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(54) **Tubular skylight**

(57) A tubular skylight (20) that comprises a ceiling frame (100) in which a diffuser plate (107) is removably installed. A compressible gasket (117) is placed between the ceiling frame (100) and the diffuser plate (107). The diffuser plate (107) is secured to the ceiling frame (100)

without compressing the gasket (117) by a partial turn of the diffuser plate (107) relative to the ceiling frame (100), and the diffuser plate (107) compresses said compression gasket (117) upon activation of a tightening mechanism.

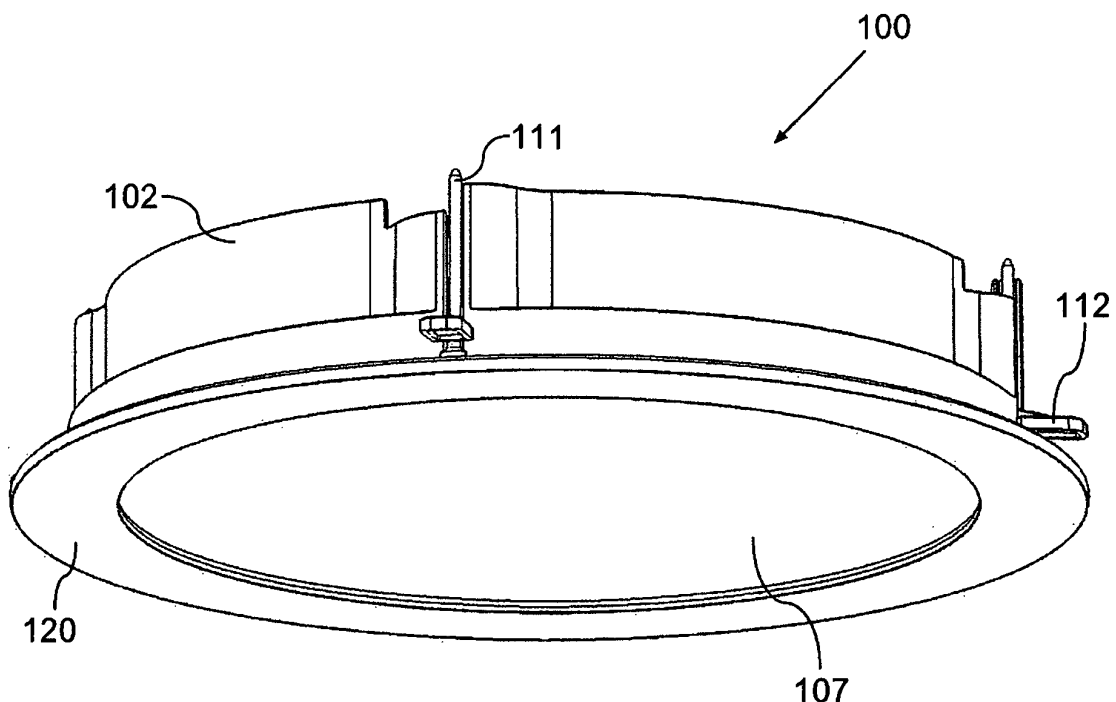


FIG. 3

Description

FIELD OF THE INVENTION

[0001] The present invention relates generally to apparatus for naturally illuminating rooms, and more particularly to tubular skylights.

BACKGROUND OF THE INVENTION

[0002] Tubular skylights are used for transmission of outdoor, natural lighting to building interiors. Energy free and aesthetically pleasing, such devices enjoy great popularity. Tubular skylights are often installed in new constructions, both residential and commercial, but are also installed as retrofitted improvements to existing residential and commercial structures.

[0003] A tubular skylight often includes an exterior dome or other transparent cover upon the roof of a building, translucent or transparent. Light received by the dome is transmitted through light tubes to the interior of the building. The light tubes are disposed through the space between the exterior roof and the interior building ceiling. At the interior building ceiling, the transmitted light is passed through an interior light diffuser.

[0004] With more experience in the installation of tubular skylights, several problems have come to be identified. One of these problems is the fixation of the diffuser plate to the ceiling frame. During the life span of the light tunnel, the diffuser plate needs to be removed from time to time for cleaning purposes to reach and replace a light bulb above the diffuser plate or to remove insects. Thus, the diffuser plate must be easy to remove and install again for a user. Further, it is desirable that the diffuser plate seals tightly to the ceiling frame to avoid the ingress of moisture or dust and dirt into the tubular skylight. Thus, it is an object of the invention to provide a tubular skylight with a diffuser plate that seals to the ceiling frame and that is easy to remove and install.

DISCLOSURE OF THE INVENTION

[0005] The above object is achieved by providing a tubular skylight for a building having a roof and a ceiling above a room, comprising: a transparent cover mountable on the roof, a tube assembly configured for depending downwardly from the roof and having an upper end covered by the cover, a ceiling frame engageable with the ceiling, the ceiling frame receiving the tube assembly therein, a light diffuser plate removably secured to said ceiling frame for covering a lower opening of the tube assembly and for directing light therefrom into the room, wherein a compression gasket is placed between the ceiling frame and the light diffuser plate, said diffuser plate is secured to said ceiling frame without compressing said gasket by a partial turn of the diffuser plate relative to the ceiling frame, and said diffuser plate compresses said compression gasket upon activation of a

tightening mechanism.

[0006] By allowing the diffuser plate to be secured to the ceiling frame without compressing the gasket, there is no contact between the compression gasket and the ceiling frame so that these elements can rotate freely relative to one another thereby making it much easier for a user to remove and install the diffuser plate. The tightening mechanism ensures that the diffuser plate is urged towards the ceiling frame and compresses the compressible gasket for obtaining a tight seal between the diffuser plate and the ceiling frame. With this construction, the diffuser plate will not inadvertently fall out of the ceiling frame when the tightening mechanism is released.

[0007] The diffuser plate can be provided with two or more radially projecting fixing tabs that can be received in a corresponding number of slots that are formed in the ceiling frame without compressing the compression gasket.

[0008] The tightening mechanism may comprise two or more levers that engage a corresponding number of said fixing tabs.

[0009] Preferably, the levers are pivotally suspended from said ceiling frame and include a fixing tab engaging portion and a handle portion.

[0010] The levers may have an engaged position in which they urge the diffuser plate towards the ceiling frame and a disengaged position in which they do not engage the diffuser plate.

[0011] The levers may snap into said engaged and/or disengaged position, so that these positions are stable positions.

[0012] Preferably, the fixing tab engaging portion of said levers includes a rounded tip. This facilitates the entry of the tip into the slope below the perspective fixing tab.

[0013] Further objects, features, advantages and properties of the tubular skylights according to the invention will become apparent from the detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] In the following detailed portion of the present description, the invention will be explained in more detail with reference to the exemplary embodiments shown in the drawings, in which:

Figure 1 is a side view of a tubular skylight assembly in accordance with one exemplary embodiment of the present invention,

Figure 2 is an exploded view of a ceiling frame of the tubular skylight assembly shown in figure 1,

Figure 3 is an elevated view of the ceiling frame shown in figure 2,

Figure 4 is a cross-sectional view of the ceiling frame shown in figure 2,

Figure 5a is an elevated view with a detailed enlargement of the ceiling frame of the shown in figure 2 without a diffuser plate,

Figure 5b is a detailed view of the ceiling frame with a tightening mechanism in a disengaged position,

Figures 5c to 5e are diagrammatic side views illustrating the activation of the tightening mechanism,

Figure 6 an elevated cross-sectional view with a detailed enlargement of the ceiling frame of the shown in figure 2 with a diffuser plate,

Figure 7 is an elevated view of the ceiling frame shown in figure 2 without a diffuser plate but without a trim ring, and

Figures 8 to 11 are diagrammatic side views of embodiments of the tightening mechanism.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0015] A full and enabling disclosure of the present invention, including the best mode contemplated by the inventors of carrying out their invention, is set forth herein. Reference will be made in detail to the presently preferred embodiments of the invention, one or more examples of which are illustrated in the drawings. Each example is provided by way of explanation of the invention, and is not meant as a limitation of the invention. For example, features illustrated or described as part of one embodiment may be used in another embodiment to yield a still further embodiment.

[0016] It is intended that the present application include such modifications and variations as come within the scope and spirit of the invention. Repeat use of reference characters throughout the present specification and appended drawings is intended to represent the same or analogous features, elements, or components.

[0017] According to the present invention and with reference to Fig. 1, a tubular skylight assembly, generally 20, is provided for use in a building having a roof and a ceiling. This assembly provides a collar 40, to which is mounted an exterior transparent cover 25. A light transmitting top elbow 50 depends through the collar 40 inwardly for disposition through the roof of the building.

[0018] Attached to top elbow 50 is a light tube 60; attached to light tube 60 is a second light tube 70. Light tubes 60 and 70 are in telescopic engagement between each other. Depending beneath light tube 70 is a displacement absorber 80, from which in turn depends a lower adaptor box 95 adapted for installation in an interior ceiling of a building. The top elbow 50, light tubes 60 and 70, light transmitting bottom elbow 80, and light diffuser assembly 100 may have reflective inner surfaces, for reflection of light transmitted there through.

[0019] As depicted in Fig. 1, the skylight assembly may be understood to have a generally askew orientation, with "upper" and "top" understood to refer toward the exterior roof 27 of a building, upon which, for example, exterior transparent cover 25 may be found, and with "lower" and "bottom" referring to an orientation toward the interior ceiling 29 of the building, to which the light diffuser assembly 100 may be disposed.

[0020] Turning in detail to the light diffuser assembly 100 shown in figures 2 to 4 the light diffuser assembly 100 comprises a ceiling ring 102, a substantially disk shaped diffuser plate 107 that is provided with radially extending fixing tabs 109 and a trim ring 120. The trim ring 120 is secured to the radial flange 119 of the ceiling ring 102 by a snap fit connection.

[0021] The ceiling ring 102 is secured to the ceiling by means of flip tabs 112 that can be tightened by means of screws or bolts 111. The flip tabs 112 can be turned inwardly to allow the ceiling ring 102 to be inserted in a circular recess in a ceiling plate. After insertion of the ceiling frame 100 into the recess the flip tabs 112 are flipped outwardly and the screws 111 are tightened until the flip tabs 112 engage the upper side of the ceiling plate and thereby secure the ceiling frame 100 to the ceiling plate.

[0022] The diffuser plate 107 is provided with a circumferential compression gasket 117 that is pressed against an internal rim 113 of the ceiling frame 100 when the diffuser plate 107 is installed. The compression gasket 117 ensures that the diffuser plate 107 seals substantially hermetically with the ceiling frame 100 and ensures that dust and dirt that accumulates above the diffuser plate 107 does not enter the room there below and moist air does not enter the flex tube from the room to avoid condense water in the tube

The ceiling frame 100 includes a fastening ring 106 securing the lower end of the light tube to the ceiling frame 100.

[0023] Turning now to figure 5, the ceiling ring 102 is provided on its radially inner surface with slots that are formed by projections 121 for receiving the radial fixation tabs 109 of the diffuser plate 107. In the present embodiment there are four fixation tabs 109 and four slots for receiving these tabs 109. However, it is noted that there could be fewer (e.g. two or three) or more (e.g. five or more) fixation tabs 109 and a corresponding number of slots in the ceiling ring 102.

[0024] The height of the slots (121) is large relative to the height of the fixation tabs 109. Thus, the diffuser plate 107 is not pressed upwards towards the internal rim 113, i.e. the compression gasket 117 is not pressed against the internal rim 113, and preferably the compression gasket 117 does not even touch the internal rim 113 when the fixation tabs 109 are received (by a partial turn) in the respective slots of the ceiling frame 100. If the compression gasket 117 would be pressed against the internal rim 113 when the fixation tabs 109 are received in the slots of the ceiling frame 100, it would be very difficult

if not impossible to rotate the diffuser plate 107 relative to the ceiling frame 100.

[0025] With the compression gasket 117 not touching the internal rim 113 the diffuser plate 107 can be rotated freely relative to the ceiling frame 100 when the fixation tabs 109 are received in the respective slots. Thus, it is easy for a user to let the diffuser plate 107 make a partial turn relative to the ceiling frame 100 for moving the fixation tabs 109 into engagement with the slots or for disengaging the fixation tabs 109 from the slots by a partial turn in the opposite direction.

[0026] The protrusions 121 on the internal surface of ceiling ring 102 are each provided with a support book 122 from which a tightening lever 124 is pivotally suspended. The tightening levers 124 are part of a tightening mechanism that can urge the diffuser plate 107 towards the ceiling frame 100 for compressing the compressible gasket 117.

[0027] The tightening levers 124 include a pivot shaft 127, a handle part 125 and a fixing tab engaging portion 126. The fixing tab engaging portion 126 is provided with a rounded tip. The tightening levers 124 can assume an engaged position in which the fixing tab engaging portion 126 is positioned in the respective slot and urges the respective fixation tabs 109 (when received in the slot) towards the inner rim 113, thereby compressing the compression gasket 117.

[0028] The tightening levers 124 can also assume a disengaged position in which the fixing tab engaging portion 126 is not positioned in the respective slot. In figure 5a the tightening levers 124 are shown in their engaged positions.

[0029] In figure 5c the levers 124 are shown in their disengaged position. In this position there will not be pressure on the compression gasket 117. In this position it is not possible to attach/install the trim ring 120 since the handle portions 125 project downwardly from the ceiling ring 102 and obstructs the trim ring 120.

[0030] Figures 5c to 5e are diagrammatic side views illustrating the activation of the tightening mechanism with figure 5c showing the lever 124 in the disengaged position and the fixing tab 109 received in its slot, figure 5d illustrating the lever 124 in an intermediate position in which the lever has partially urged the fixing tab 109 upwards and figure 5e showing the lever 124 in its engaged position.

[0031] In an embodiment the disengaged position is a stable position, and the stability of this position may be obtained by a snap effect. This snap effect may be caused by the arrow 128 that is formed in relief on the inner side of the ceiling ring 102 and the protruding material of the arrow engaging the lever 124. The arrow 124 also serves to indicate to the user where the fixation tabs should be inserted.

[0032] In an embodiment the engaged position is also a stable position to ensure that the tightening levers will not inadvertently release the tightening pressure.

[0033] Turning now to figure 6, and in particular the

detailed section thereof the diffuser plate 107 is shown in its fully installed position with the fixation tabs 109 received in the slots and the levers 124 in their engaged position urging the fixation tabs 109 and thereby the diffuser plate 107 towards the inner rim 113 thus compressing the compression gasket 117.

[0034] In an embodiment (not shown) the levers 124 have a special shape that causes them to pull down the diffuser plate 107 when the levers 124 are moved to their disengaged positions. Thus, the compression gasket 117 is disengaged from the internal rim 113 so that the diffuser plate 107 can rotate freely with respect to the ceiling frame 100.

[0035] Figure 7 shows the ceiling frame with the diffuser plate 107 fully installed but without the trim ring 120 (for illustration purposes).

[0036] Although the invention has been shown with a double glazed diffuser, it is understood that the invention can also be used with single glazed diffusers. The fixation tabs have been shown as an integral part of the diffuser plate, however it is understood that the fixation tabs and the diffuser plate can be a compound construction. Further, the invention has been shown with the fixation tabs being part of the diffuser plate and the slots being part of the ceiling frame. It is understood that this arrangement can be reversed with the slots being part of the diffuser plate and the fixation tabs being part of the ceiling frame. Further, the invention has been shown with the tightening levers being associated with the slots. It is however understood that the tightening levers may be arranged in any other position that enables them to press the diffuser plate towards the ceiling frame. Further, it is understood that the tightening of the diffuser plate can be performed with another form of tightening mechanism than a lever. The slots have been shown as formed by projections. However, it is understood that the slots can alternatively be formed by recesses. The compression gasket has been shown as an integral part of the diffuser plate. However, it is understood that the compression gasket can be a loose element or be integral with the flange of the ceiling frame.

[0037] Examples of other mechanisms are eccentric discs as shown in Figure 8, wherein an eccentric disc 220 that is operated by a lever 221 is used to urge the fixation tab 109 upwards, wedges, a slide switch 223 in combination with an angled leave spring 224 as illustrated in figure 9, or pressure pins 225 or 226 that are provided with a bayonet type securing mechanism as shown in figures 10 and 11.

[0038] The term "comprising" as used in the claims does not exclude other elements or steps. The term "a" or "an" as used in the claims does not exclude a plurality.

[0039] The reference signs used in the claims shall not be construed as limiting the scope.

[0040] Although the present invention has been described in detail for purpose of illustration, it is understood that such detail is solely for that purpose, and variations can be made therein by those skilled in the art without

departing from the scope of the invention.

Claims

1. A tubular skylight for a building having a roof and a ceiling above a room, comprising:

a transparent cover mountable on the roof;
a tube assembly configured for depending
downwardly from the roof and having an upper
end covered by the cover;
a ceiling frame engageable with the ceiling, the
ceiling frame receiving the tube assembly there-
in;

a light diffuser plate removably secured to said
ceiling frame for covering a lower opening of the
tube assembly and for directing light therefrom
into the room;

characterized in that:

a compression gasket is placed between said
ceiling frame and said light diffuser plate;
said diffuser plate is secured to said ceiling
frame without compressing said gasket by a par-
tial turn of said diffuser plate relative to said ceil-
ing frame;
and said diffuser plate compresses said com-
pression gasket upon activation of a tightening
mechanism.

2. A tubular skylight according to claim 1, wherein said
diffuser plate is provided with two or more radially
projecting fixing tabs that can be received in a cor-
responding number of slots that are formed in the
ceiling frame without compressing the compression
gasket.

3. A tubular skylight according to claim 1 or 2, wherein
said tightening mechanism comprises two or more
levers that engage the diffuser plate.

4. A tubular skylight according to claim 3, wherein said
levers engage said fixation tabs.

5. A tubular skylight according to claim 3 or 4, wherein
said levers are pivotally suspended from said ceiling
frame and include a fixing tab engaging portion and
a handle portion.

6. A tubular skylight according to claim 5, wherein said
levers have an engaged position in which they urge
the diffuser plate towards the ceiling frame and a
disengaged position in which they do not engage in
the diffuser plate.

7. A tubular skylight according to claim 6, wherein the
lever snaps into said engaged and/or disengaged
position.

8. A tubular skylight according to claim 5, wherein said
fixing tab engaging portion of said levers includes a
wedge shaped tip.

9. A tubular skylight according to claim 5, wherein said
levers are arranged to pull down the diffuser plate
when they are moved from their engaged position to
their disengaged position.

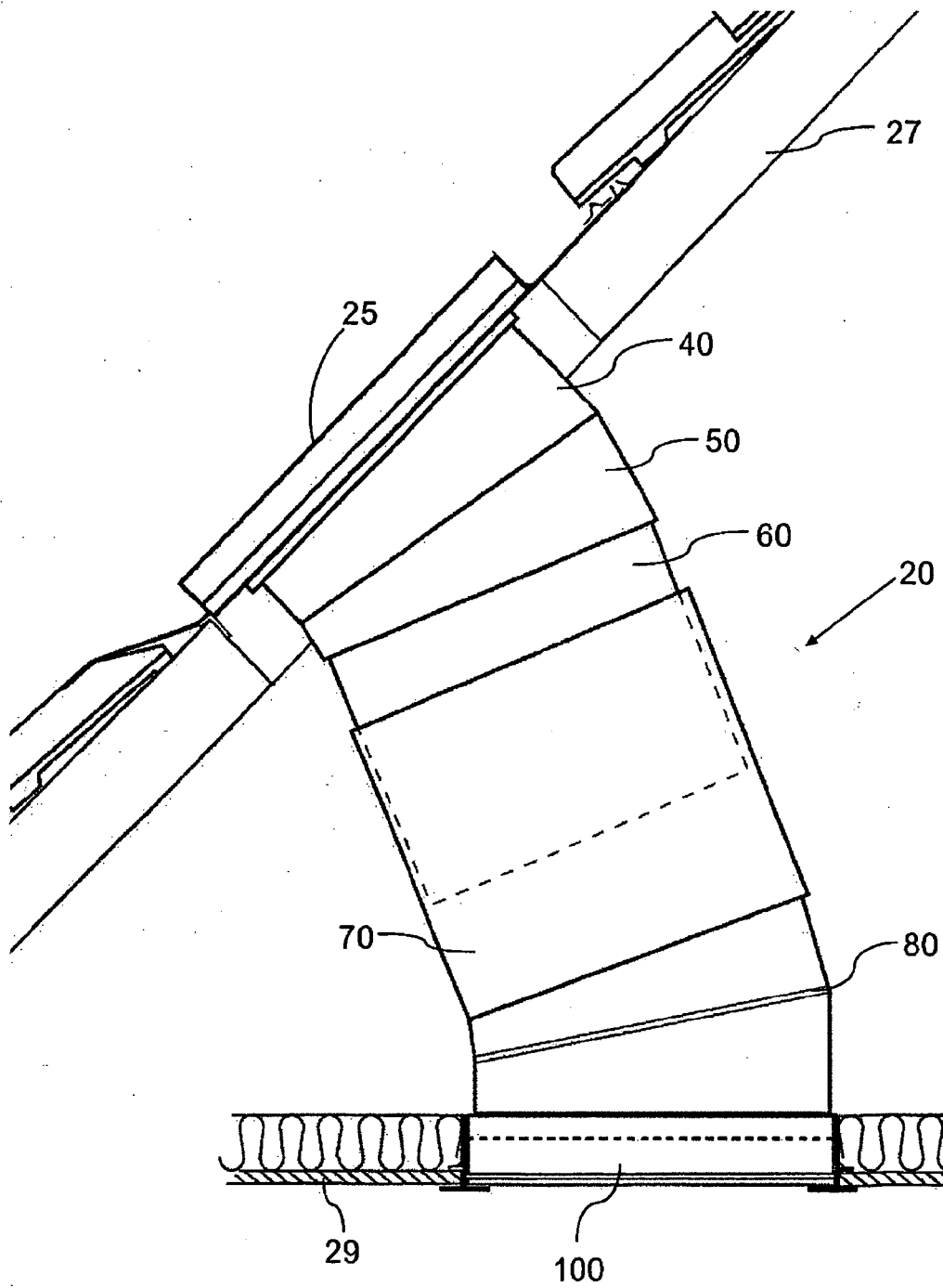


FIG. 1

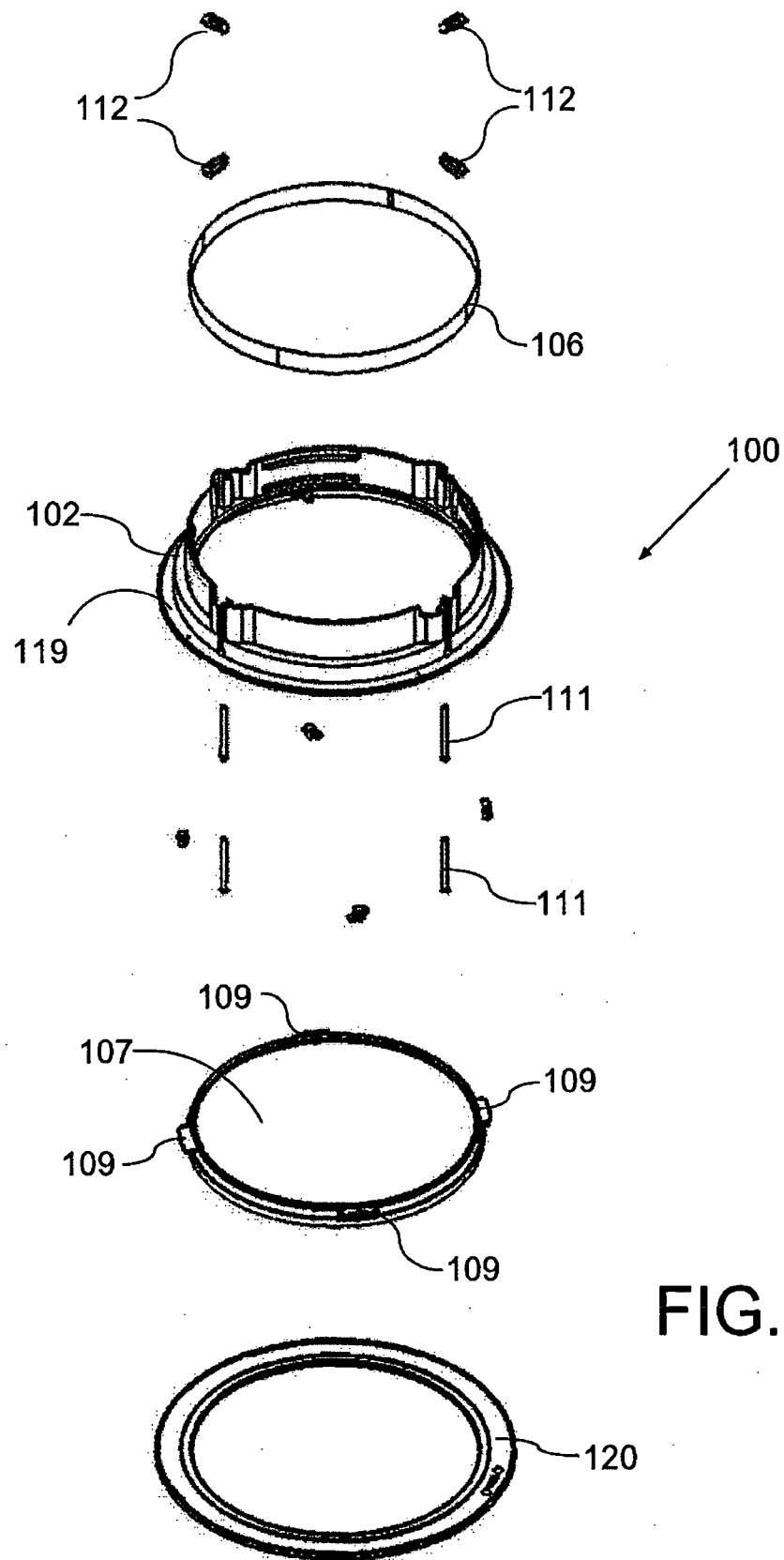


FIG. 2

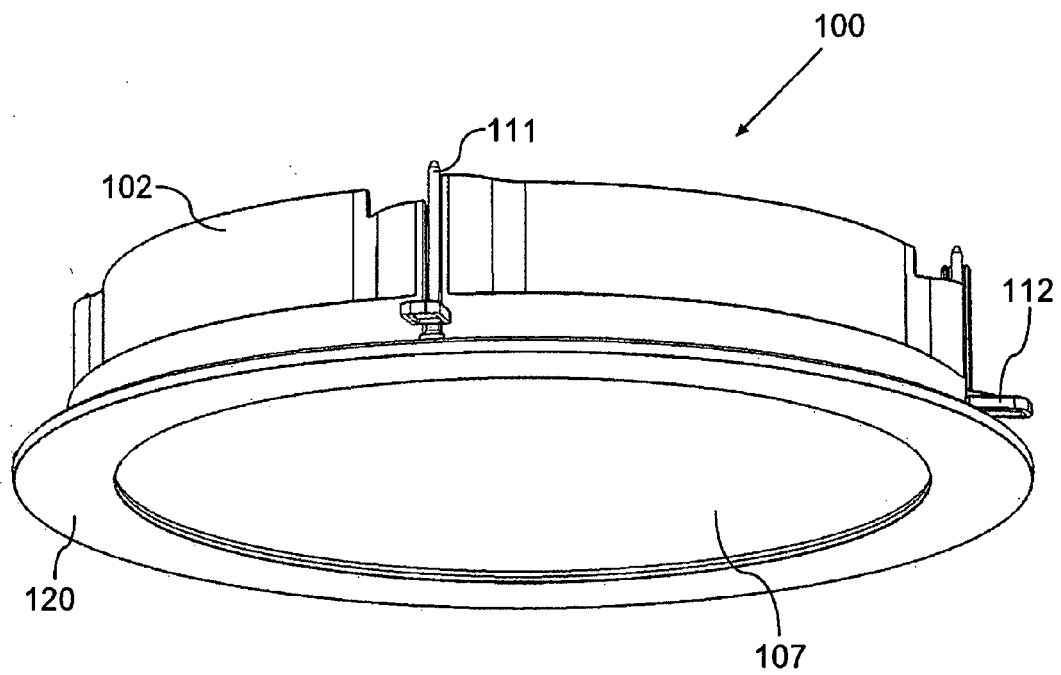


FIG. 3

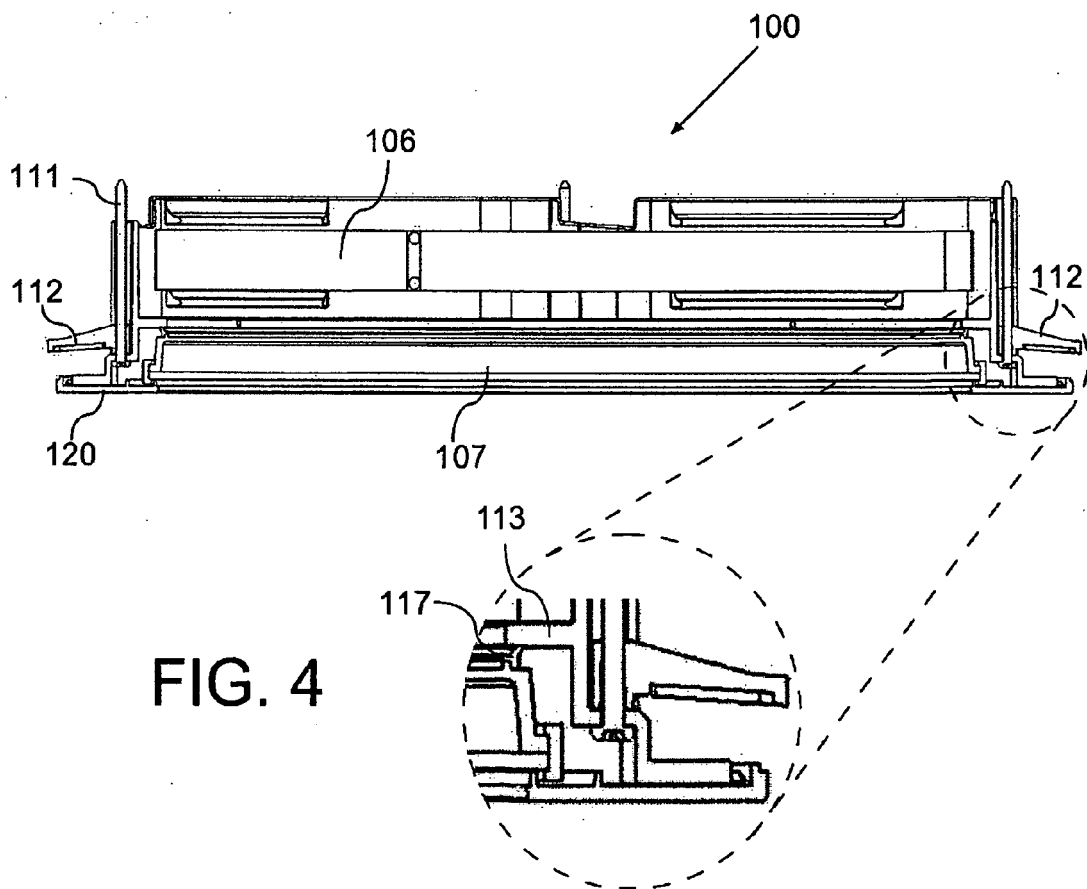


FIG. 4

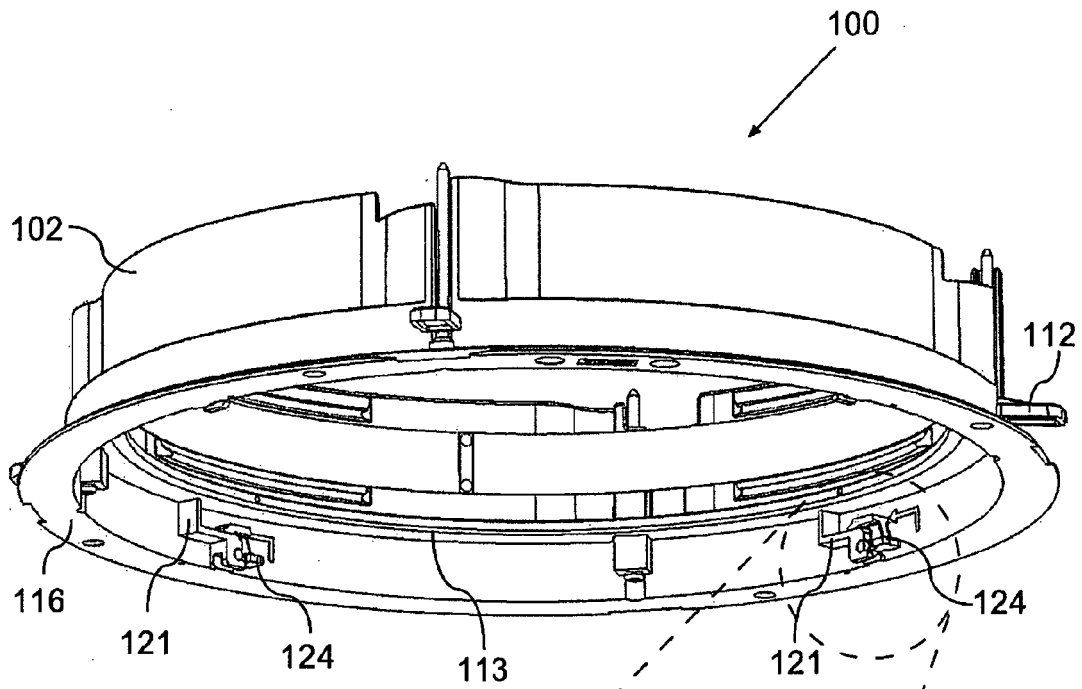


FIG. 5a

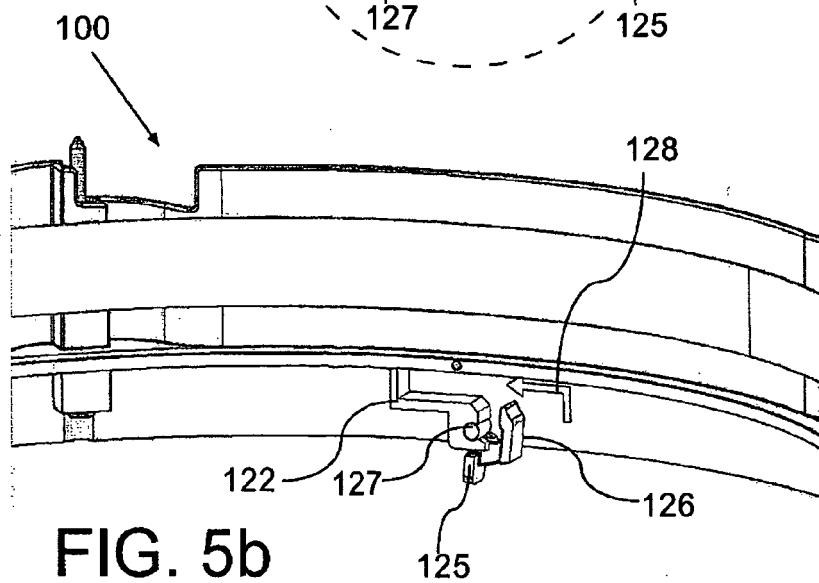
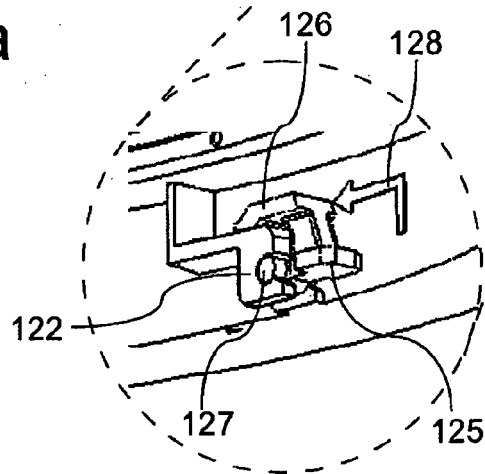
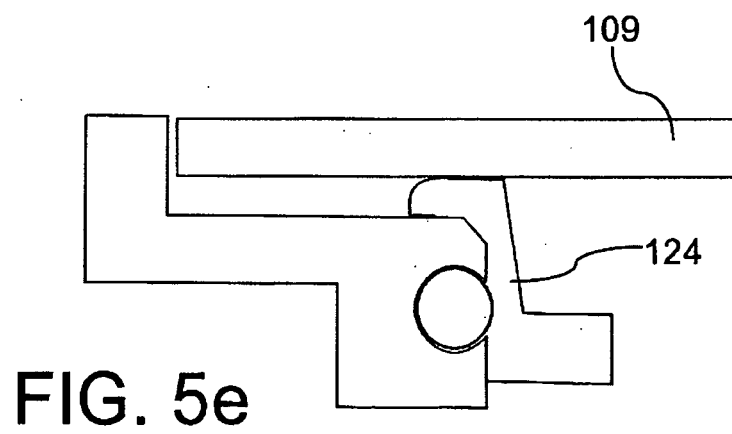
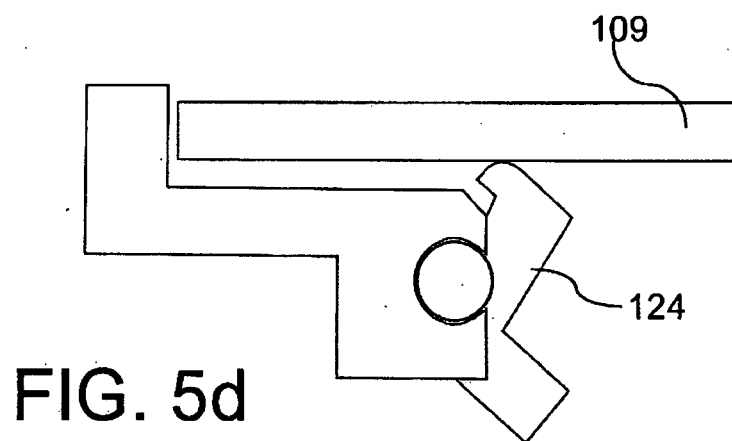
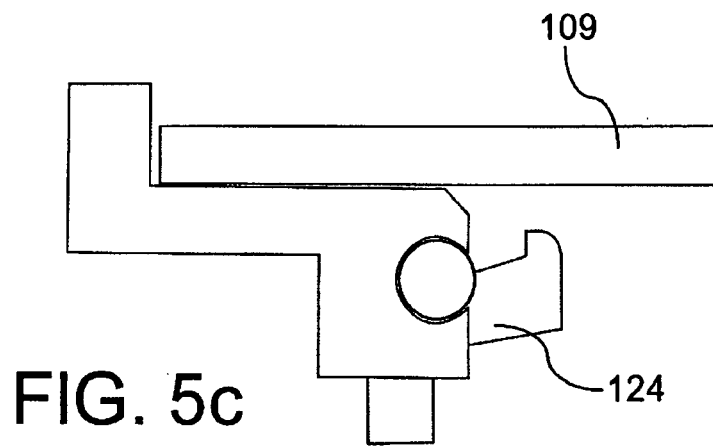
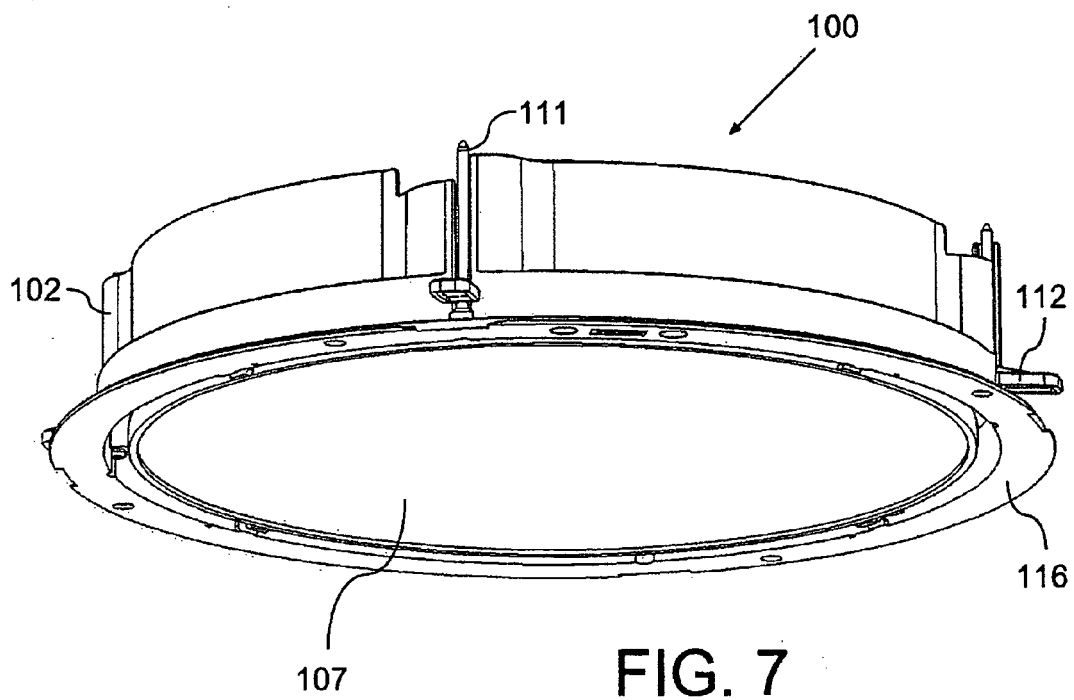
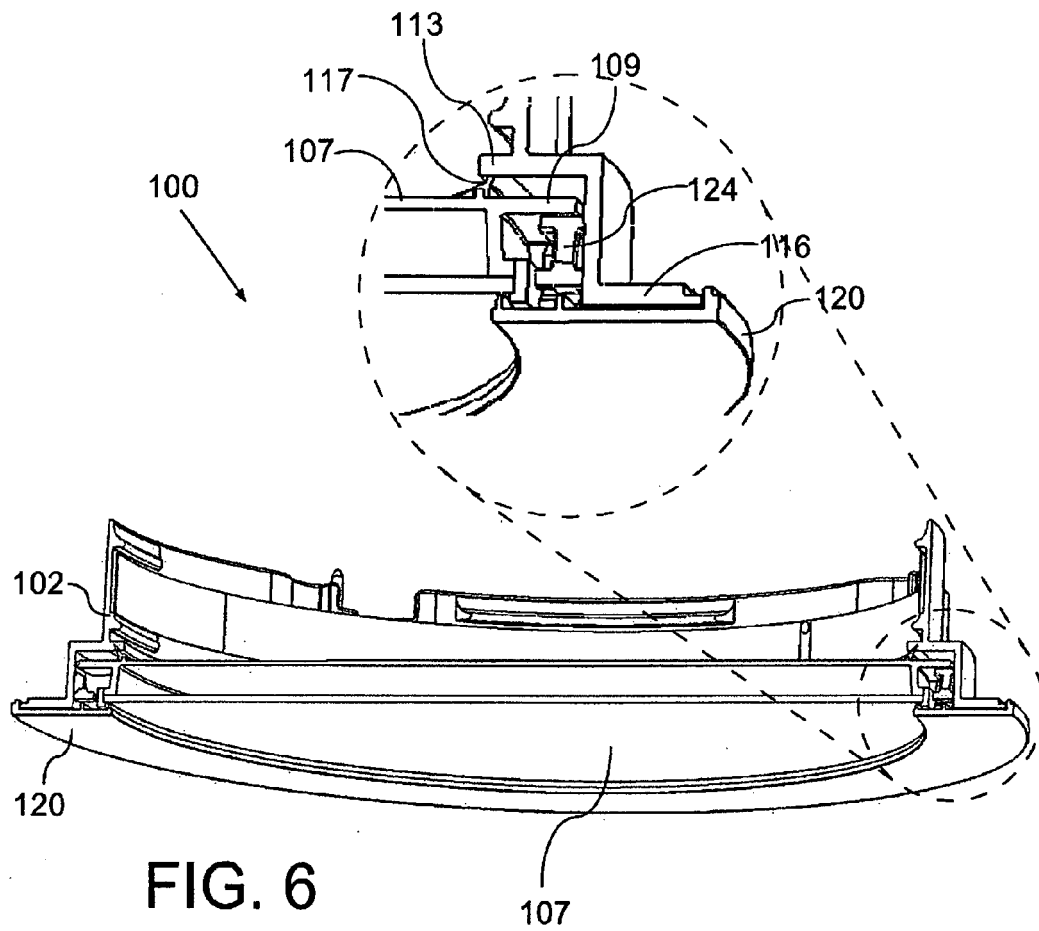
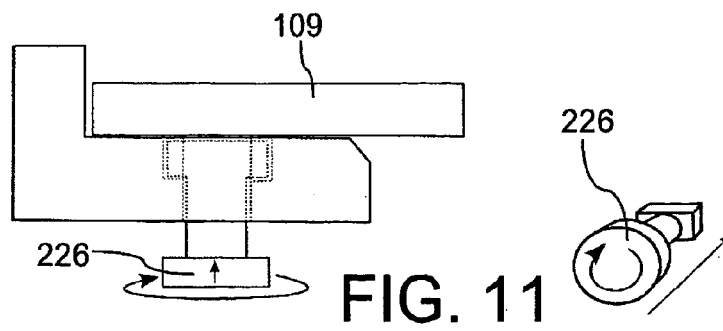
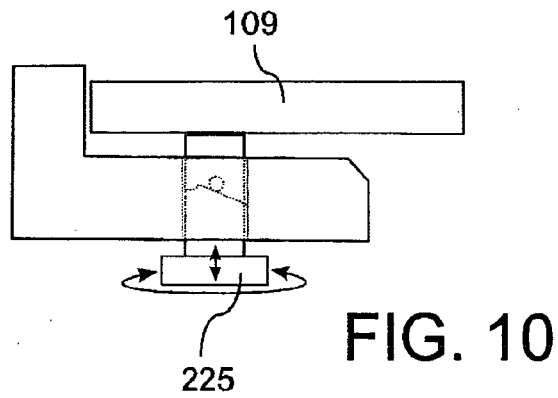
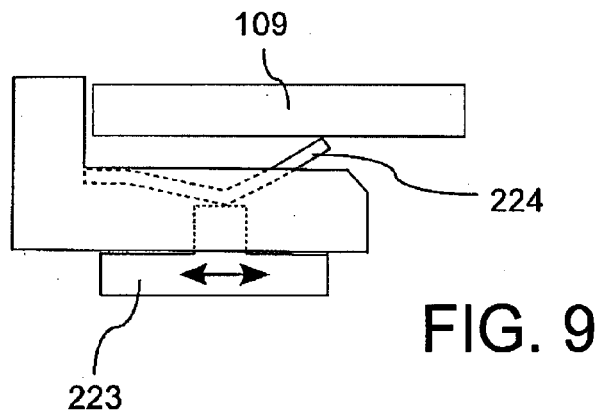
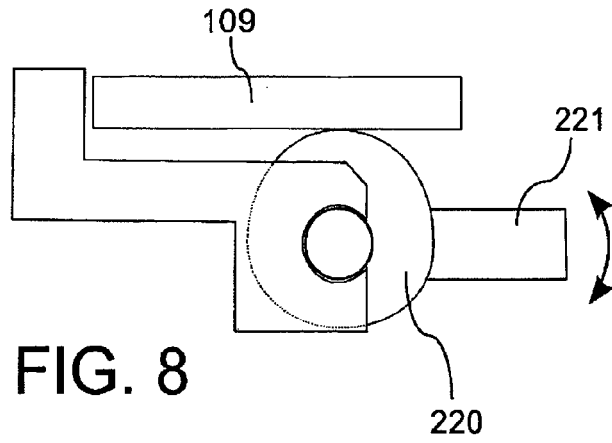


FIG. 5b









European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 02 1137

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 2003/000159 A1 (ESTRADA LUGARDO R [US]) 2 January 2003 (2003-01-02) * figures 1,5 *	1	INV. E04D13/03 E05C3/12
A	US 6 256 947 B1 (GRUBB DENNIS [US]) 10 July 2001 (2001-07-10) * figures 2-7 *	1	
A	US 6 035 593 A (CHAO BING-LING [US] ET AL) 14 March 2000 (2000-03-14) * figures 1,5 *	1	
A	US 2004/244666 A1 (BLACK JAMES W [US]) 9 December 2004 (2004-12-09) * figures 1-8 *	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			E04D E05C B63B
Place of search		Date of completion of the search	Examiner
Munich		21 May 2008	Vratsanou, Violandi
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			

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EPO FORM 1503 03.82 (P04C01)

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

EP 07 02 1137

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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21-05-2008

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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