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Fastening Assembly for Securing Bed Liner to Truck Bed

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Abstract

Fastening assembly for pickup bed liner by using foldable tie-down ring assembly and supporting plate pursuant to this invention is applicable to pickup truck bed with inward extended bed rail. The bed liner used pursuant to this invention has been drilled to provide circular open holes in the side walls at the position which, when the liner is placed on the truck bed, the perimeter of the holes shall cross the lower edge of the inward extended bed rail. This invention consists of a foldable tie-down ring assembly, screw and supporting plate. The foldable tie-down ring assembly consists of base member, elastic pad for base member, foldable tie-down ring, clamp member, rubber pad for clamp member and anti-loosing plastic which attached to the clamp member. The principle for fastening is to fasten the screw so that the clamp member exerts clamp force on the base member, while the bed liner and the bed rail are in between. When install the fastening assembly by the aforesaid method at number of positions along the bed rail, the bed liner shall be securely fastened to the truck bed. The method of installing the fastening assembly requires no drilling and shall not cause damage to the truck bed. It also provides foldable tie-down rings. In addition, in case of heavy loads such as high tension from tying rope, supporting plate may be attached to the inner surface of the bed rail prior to the installation of the foldable tie-down ring assembly to provide tie-down ring which can stand high tension without causing distortion on the bed rail.

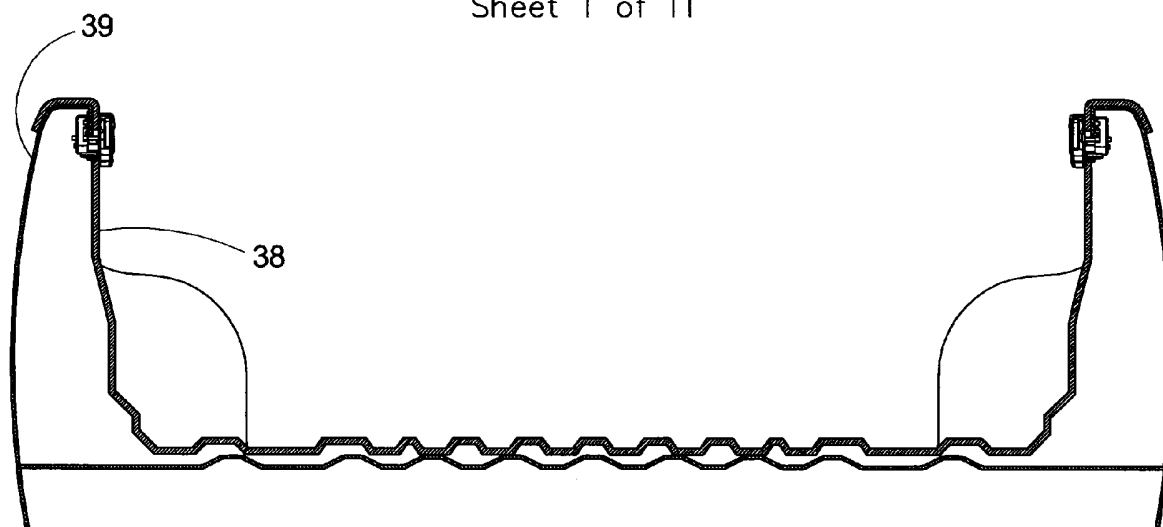


FIG. 1

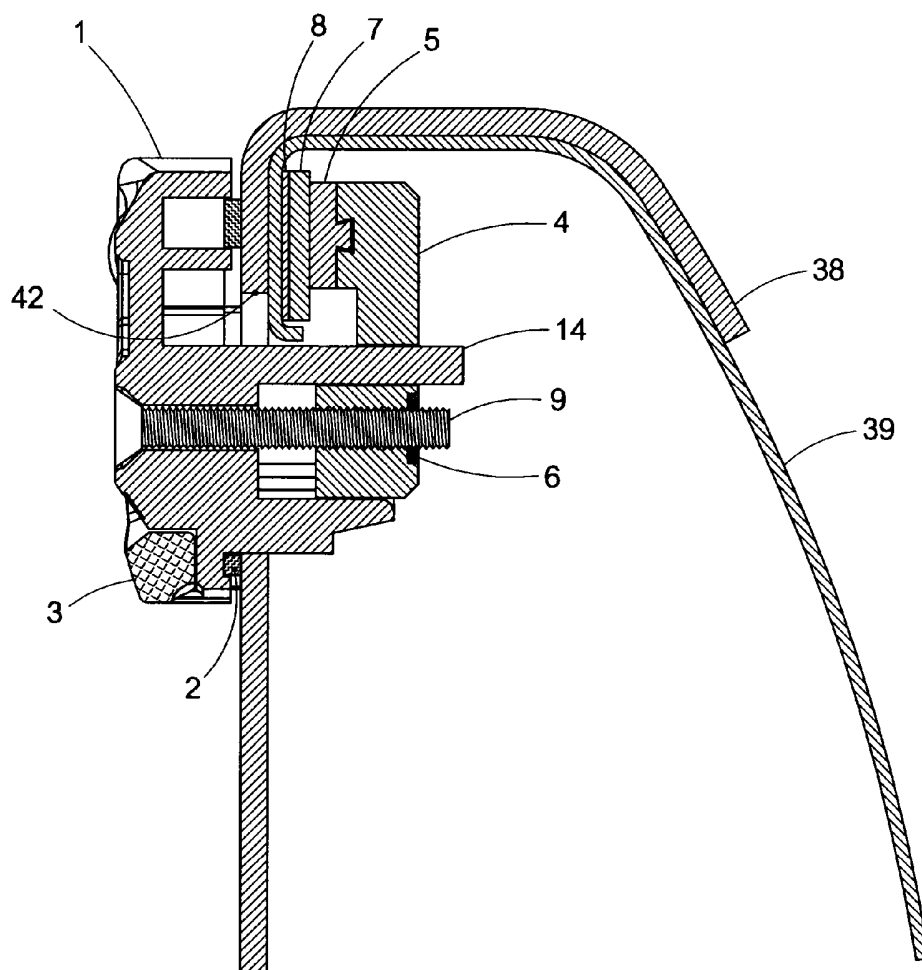


FIG. 2

AUSTRALIA

Patents Act 1990

ORIGINAL

COMPLETE SPECIFICATION

STANDARD PATENT

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Invention Title: "Fastening Assembly for Securing Bed Liner to Truck Bed"

Details of Associated Priority Application No: Taiwanese Petty Patent 0303000218
filed on 18 March 2003

The following statement is a full description of this invention, including the best method of performing it known to me:-

“Fastening Assembly for Securing Bed Liner to Truck Bed”

Field of the Invention

This invention relates to bed liners used in vehicle such as pickups, trucks and utilities. In particular the invention is with respect to a fastening assembly for use
5 with pickup bed liners and which incorporate foldable tie-down ring assemblies.

Background Art

This invention relates to bed liners.

There are several approved patents in relation to bed liners. One of these, US Patent no. 5,267,820, issued to Thomas Sturtevant on 7 December 1993,
10 discloses a fastening assembly with an explanation note on support member with face plate and trough-shaped wall for supporting clamp member that can move linearly. The clamp member can twirl within the trough-shaped wall structure in order to turn the clamp arm upward to the position required for clamping on the downward lip of the bed rail. When a screw is fastened into the trough-shaped
15 wall, in a threaded hole of the clamp member, the screw may twirl and cause the clamp arm to twirl. This will cause the clamp member to move linearly within the trough to the position required for clamping on the downward lip of the bed rail. The fastening assembly is a completely assembled apparatus which can be installed into an open hole on the side walls of a pickup truck bed liner after
20 placing the liner on the truck bed.

A disadvantage of the fastener assembly pursuant to US Patent no. 5,267,820 is that the fastening assembly has been designed only to hold bed liners to the truck bed without tie-down rings attached. Pickup trucks typically have tie-down rings attached to the truck beds. However, after installing the bed liner with the
25 fastener assembly pursuant to the US Patent no. 5,267,820, the bed liner covers the truck bed including the original tie-down rings. If tie-down rings are required, it is then necessary to drill holes in the liner. These holes must be big enough to

provide access to the original tie-down rings by the installer. These holes will also allow water, rock or sand to enter the space between the liner and the bed.

- Another retainer apparatus is disclosed in US Patent no. 6,203,090 BI and Thai Patent no. 10615. These patents disclose a retainer apparatus for securing a
- 5 bed liner to a pickup truck bed with having inwardly or outwardly extending bed rails. The pickup truck bed has a plurality of bed holes and the bed liner has a plurality of liner holes. The retainer apparatus includes a front tie-down ring retaining plate for positioning between the pickup truck bed and the bed liner. The front tie-down ring retaining plate has a first end and an opposing second
- 10 end. The first end has at least one hole therethrough for alignment with one of the bed holes. The first end is secured to one of the bed holes. The second end has at least one hole therethrough for alignment with one of the liner holes. The second end is secured to one of the liner holes. The apparatus also includes a rear tie-down ring retaining plate for positioning between the pickup truck bed
- 15 and the bed liner. The rear tie-down ring retaining plate has a first end and an opposing second end. The first end has at least one hole therethrough for alignment with one of the bed holes. The first end is secured to one of the bed holes. The second end has at least one hole therethrough for alignment with one of the liner holes. The second end is secured to one of the liner holes. The tie-
- 20 down rings are attached to the bed liner in alignment with the front and rear tie-down ring retaining plates. The tie-down ring is an accessory with a base member which has a plurality of holes for alignment with at least one of the bed liner holes and consists of a fold down ring with a fulcrum at the base member and the fold down ring has a through hole.
- 25 A disadvantage of the retainer apparatus pursuant to the US Patent no. 6,203,090 BI and Thai Patent no. 10615 is that in case there is no holes in the truck bed, this apparatus can not secure the bed liner.

The preceding discussion of the background to the invention is intended to facilitate an understanding of the present invention. However, it should be

30 appreciated that the discussion is not an acknowledgement or admission that

any of the material referred to was published, known or part of the common general knowledge in Australia as at the priority date of the application.

The present invention relates to the fastening assembly for securing a plastic bed liner to a pickup truck bed without drilling. This invention has been designed to
5 solve the problem regarding the mechanism for securing a bed liner as aforesaid, and also add convenience or utility from the foldable tie-down rings.

Summary of the Invention

In particular, this invention relates to a fastening assembly for fastening a bed liner to a pickup truck bed without requiring to drill the truck bed, and
10 incorporates foldable tie-down rings attached to the bed liner.

The object of the present invention is to create an apparatus which secures a plastic bed liner to a pickup truck bed. The apparatus utilises an installation method which does not require drilling of the pickup truck bed, nor does it cause damage to the pickup truck bed. This invention also provides foldable tie-down
15 rings to assist in securing loads. This invention has been developed from the idea that fasteners should be capable of securing the liner to the pick up truck bed so as to withstand forces exerted on the tie-down rings by large loads.

Another object of this invention is to provide a number of foldable tie-down rings to assist in securing a load. The tie-down rings may be in various shapes
20 designed for tying, hanging or hooking ropes thereto to secure the load. The tie down rings must be strong enough to withstand tension from heavy use of the tie-down rings due to large loads.

Moreover, the present invention also includes improvement and modification of the foldable tie-down ring(s) in order to secure a canopy, multi purpose box or
25 load blocking beam without having to drill into the pickup truck bed, and which is/are strong enough to withstand forces exerted from heavy loads whilst being able to hold such apparatus securely.

The fastening assembly, pursuant to the present invention, is suitable for use with pickup truck beds inwardly extending bed rails. The bed liner, used pursuant to this invention, has been drilled to provide holes in the side walls at the position which, when the liner is placed on the truck bed, the perimeter of the holes shall
5 cross the lower edge of the inwardly extending bed rail, and the diameter of the holes shall be sufficient for insertion of a clamp member of a foldable tie-down ring assembly.

The fastening assembly, pursuant to the present invention, consists of a foldable tie-down ring assembly, a screw and a supporting plate. The foldable tie-down
10 ring assembly consists of a base member, an elastic pad for the base member, a foldable tie-down ring, a clamp member, a rubber pad for the clamp member and an anti-loosing plastic.

By using only the foldable tie-down ring assemblies and screws, a bed liner can be fastened to the truck bed. The principle for securing is that the screw shall be
15 fastened to press the clamp member to the base member, with the bed liner and the bed rail in between. In case a supporting plate, which is attached to the inner surface of the bed rail, is also applied, the tie-down ring shall be used for tying heavy load without causing distortion to the bed rail. Effect from use and non-use of the supporting plate when heavily use the tie-down ring, can be compared as
20 follows: in case of no supporting plate, as shown in fig. 5, a rope (45) has pulled hardly at the tie-down ring to certain strain which cause torsion in the bed rail, as shown in fig. 6. However, if a supporting plate, which is made from sturdy material, is applied, at the same strain level, there is no distortion in the bed rail. This is a result from the supporting plate which spreads pressure over its surface
25 resulting in less pressure per each unit of area on the bed rail.

This invention further provides a fastening assembly for securing a bed liner having at least one hole to a truck bed, the truck bed having inwardly extending bed rails, the fastening assembly comprising:

30 a base member adapted to engage a clamp member through the bed liner hole, the base member and the clamp member clamp the bed liner

wall and the bed rail therebetween, the back of the base member has at least one extended direction control rod which is inserted through the bed liner hole;

- 5 the clamp member has at least one hole which receives the extended direction control rod of the base member, the hole of the clamp member can be moved relative to the extended direction control rod of the base member along its longitudinal axis, when the clamp member is assembled to the base member, the clamp member is still able to be inserted through the hole in the bed liner wall; and
- 10 a tie-down ring for attaching to the base member.

Brief Description of the Drawings

- The invention will be better understood by reference to the following description of several specific embodiments thereof as shown in the accompanying drawings.. However, this invention shall not be limited to the method, layouts
- 15 and type of apparatus precisely as shown in the drawings.

Figure 1 is the bed liner system which is secured by the fastening assembly pursuant to an embodiment of the present invention.

Figure 2 is the magnified cross section of one of the fastening assembly as shown in figure 1

- 20 Figure 3 is the side view of the fastening assembly.

Figure 4.1 is the fastener assembly pursuant to the US Patent no. 5,267,820, of which objective is only to secure the bed liner to the pickup truck bed.

Figure 4.2 is the fastening assembly of which the objective is to secure the bed liner to the pickup truck bed and to provide foldable tie-down rings with rotating axis attached to the base member. The figure shows the tie-down ring being lifted for tying loads.

- 5 Figure 5 is the side view of the fastening assembly with no supporting plate, with tension from rope 45 which is tied to the tie-down ring 3.

Figure 6 is the damage caused to the bed rail which resulted from high tension from the clamp member without using the supporting plate.

- Figure 7 is the front isometric view showing the foldable tie-down ring assembly
10 when de-assembled.

Figure 8.1 is the rear isometric view showing the foldable tie-down ring assembly when de-assembled.

Figure 8.2 shows the curved surface 34 of the lowest edge of the clamp 4.

- Figure 8.3 shows the curved surface 35 of the lower part of the extended plate at
15 the base member 1.

Figure 9.1 is the isometric view showing the supporting plate 7.

Figure 9.2 is the side view of the supporting plate 7.

Figure 10 is the dimension of the lock rotating axis 26 and the first part of the rotating axis socket 11.

- 20 Figure 11.1 is the cross section showing center 36 of the first part of the rotating axis socket 11.

Figure 11.2 is the side view of the rotating axis 37 of the tie-down ring which precisely overlays the center 36 of the first part of the rotating axis socket 11.

Figure 12.1 is the side view of the foldable tie-down ring assembly showing the tie-down ring 3 in the only position at which the lock rotating axis 26 can be inserted or removed, in accordance with the direction of the arrow shown in the figure.

- 5 Figure 12.1A is the magnified cross section of the lock rotating axis 26 when placed in the first part of the rotating axis socket 11 and the tie-down ring 3 is in the position shown in figure 12.1.

Figure 12.2 is the side view of the foldable tie-down ring assembly which the tie-down ring 3 is in a position as shown in the figure.

- 10 Figure 12.2A is the magnified cross section of the lock rotating axis 26 when placed in the first part of the rotating axis socket 11 and the tie-down ring 3 is in the position shown in figure 12.2.

Figure 12.3 is the side view of the foldable tie-down ring assembly when the tie-down ring 3 is folded to the base member 1.

- 15 Figure 12.3A is the magnified cross section of the lock rotating axis 26 when placed in the first part of the rotating axis socket 11 and the tie-down ring 3 is in the position shown in figure 12.3.

Figure 13.1 is the front isometric view when the tie-down ring 3 is assembled to the base member.

- 20 Figure 13.2 is the rear isometric view when the tie-down ring 3 is assembled to the base member.

Figure 14.1 is the cross section of the extended U-shaped 20 of the base member elastic pad 2 with the blocking rotating axis 24 preventing the base member elastic pad 2 from being removed from its position.

- 25 Figure 14.2 is the magnified cross section of figure 14.1.

Figure 15.1 is a front isometric view of the foldable tie-down ring assembly when completely assembled.

Figure 15.2 is a rear isometric view of the foldable tie-down ring assembly when completely assembled.

- 5 Figure 16.1 is the installation step showing the vertical mark 40 on the outer surface of the bed rail.

Figure 16.2 is the magnified cross section of figure 16.1.

Figure 17 is the step for installing the supporting plate 7 to the inner surface of the bed rail.

- 10 Figure 18.1 show the supporting plate 7 when completely installed.

Figure 18.2 is the step for installation supporting plate 7 to the inner surface of the bed rail. A spring clip 43 can be used to clamp and press on the outer surface of the bed rail.

- 15 Figure 19 is the installation step showing the inclining of the fastening assembly for insertion into a hole 42 drilled at the plastic bed liner 39.

Figure 20 is the installation step after inserting the fastening assembly into a hole 42 and setting the fastening assembly up right. This figure shows that there are supporting plate 7, pickup truck bed rail and side wall of the plastic bed liner placed between the clamp member 4 and the base member 1.

- 20 Figure 21 showing the rotating direction to fasten the screw in order to pull the clamp member linearly to press on the base member.

Figure 22 is a front isometric view after completely installed which the tie-down ring is folded to the base member.

Figure 23 is a front isometric view after completely installed which the tie-down ring is pulled up to tie rope.

Best Mode(s) for Carrying Out the Invention

Fastening assembly for pickup truck bed liner by using foldable tie-down ring
5 assembly and supporting plate consists of the following components:

1. Base member 1 works as a plate for pressing on the bed rail and also serves as base for attaching foldable tie-down ring 3, having the front and rear appearance as follows:

On the front there is a hole 10 for insertion of screw 9.

- 10 On the back, at the upper edge, there are number of cylinder shaped sockets, divided into two parts, i.e. first part 11 is for supporting lock rotation axis 26 and second part is the cylinder shaped socket 12 for insertion of blocking rotation axis 24, the rotation axis has collar 25 and the extended u-shaped part 20. The diameter of the first part of the rotating axis socket 11 is
15 slightly longer than that of the lock rotating axis 26 so that the lock rotating axis 26 can be rotated easily in the first part of the rotating axis socket 11.

- At the middle area, there are number of contact rods 15 extended from the base member 1 and placed around the open hole 10 of the base member. These rods shall be placed and contact with the perimeter of the open hole
20 42 in the bed liner so that the tie-down ring assembly can stand on the bed liner.

- Above the open hole 10, there is an contact plate 13 extended from the base member 1 with flat upper surface for placing in contact with the lower edge
25 41 of the bed rail and keep the tie-down ring assembly from rotating. The lower surface of the contact plate is convex surface 35, as shown in figure 8.3 for precise contact with the concave surface 30 in order to absorb forces passed from the concave surface 30.

Above the open hole 10, there is a direction control rod 14 which is longer than the contact plate 13. It has square or whatever shaped cross section which can be inserted into hole 29 of the clamp member 4 in order to control the moving direction of the clamp member 4.

5 Below the open hole 10, there is a force absorbing rod 16 with concave surface 18 for precise contact with the convex surface 34 at the lower part of the clamp member. This rod shall support the clamp member 4 in up right position and shall absorb forces passed from the convex surface 34 due to heavy load at the tie-down ring.

10 At the lower left and right, there are number of lock sockets 19 which fit to the extended locks 23 of the elastic pad of the base member 2, with sufficient friction so that the elastic pad of the base member 2 can be hardly removed from the base member 1.

The edge of the force absorbing rod is chamfered in a curve surface 17 so
15 that when the clamp member 4 moves toward the base member 1, it will not hit the edge of the force absorbing rod 16.

2. Elastic pad of the base member 2 serves as buffer of the base member 1. When the fastening assembly is installed, the rubber pad shall be placed between the base member 1 and the bed liner 38 and works as an insulator
20 preventing water to enter an open hole 42, having appearance as follows:

There are number of U-shaped extended parts 20 which perfectly fit to the cylinder sockets 12 and there are number of extended locks 27 which perfectly fit into the locking sockets 27 with sufficient friction to lock the tie-down ring 3 to the base member when in folding position. There is an open
25 hole 22 in any shape which may not block the insertion of the contact rods 15, with number of extended locks 23 that perfectly fit into the lock sockets 19.

3. Foldable tie-down ring 3, in U-shaped, anchor-shaped or any shape for the purpose of tying, hanging or hooking rope for tying load. At the upper edge, there is a three parts rotating axis. Each part of the axis has different function as follows:

- 5 First part is the lock axis 26 with circular cross section that has been unevenly bevelled at the upper and lower side. According to figure 10, the upper side bevelled at the length a and the lower side bevelled at the length b and this makes the thickness of the axis 26 equals to c. The lock axis 26 serves in keeping the foldable tie-down ring 3 in the first part of the socket 11
10 unless being removed horizontally from the back side of the base member 1, according to figure 12.1. In addition, there is a rotating axis 37 which precisely overlays the center 36 of the first part of the socket 11, as shown in figures 11.1 and 11.2.

- 15 Since the lock axis 26 is an integral part of the foldable tie-down ring 3, the assembly of the foldable tie-down ring assembly can be done quickly.

Second part is the axis with collar 25 with circular cross section serves as side tension absorbance due to load that are lateral to the foldable tie-down ring 3 from the left or right side so that both sides of the tie-down ring 3 are not broken apart.

- 20 Third part is the blocking axis 24 with circular cross section serves as a blockage to the extended U-shaped 20 to prevent the elastic pad of the base member 2 from falling off the base member 1.

- 25 There is also number of sockets 27 which perfectly fit with the extended locks 21 of the elastic pad of the base member 2 to provide friction when the tie-down ring is pulled or folded down. This prevents the tie-down ring from shaking when truck is moving.

4. Clamp member 4, having the front and rear appearance as follows:

On the front, there is a locking trough 28 in trapezoid shaped which perfectly fit the extended locking rod 33 of the rubber pad for clamp member 5 which also has a cross section in trapezoid shaped. They have sufficient friction to prevent the rubber pad for clamp member 5 from being removed from the locking trough 28.

In the middle, there is a hole 29 which is slightly bigger than the a direction control rod 14, for insertion of the a direction control rod 14 to control motion of the clamp member along the direction control rod 14.

Below hole 29 is a concave surface 30, as shown in figure 7, to support the convex surface 35, as shown in figure 8.3.

Next below the concave surface 30, there is an internal threaded hole 31 used for tightening the screw 9.

At the lowest edge is the convex surface 34, as shown in figure 8.2 to perfectly fit with the curve surface 18, as shown in figure 8.1.

On the back, there is a crucible 32 for placing anti-loosening plastic 6.

5. Rubber pad for clamp member 5 for preventing scratch on the inner surface of the bed rail or the supporting plate 7 due to the clamp member. Behind the pad, there is an extended locking rod 33 which perfectly fit into the locking trough 28 on the clamp member 4.

6. Anti-loosening plastic 6 to prevent the screw 9 from loosen.

7. Supporting plate 7 in rectangular shape. The purpose of the supporting plate is to distribute compressive force, from the clamp member 4 on the bed rail, all over the supporting plate contact surface.

As for the installation, it requires a method to place the supporting plate 7 in the correct position before fastening the screw, i.e. at the inner side and parallel to the bed rail. The present invention uses double side adhesive tape 8, as shown in figure 18.1. There are other methods which may be categorized in 2 groups, e.g. by using material to be laid between the bed rail and the supporting plate, such as using glue, and by using material to be laid on the outer surface of the bed rail, such as a spring clip, as shown in figure 18.2.

An advantage of using the double side adhesive tape 8 is to prevent the supporting plate from scratching the inner side of the bed rail.

8. Screw for fastening into the internal threaded 31.

The base member 1, foldable tie-down ring 3, clamp member 4, supporting plate 7 and screw 9 are made from sturdy material. Therefore, when assembled, shall create a strong and secure fastening with tie-down rings for heavy loads.

The assembly of the foldable tie-down ring assembly starts from attaching the elastic pad of the base member 2 to the base member 1 and attach the foldable tie-down ring 3 by pushing the lock axis 26 into the first part of the socket 11 horizontally, as shown in figure 12.1. Thereafter, turn the foldable tie-down ring in direction as shown in figure 12.2 and 12.3. Then assemble the clamp member 4 by inserting the direction control rod 14 into the hole 29 and insert the screw 9 through hole 10 at the base member 1. fastening the screw 9 into the internal threaded hole 31. Completely assembled is shown in figure 15.1 and 15.2.

Method for installation the fastening assembly pursuant to the present invention is as follows:

1. Place the bed liner 38 with number of drilled holes 42 on the side walls, on the pickup truck bed. At the intersection of the perimeter of the holes 42 on

the bed liner and the lower edge of the bed rail 41, part of the bed rail edge can be seen. Use a pen to make a vertical mark on the edge of the bed rail in alignment with the center of the hole 42. Make such mark in every intersection, both on the left and right walls of the truck bed, as shown in figure 16.1 and 16.2.

2. Lift the bed liner 38 off the truck bed and install the supporting plate 7 at the bed rail by pulling the cover pad of the double glued surface tape 8 on the supporting plate 7 and press the double glued surface tape 8 on the inner surface of the bed rail. The center 44 of the supporting plate 7 must be aligned with the vertical mark 40 already prepared, as shown in figure 17. Complete the installation at all positions, both on the left and right walls of the truck bed.
3. Place the bed liner 38 on the pickup truck bed.
4. Tilt the foldable tie-down ring assembly and insert into hole 42 on the bed liner 38, as shown in figure 19. Set the tie-down ring assembly up right, as shown in figure 20 and fasten the screw 9, as shown in figure 21. Complete the installation at all positions, both on the left and right walls of the truck bed.
5. Complete installation is shown in figure 22. It should be noted that the tie-down ring assembly fully covers the holes 42 on the bed liner 38.

Any modification may be made by a person with ordinary skill in the pertaining science and can be done without being regarded as a differentiation from the object of this invention, as appears in the attached claims.

Throughout the specification, unless the context requires otherwise, the word "comprise" or variations such as "comprises" or "comprising", will be understood to imply the inclusion of a stated integer or group of integers but not the exclusion of any other integer or group of integers.

The Claims Defining the Invention are as Follows

1. A fastening assembly for securing a bed liner having at least one hole (42) to a truck bed, the truck bed having inwardly extending bed rails, the fastening assembly comprising:
 - 5 a base member (1) adapted to engage a clamp member (4) through the bed liner hole (42), the base member (1) and the clamp member (4) clamp the bed liner wall and the bed rail therebetween, the back of the base member (1) has at least one extended direction control rod (14) which is inserted through the bed liner hole (42);
 - 10 the clamp member (4) has at least one hole (29) which receives the extended direction control rod (14) of the base member (1), the hole (29) of the clamp member (4) can be moved relative to the extended direction control rod (14) of the base member (1) along its longitudinal axis, when the clamp member (4) is assembled to the base member (1), the clamp
 - 15 member (4) is still able to be inserted through the hole (42) in the bed liner wall; and
 - a tie-down ring for attaching to the base member (1).
2. A fastening assembly of claim 1 further comprising a fastener having male thread which cooperates with a female threaded portion to secure the base
- 20 member (1) to the clamp member (4).
3. A fastening assembly of claim 2 further comprising an anti-loosening plastic (6) installed in an end of the female threaded portion.
4. A fastening assembly of claims 1, 2 or 3 further comprising a elastic pad (2) which is placed between the base member (1) and the bed liner wall.

5. A fastening assembly of any one of the preceding claims further comprising a rubber pad (5) for attaching to the clamp member (4), the rubber pad (5) is placed between the clamp member (4) and the inner surface of the bed rail.
- 5 6. A fastening assembly of any one of the preceding claims further comprising a supporting plate (7) for attaching to the inner surface of the bed rail, the support plate (7) is positioned such that it is between the clamp member (4) and the inner surface of the bed rail when the fastening assembly is in place.
- 10 7. A fastening assembly of claim 6 further comprising a double side adhesive tape (8) for attaching the supporting plate (7) to the inner surface of the bed rail.
8. A fastening assembly of claim 6 further comprising spring clips for securing the supporting plate (7) to the inner surface of the bed rail.
- 15 9. A fastening assembly of any one of the preceding claims wherein the base member (1) includes a force absorbing rod (16) which is adapted to support the lower edge of the clamp member (4), when the fastening assembly is in place.
10. A fastening assembly of any one of the preceding claims wherein the direction control rod (14) has a contact plate (13) extending from both sides.
- 20 11. A fastening assembly substantially as herein described with reference to the drawings with the exclusion of figure 4.1.

Dated this Eighteenth day of March 2004.

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Patent Attorneys for the Applicant

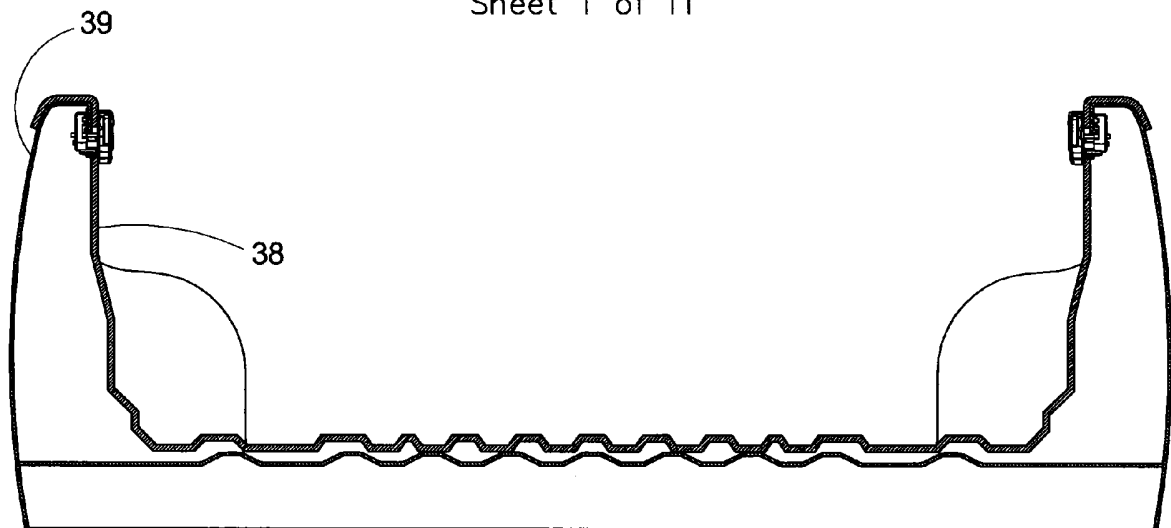


FIG. 1

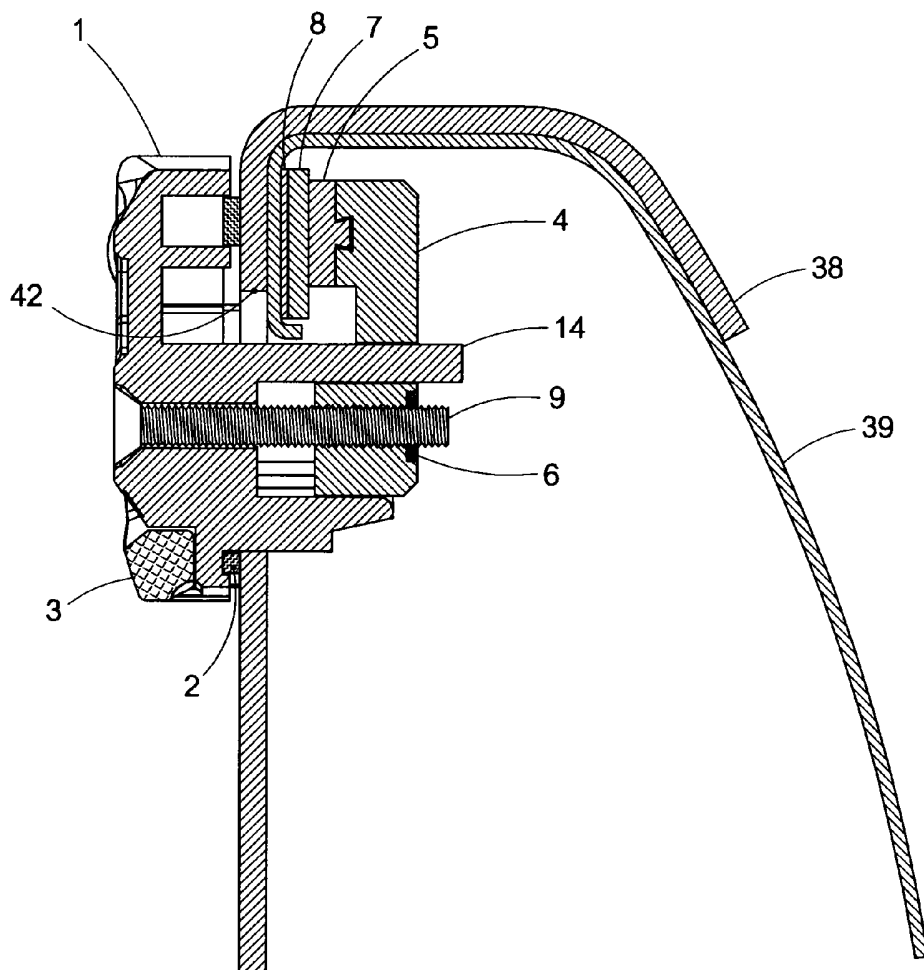


FIG. 2

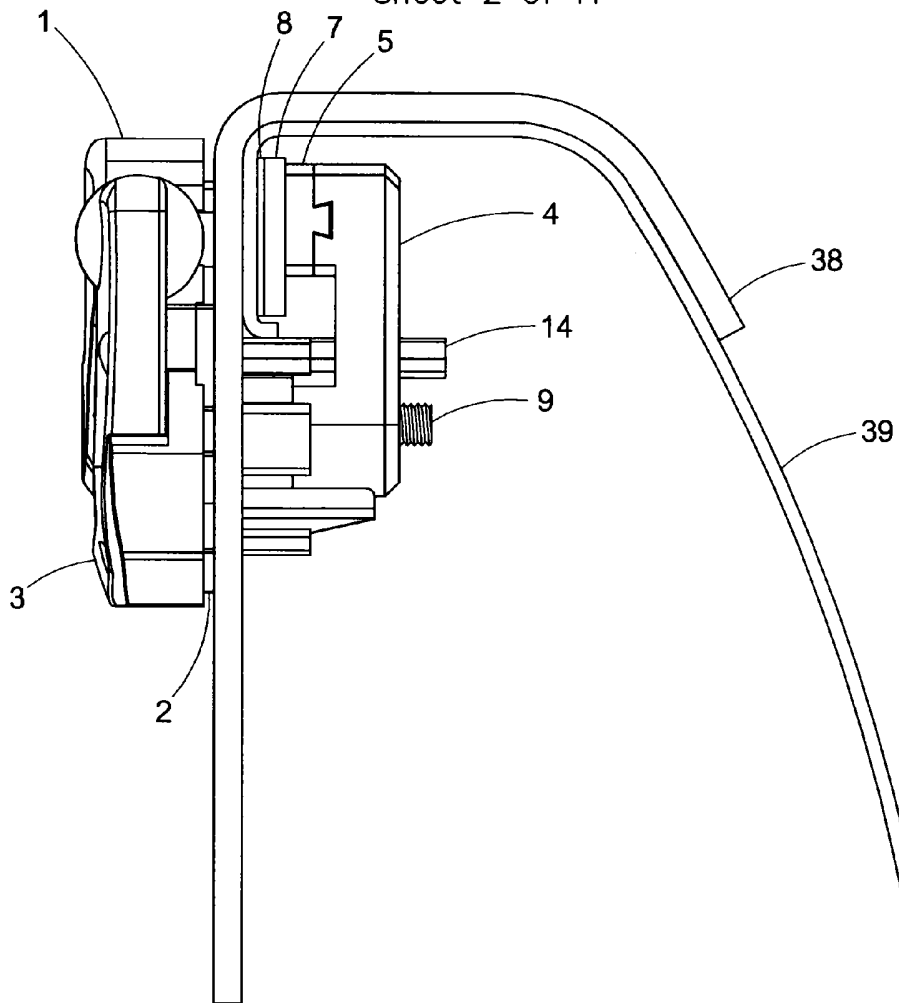


FIG.3

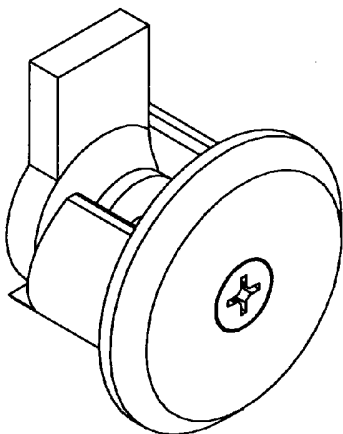


FIG. 4.1

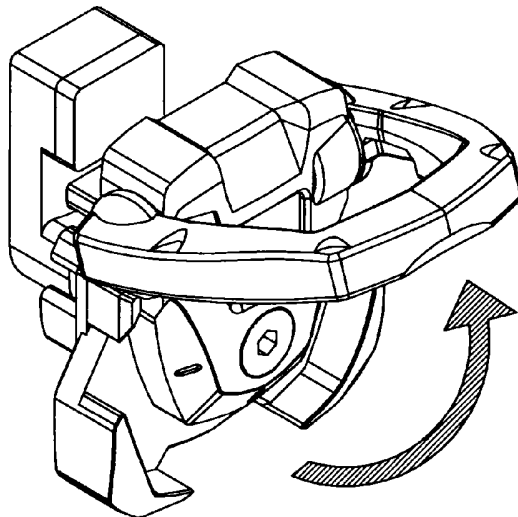


FIG. 4.2

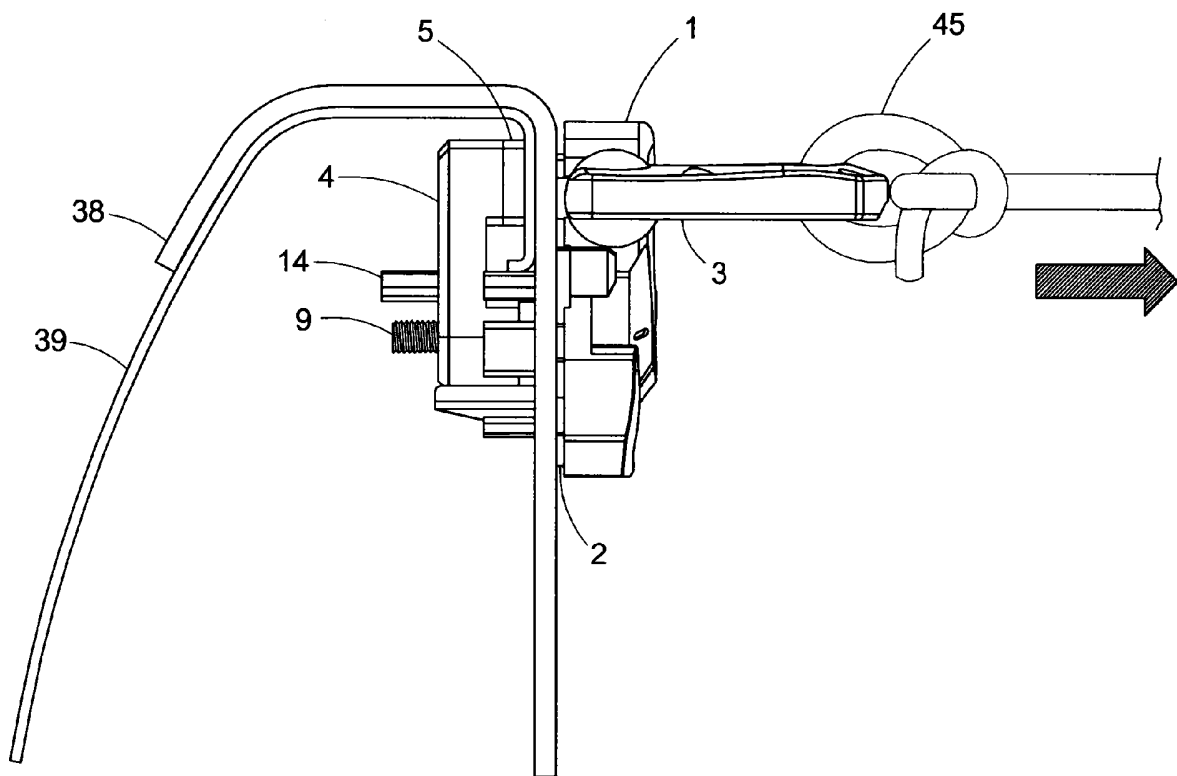


FIG. 5

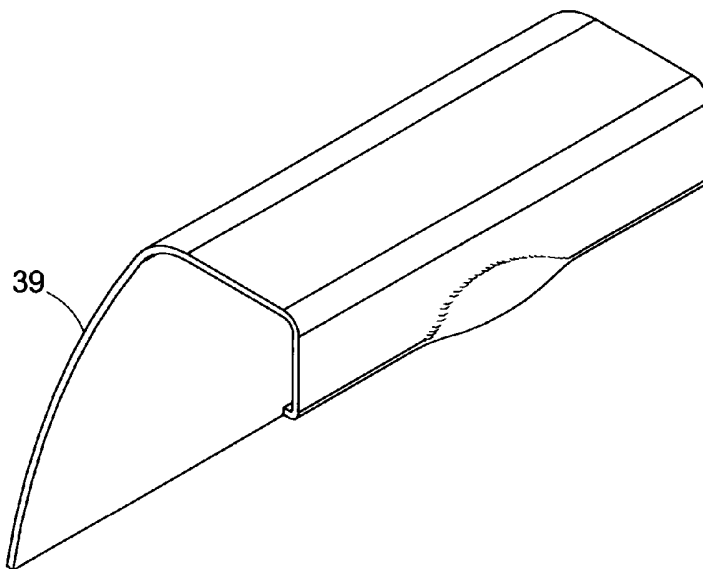


FIG. 6

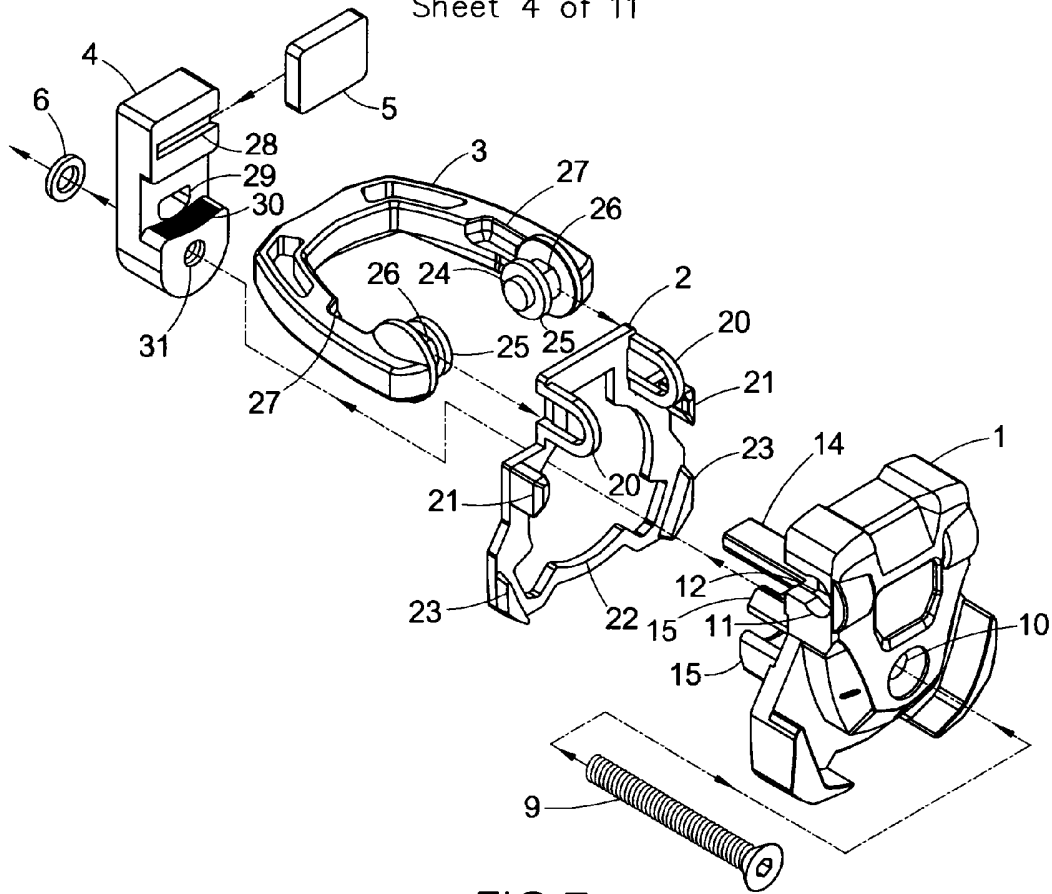


FIG. 7

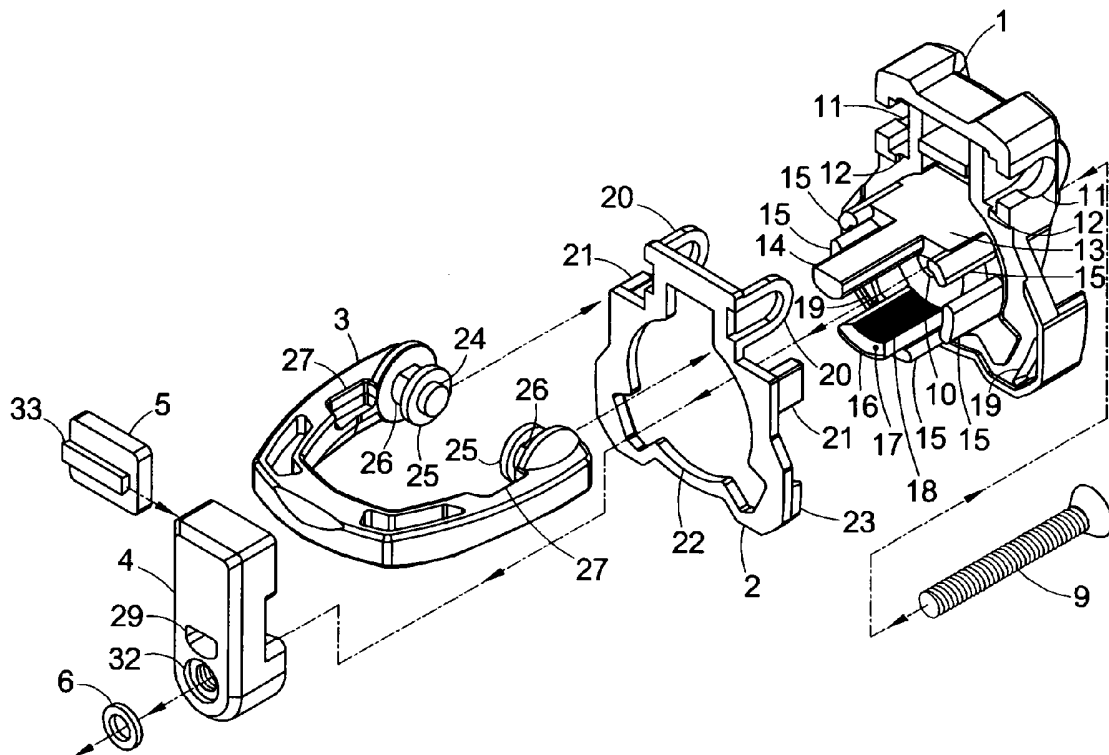


FIG. 8.1

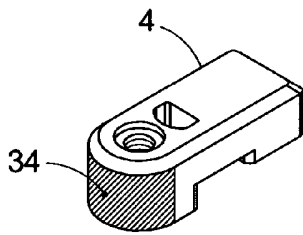


FIG. 8.2

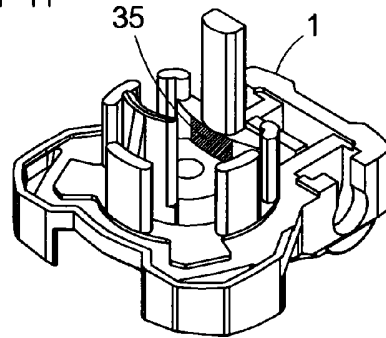


FIG. 8.3

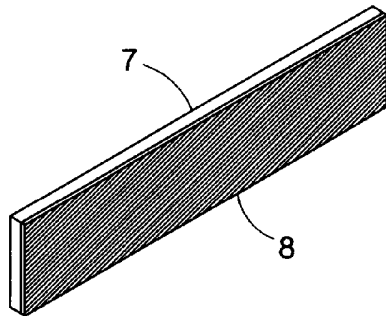


FIG. 9.1

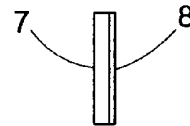


FIG. 9.2

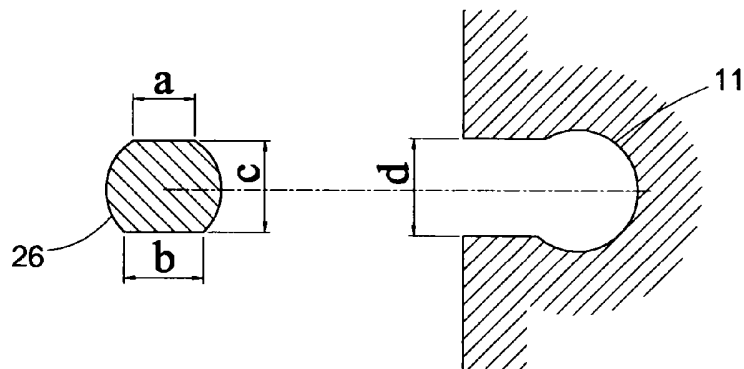


FIG. 10

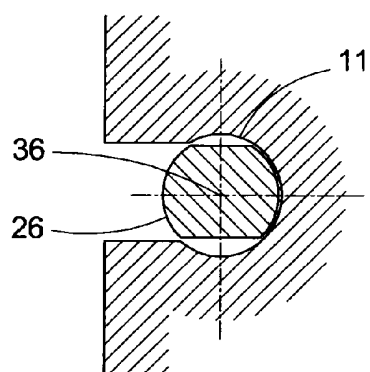


FIG. 11.1

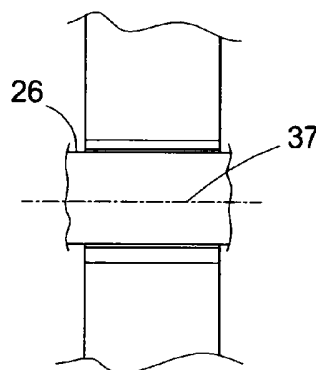


FIG. 11.2

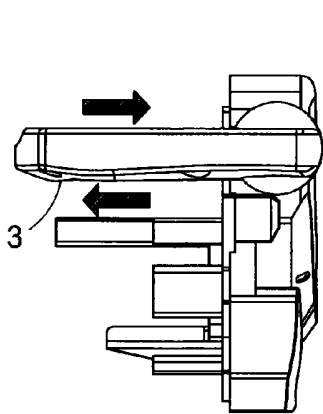


FIG. 12.1

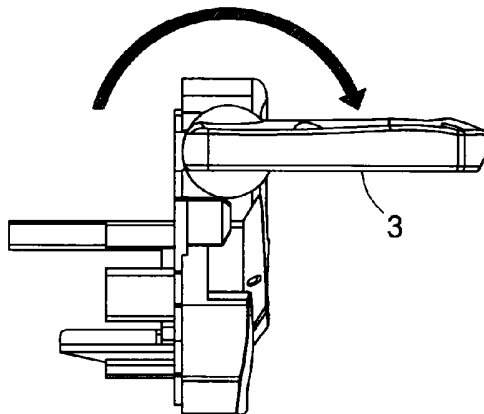


FIG. 12.2

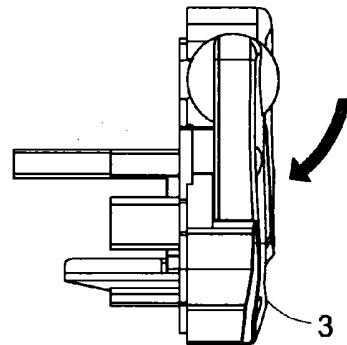


FIG. 12.3

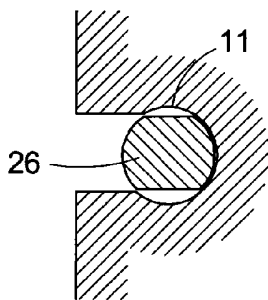


FIG. 12.1A

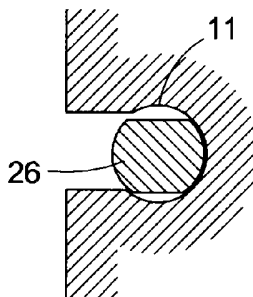


FIG. 12.2A

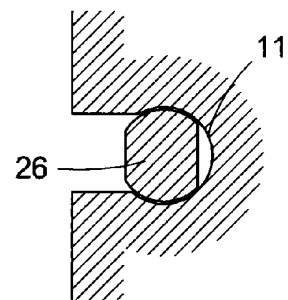


FIG. 12.3A

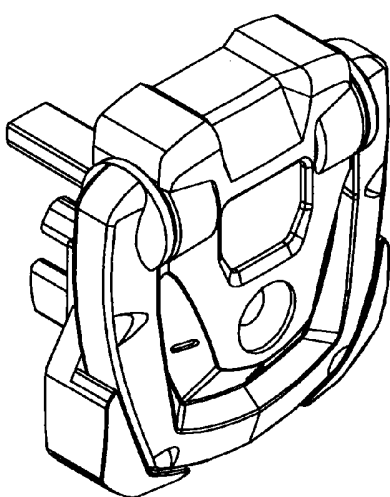


FIG. 13.1

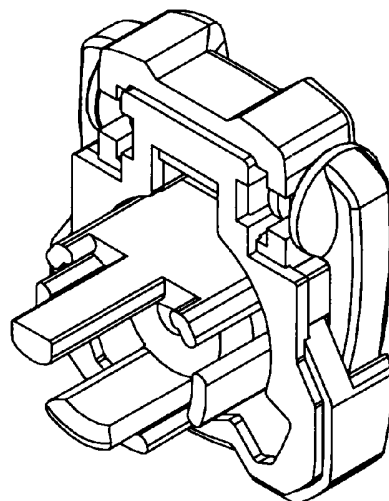


FIG. 13.2

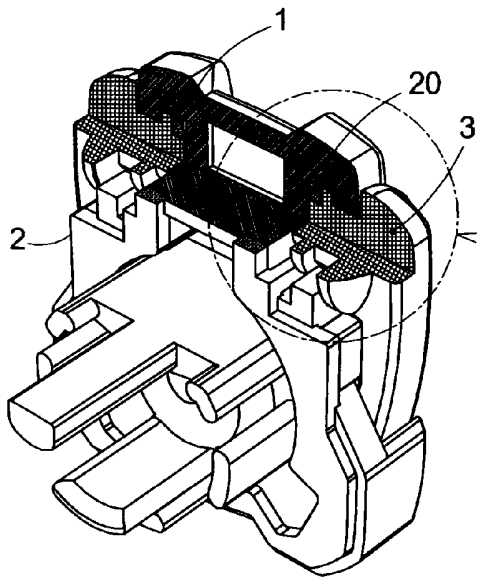


FIG. 14.1

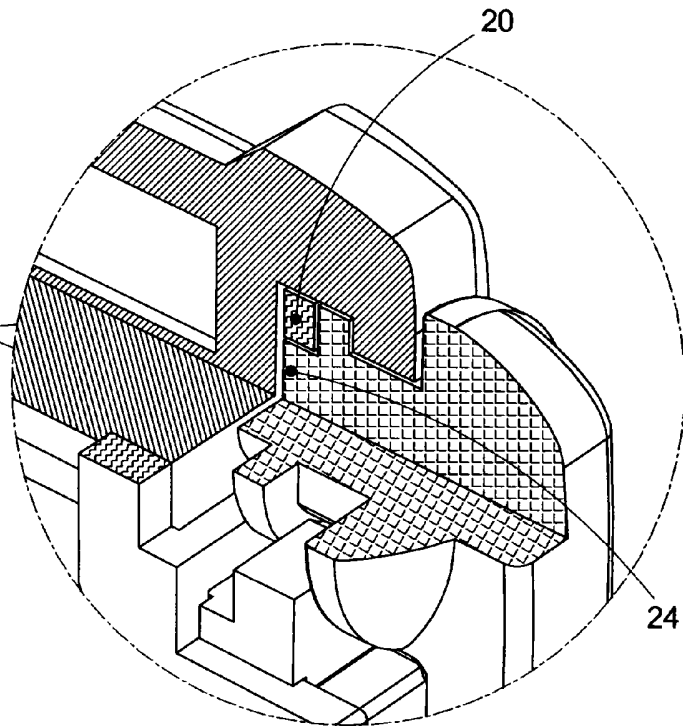


FIG. 14.2

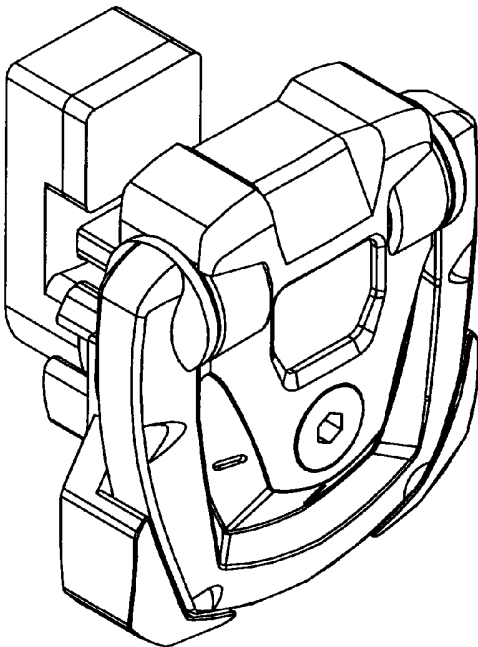


FIG. 15.1

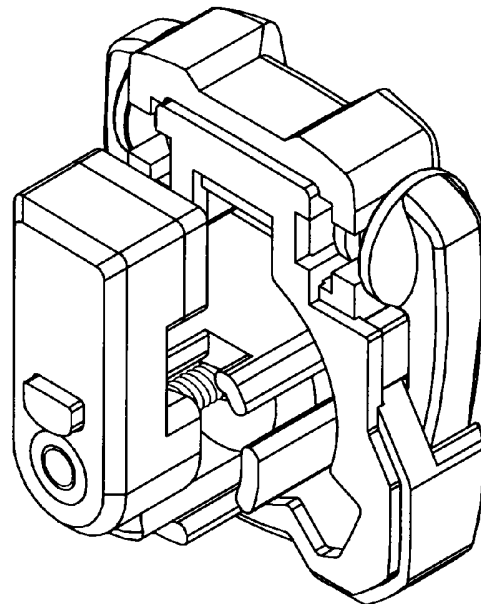


FIG. 15.2

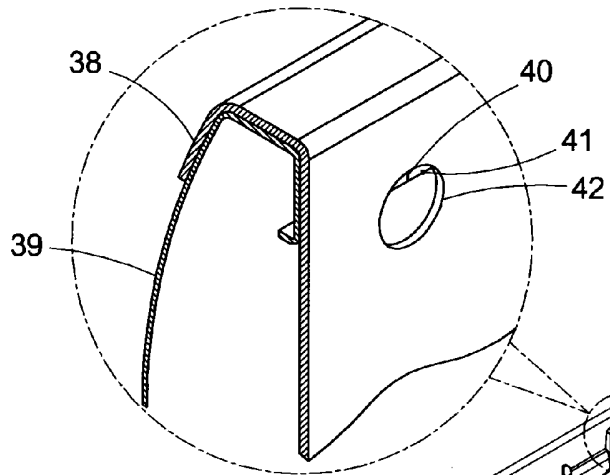


FIG. 16.2

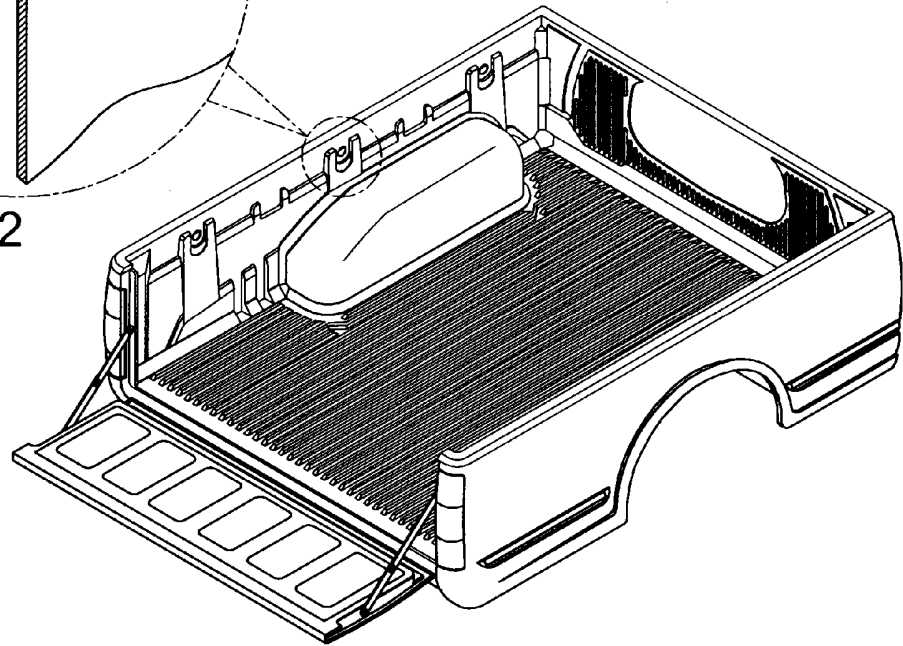


FIG. 16.1

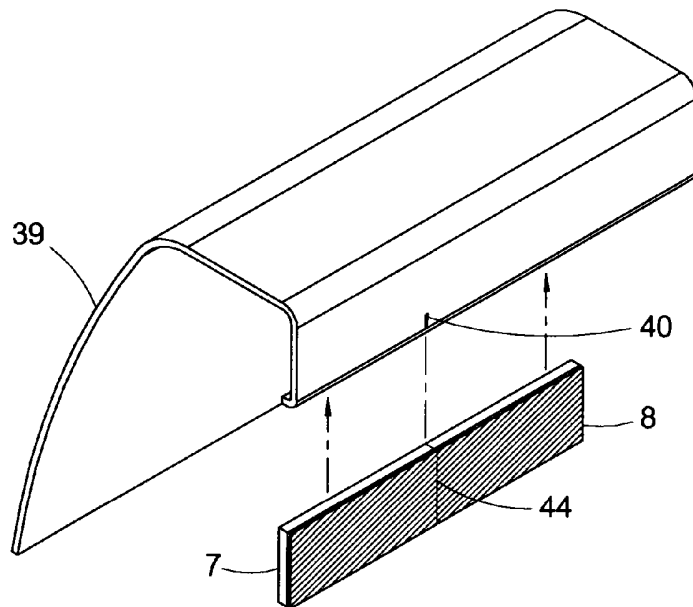


FIG. 17

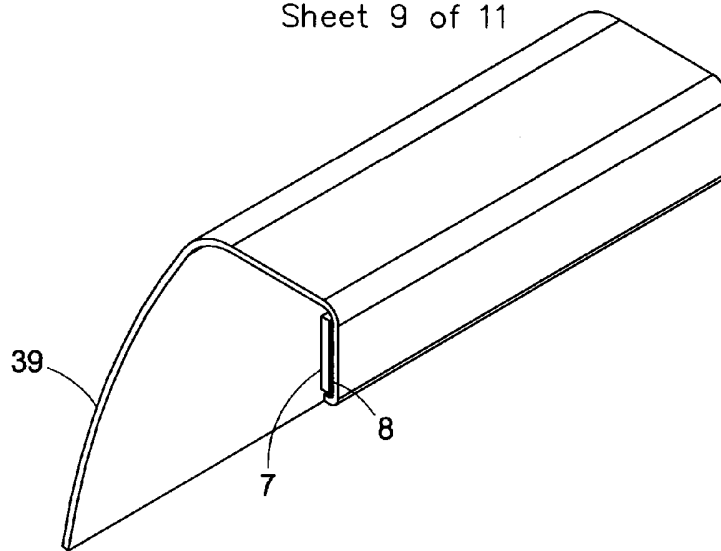


FIG. 18.1

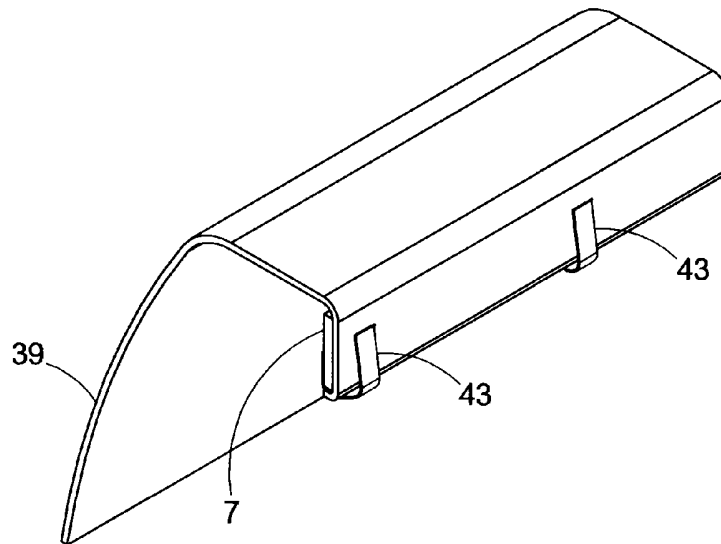


FIG. 18.2

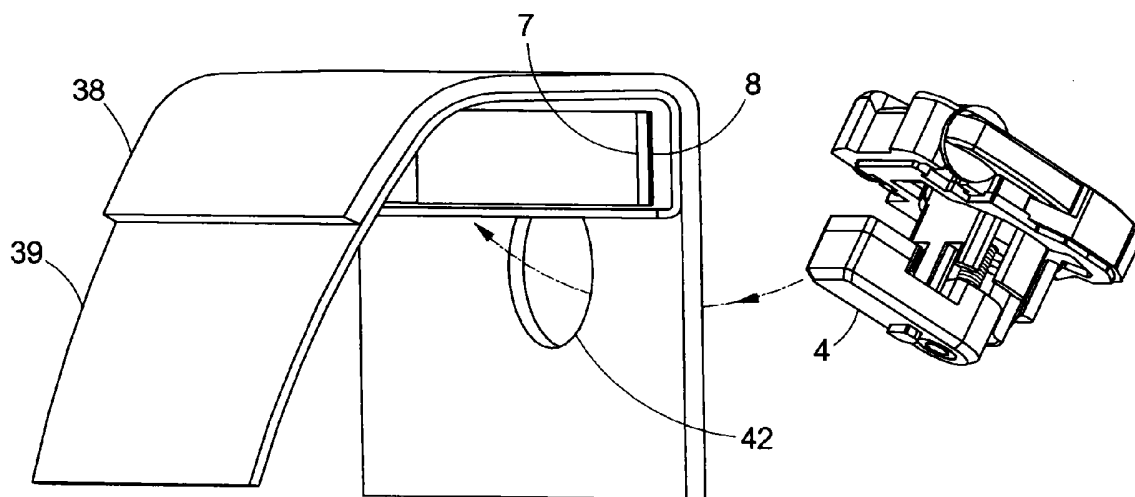


FIG. 19

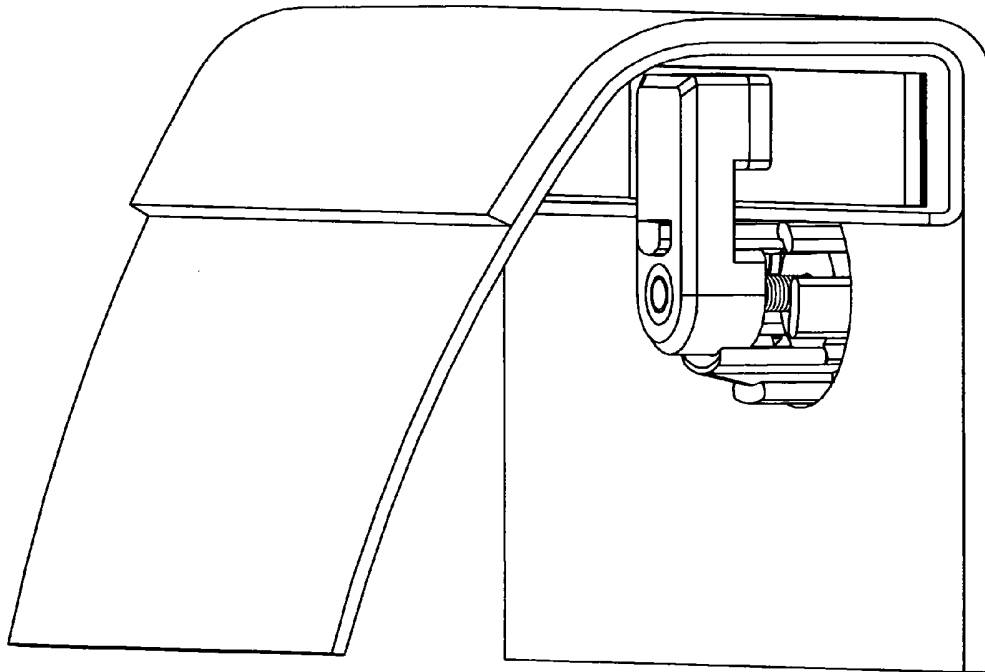


FIG. 20

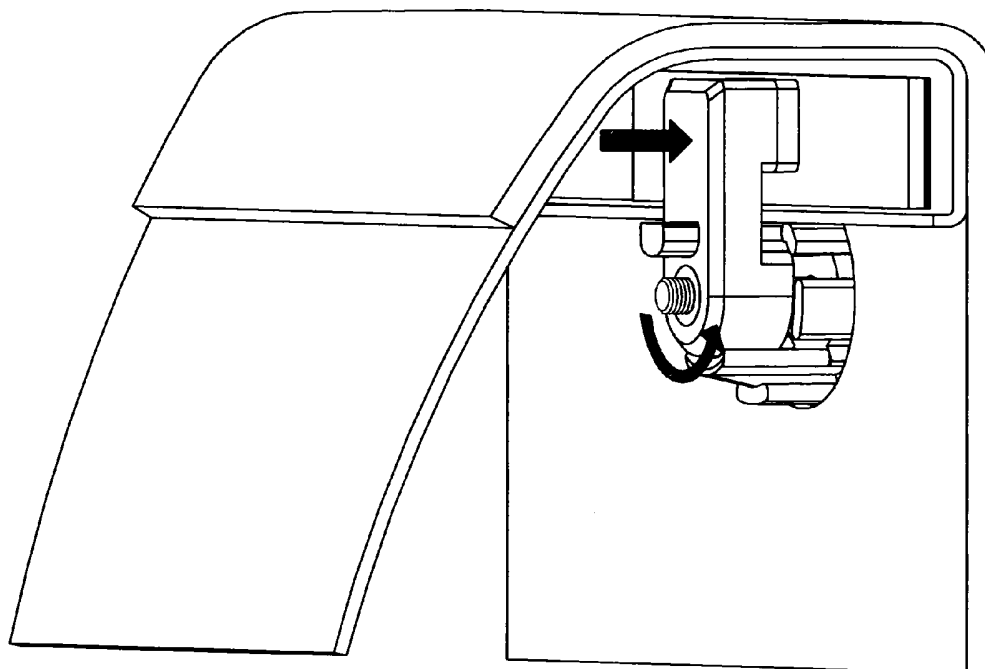


FIG. 21

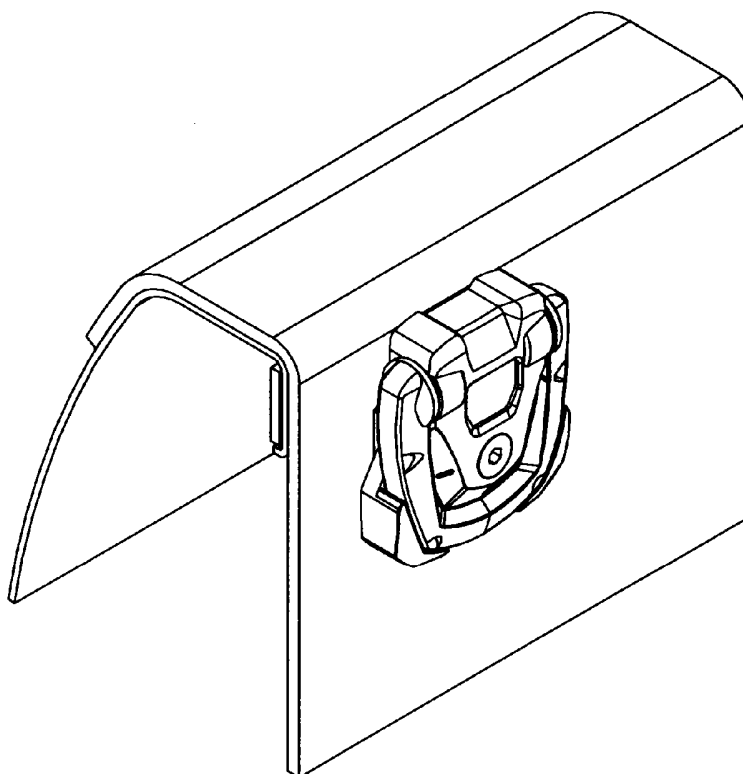


FIG. 22

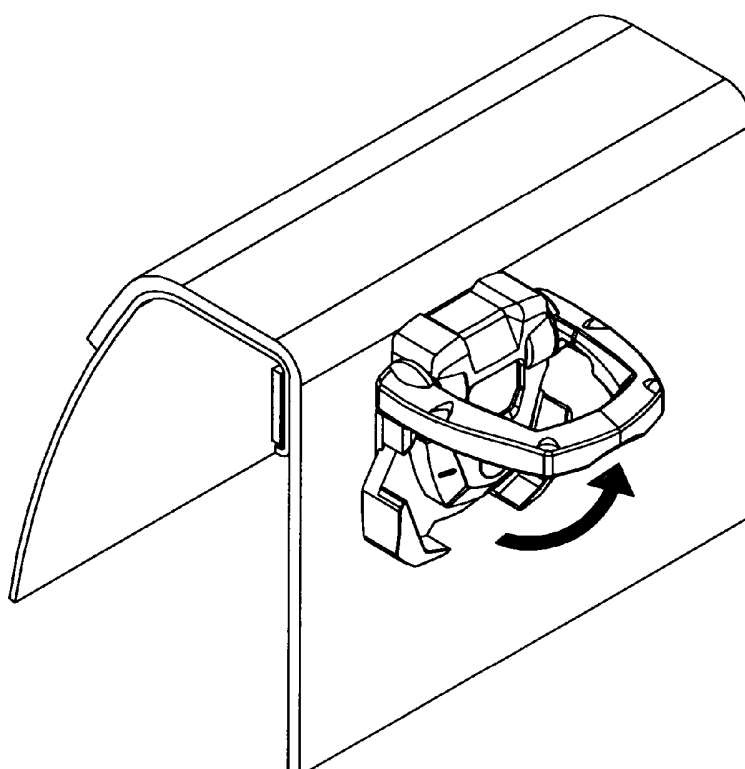


FIG. 23