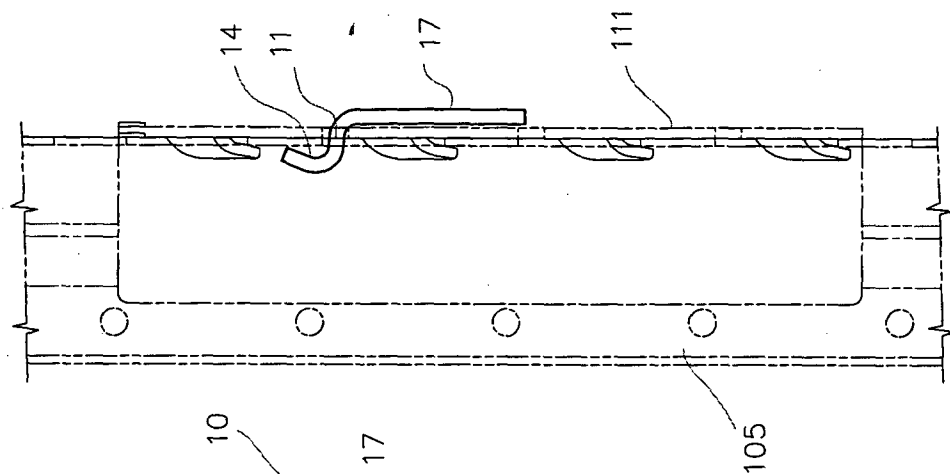


FIG 5d

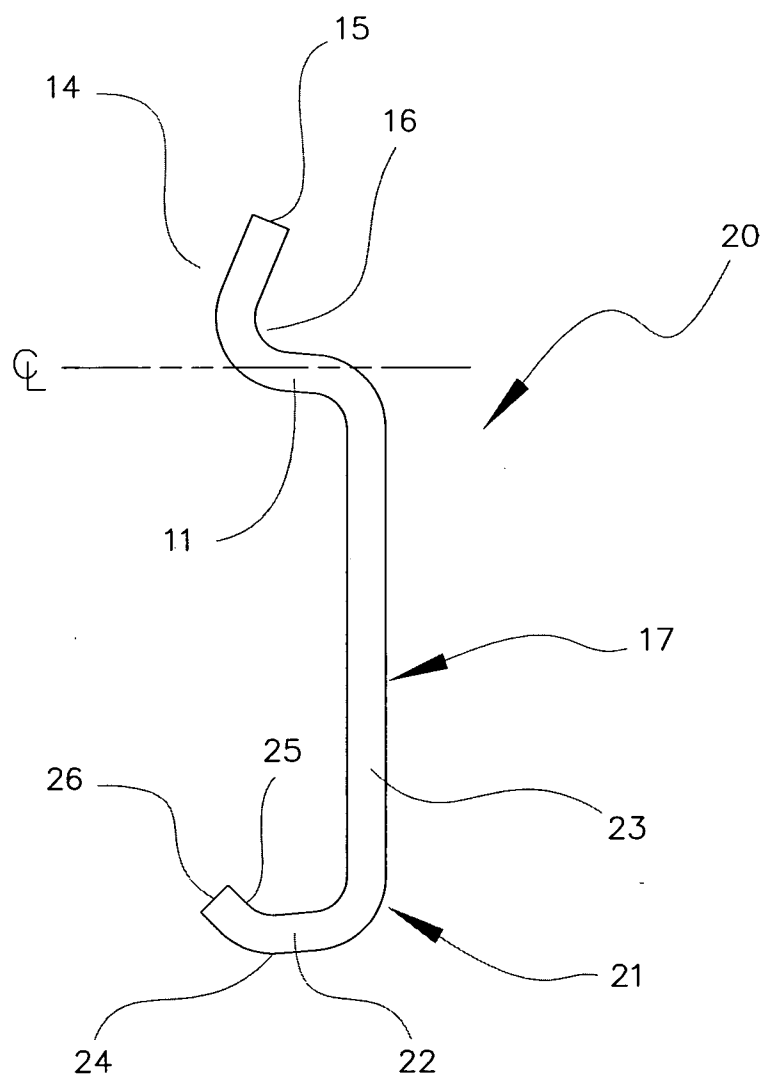


FIG 6

7/14

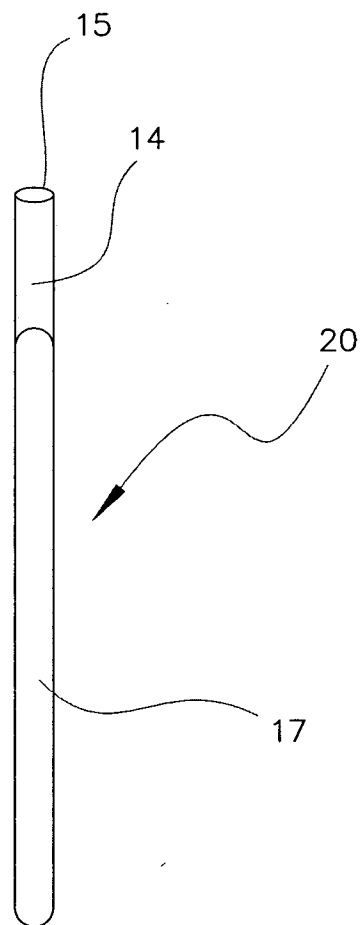


FIG 7

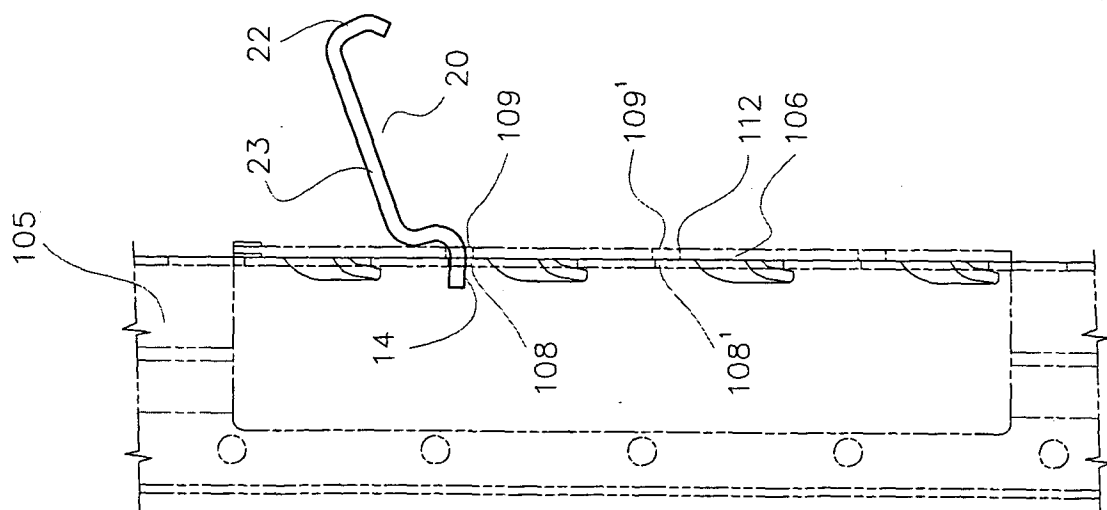


FIG 8a

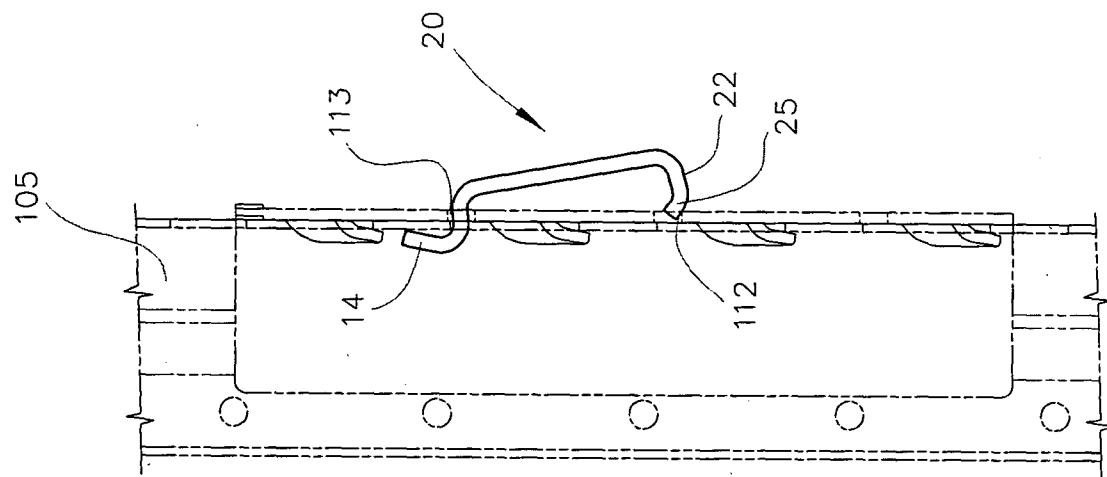


FIG 8b

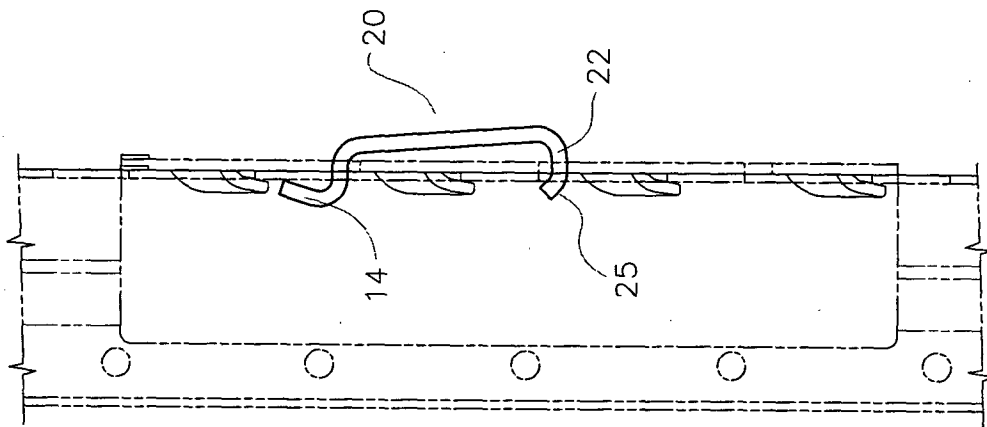


FIG 8C

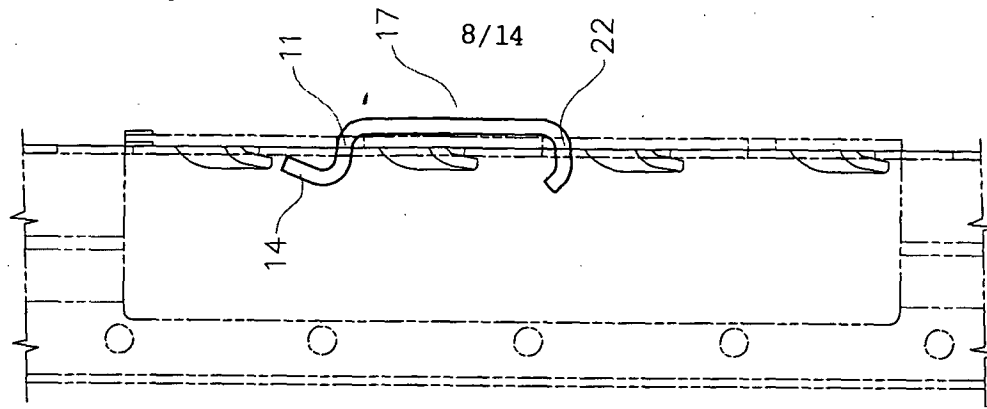


FIG 8d

9/14

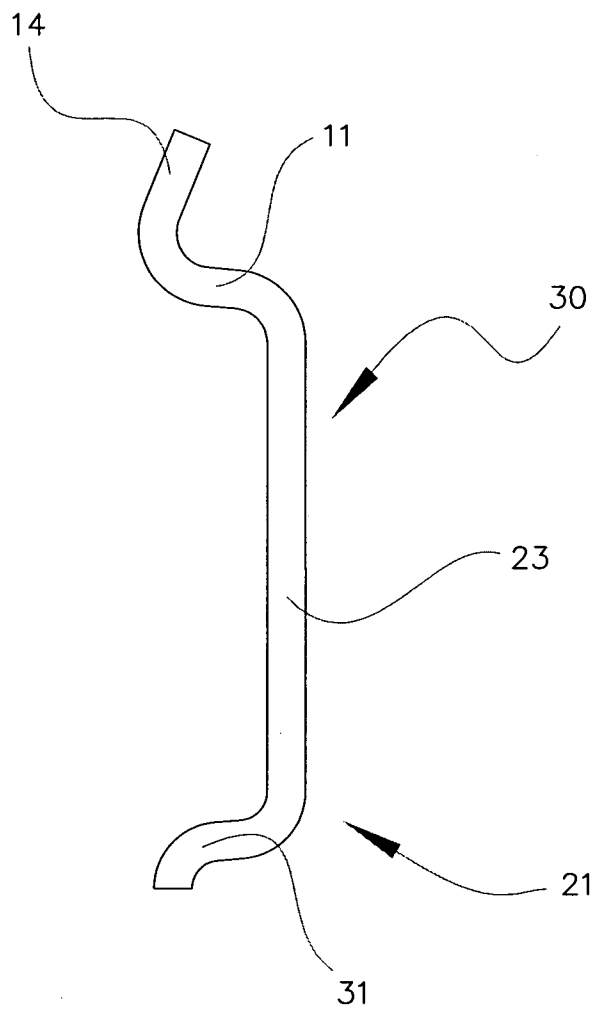


FIG 9

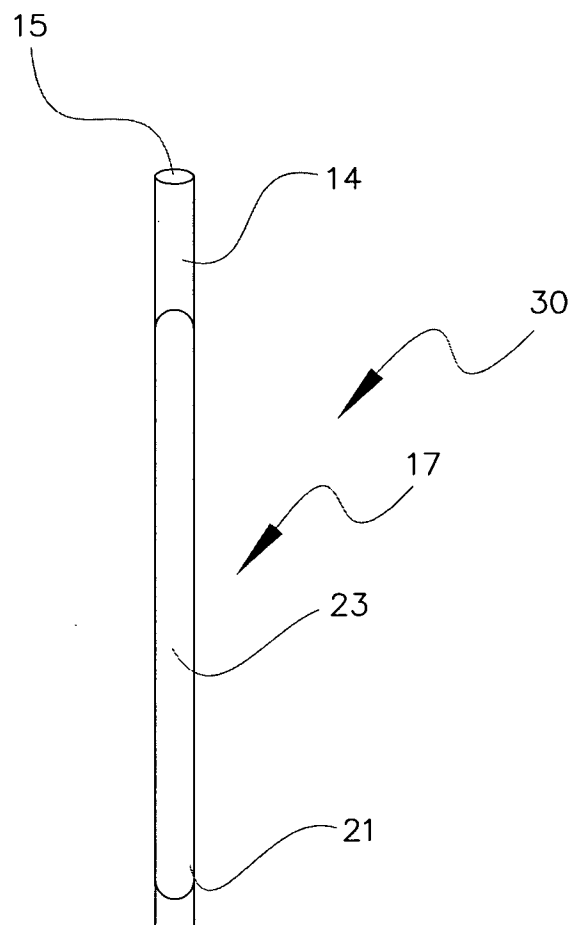


FIG 10

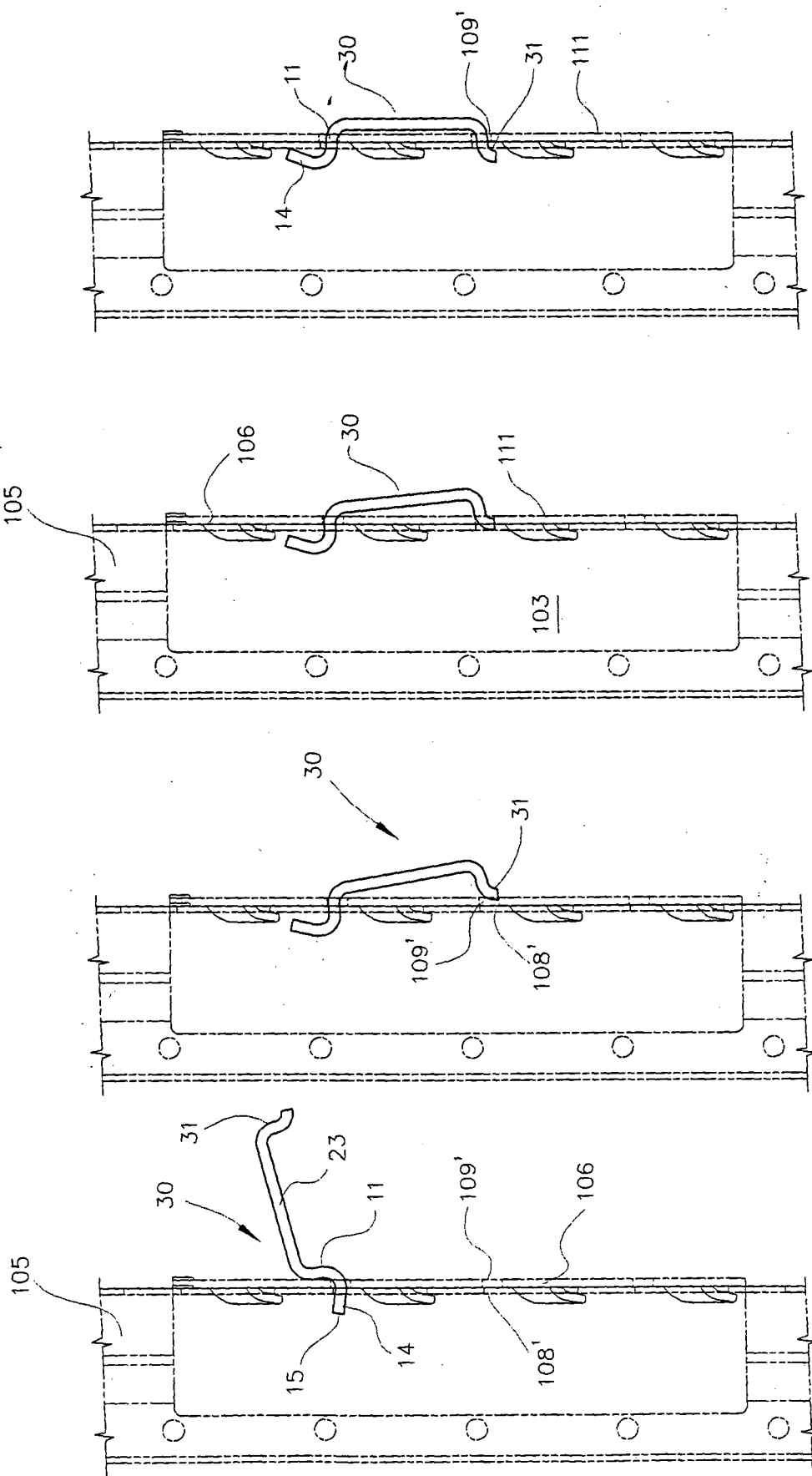


FIG 11d

FIG 11c

FIG 11b

FIG 11a

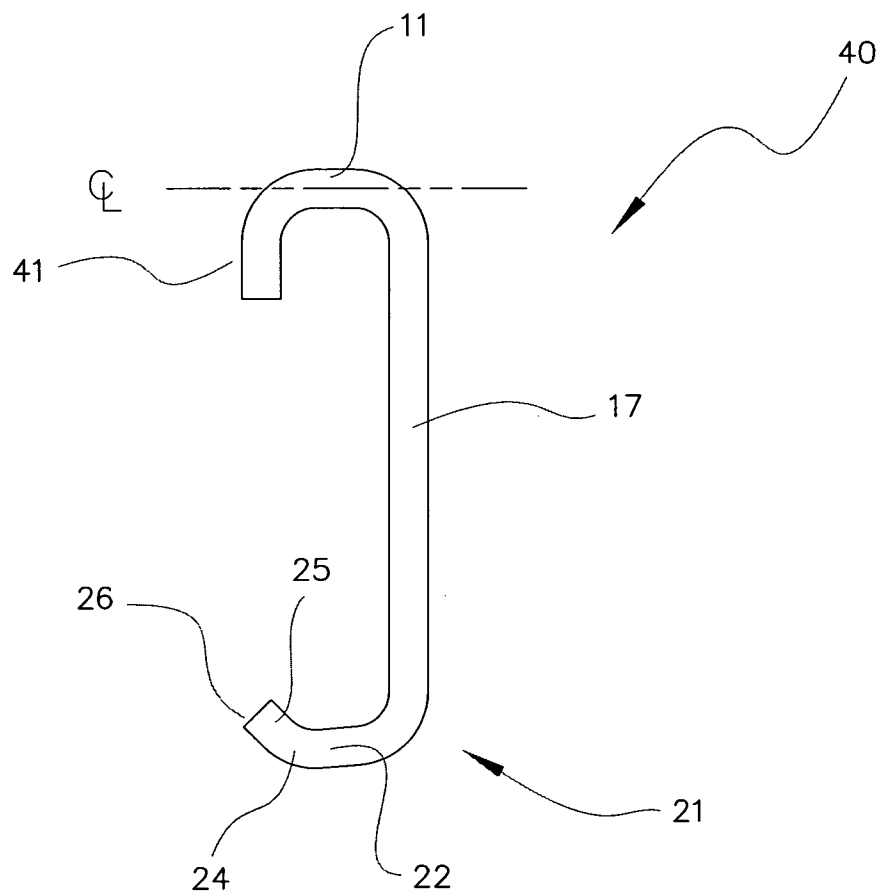


FIG 12

13/14

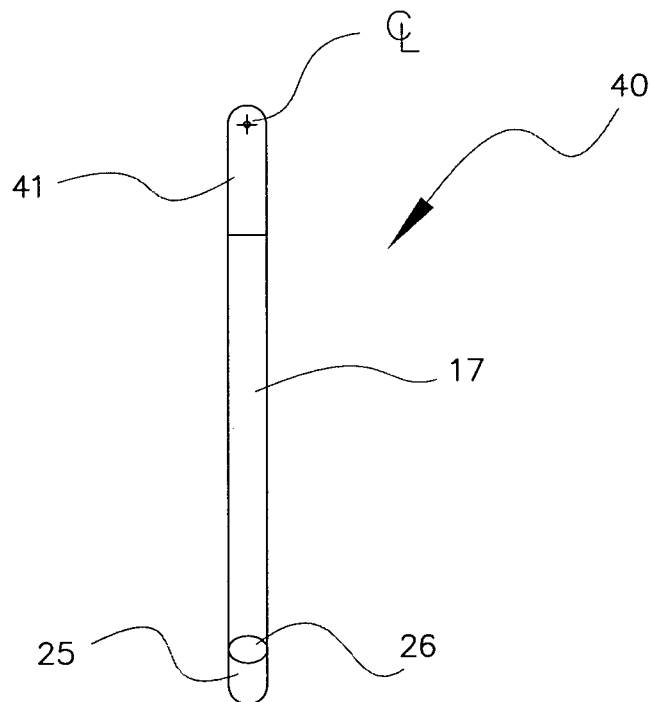


FIG 13

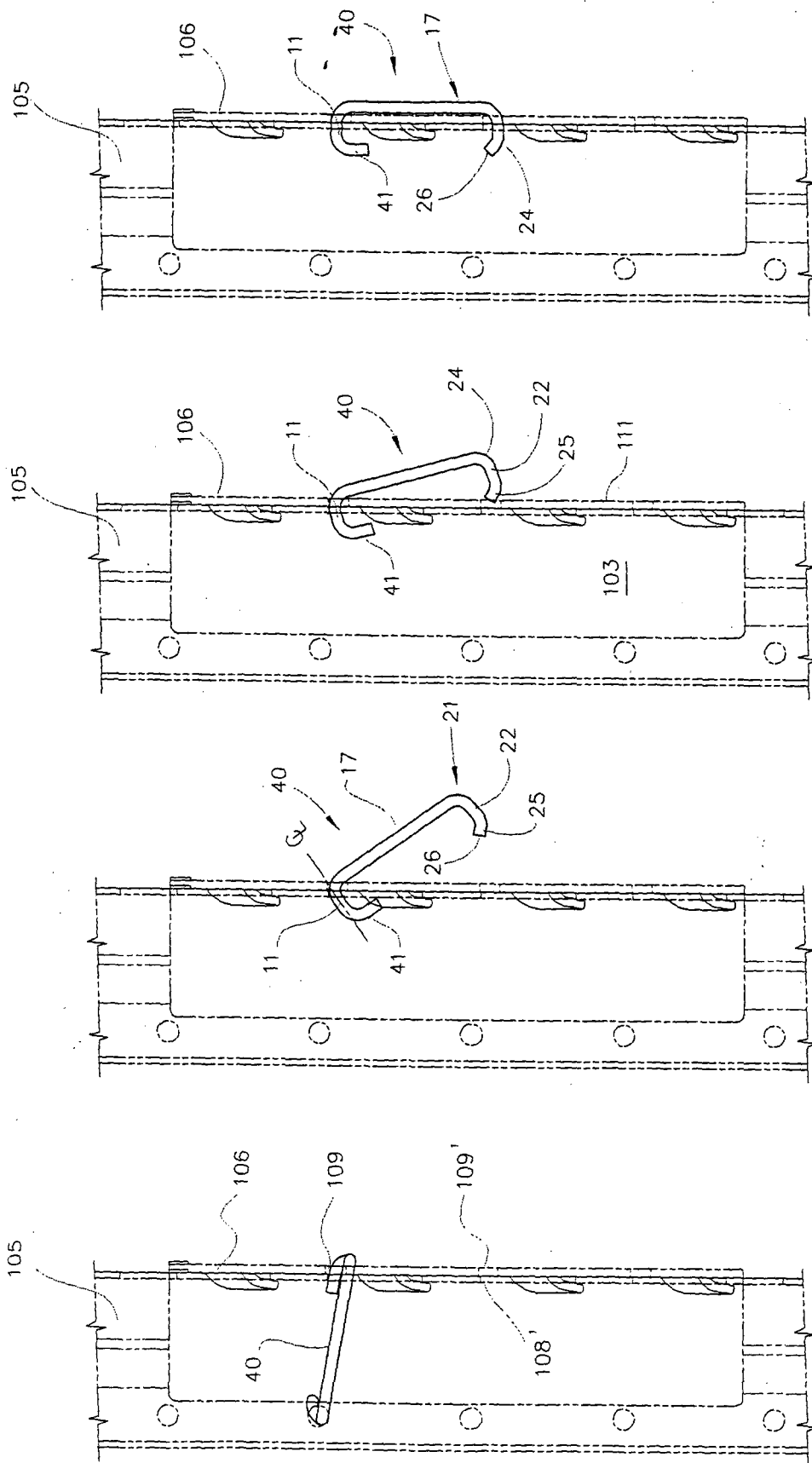


FIG 14a

FIG 14b

FIG 14c

FIG 14d

INTERNATIONAL SEARCH REPORT

International application No.

PCT/AU2007/000708

A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl.

A47B 57/16 (2006.01) **A47B 96/00** (2006.01)

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)

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)
DWPI, A47B/IC key words RACK+, SHEL+, HOLE+, SLOT+, OPENING+, APERTUR+, LOCK+, RETAIN+, PREVENT+, SECUR+, HOLD+, RETEMNT+, MOV+, ROTAT+, DISPLAC+, PIN+

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5791502 A (BIETZ et al.) 11 August 1998 Whole document	1-17
A	US 2002/0027116 A (HERZOG et al.) 7 March 2002 Whole document	1-17
A	US 2004/0079719 A (WEAVER et al.) 29 April 2004 Whole document	1-17



Further documents are listed in the continuation of Box C



See patent family annex

* "A"	Special categories of cited documents: document defining the general state of the art which is not considered to be of particular relevance	"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
"E"	earlier application or patent but published on or after the international filing date	"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
"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)	"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
"O"	document referring to an oral disclosure, use, exhibition or other means	"&"	document member of the same patent family
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search
14 June 2007

Date of mailing of the international search report

27 JUN 2007

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/AU2007/000708

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member			
US	5791502	NONE			
US	2002027116	US	6443320		
US	2004079719	CA	2413266	MX	PA02011945
		US	6802426	US	6679393
Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.					
END OF ANNEX					