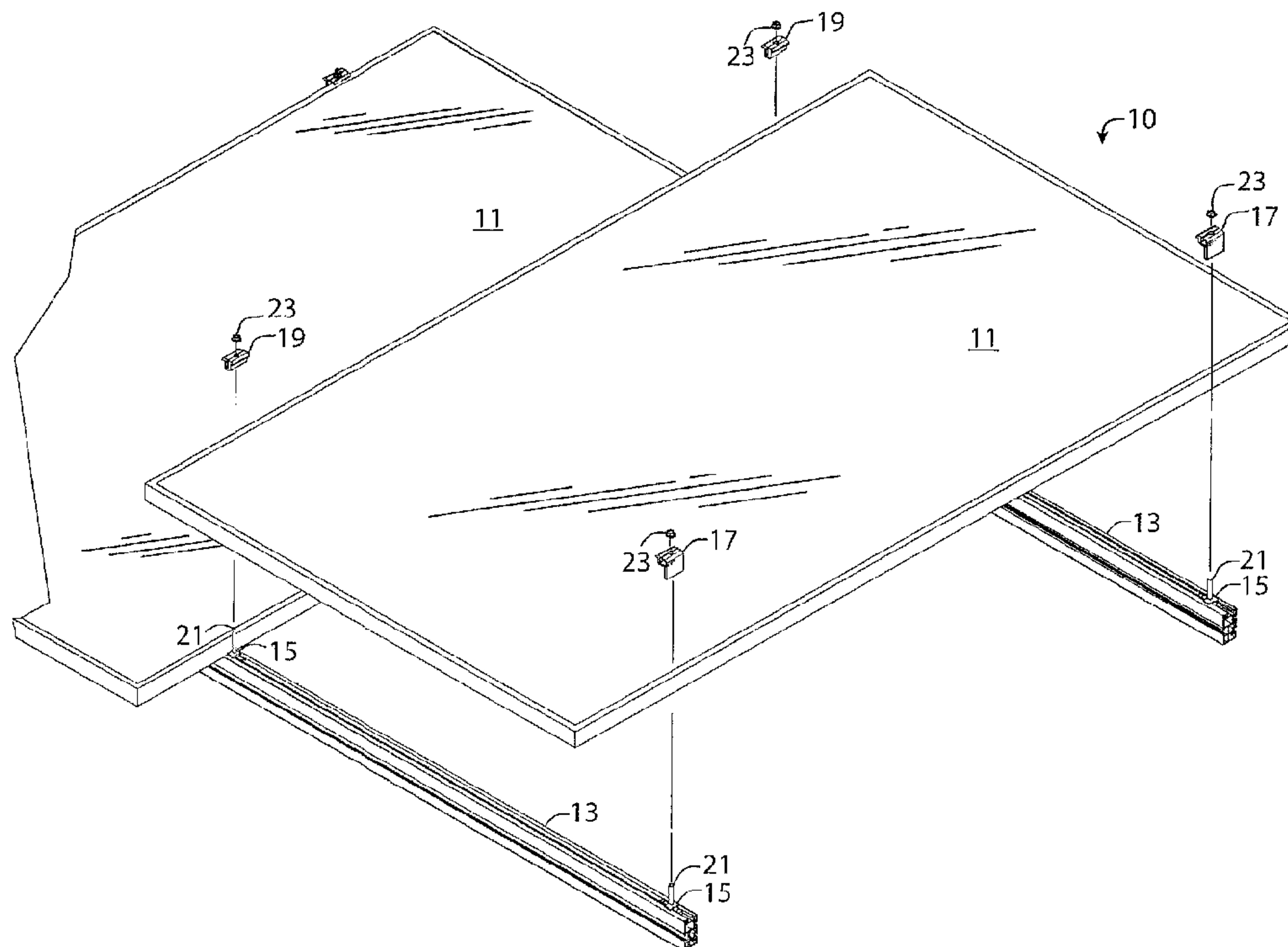




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(54) Titre : DISPOSITIF DE FIXATION SUR TOITURE ET DE MISE A LA TERRE DE PANNEAUX SOLAIRES  
 (54) Title: SOLAR PANEL ROOFTOP MOUNTING AND GROUNDING DEVICE



(57) **Abrégé/Abstract:**

Disclosed is a device for securing, mounting, aligning, and grounding solar panels to a roof mounted rail. The device in combination with a t-bolt, a nut, and a solar panel end-clamp or mid-clamp, secure, mount, align, and ground the solar panels to the roof mounted rail. The device can be inserted into the top of the rail anywhere along its length. After the device and t-bolt are inserted in the rail, the t-bolt rotated so it inserts into a slot at the bottom of the rail thereby securing the device to the rail, assuring the proper orientation of the t-bolt, and preventing further rotation of the t-bolt.

ABSTRACT

[0042] Disclosed is a device for securing, mounting, aligning, and grounding solar panels to a roof mounted rail. The device in combination with a t-bolt, a nut, and a solar panel end-clamp or mid-clamp, secure, mount, align, and ground the solar panels to the roof mounted rail. The device can be inserted into the top of the rail anywhere along its length. After the device and t-bolt are inserted in the rail, the t-bolt rotated so it inserts into a slot at the bottom of the rail thereby securing the device to the rail, assuring the proper orientation of the t-bolt, and preventing further rotation of the t-bolt.

**SOLAR PANEL ROOFTOP MOUNTING AND GROUNDING DEVICE****BACKGROUND**

[0001] The present disclosure relates to a device for mounting solar panels. In particular, the present disclosure relates to a device for mounting solar panels, such as solar photovoltaic (PV) or solar thermal panels, to rooftop mounted rails.

[0002] Solar panels can be mounted to various types of roof structures, such as pitched shingle, tile, metal, or concrete roofs with rails. For pitched roofs that are rectangular shaped, the rails are often mounted along the length of the roof. The solar panels are generally mounted to the rails along an edge perpendicular to the rails. In addition, it is desirable, and often required by local building codes, to electrically ground the solar panels to the rails.

[0003] Aligning and mounting the solar panels to the rails and then assuring that they are properly grounded can often be labor intensive and time consuming. It is therefore desirable for a device that secures, aligns, and grounds the solar panels to the rails that is simple and efficient.

SUMMARY

[0004] Disclosed is a device for securing, aligning, and grounding solar panels to roof mounted mounting rails that overcomes one or more of the challenges presented in the Background Section. The device in combination with a t-bolt, a nut, and a solar panel end-clamp or mid-clamp, now secure, mount, align, and ground the solar panels to each other and to the roof mounted rail. The device can be inserted into the top of the rail anywhere along its length. After the device and t-bolt are inserted in the rail, the t-bolt is rotated so it inserts into a slot at the bottom of the rail thereby securing the device to the rail and preventing further rotation of the t-bolt.

[0005] In one aspect of the present disclosure, an apparatus for mounting a solar panel to a rail includes a t-bolt in conjunction with a mounting device. The mounting device includes a base portion and an alignment portion. The alignment portion projects upward from the base portion. The alignment portion is configured to align at least one side of a solar panel perpendicular to the rail. Grounding pins go through both the top and bottom surface of the base portion, the grounding pins have conical or pointed tips on either end to penetrate the non-conductive oxide layer of the solar panels frames and the mounting rail. When the solar panels are secured to the mounting device base portion on either side of the alignment portion, they are electrically bonded to each other as well as the mounting rail. The apparatus can be configured so that when t-bolt is engaged in a slot in the base portion, and the base portion and t-bolt in combination are both engaged

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within a slot at the top of the rail, the top surface of the base portion will be parallel with and positioned at or below the top surface of the rail slot. This provides a stable seating surface for the solar panels. In addition, the alignment portion bottom surface will include portions resting against the rail top surface on opposing sides of the rail slot. This arrangement adds stability to the apparatus. The t-bolt is vertically captive within the rail slot and rotatively captive within the base portion slot. This arrangement allows an installer to secure the solar panel to the t-bolt with only a solar panel clamp and a single mounting nut.

**[0006]** In another aspect of the present disclosure, an apparatus for mounting a solar panel to a rail the apparatus includes a t-bolt and a mounting device. The mounting device includes a base portion and an alignment portion that projects upward from the base portion. The base portion and alignment portion are integrally joined and can be integrally formed. The base portion includes a pair of opposing and parallel sides. The bottom surface of the base portion includes a transverse slot. The slot is wider than the width of the t-bolt head and narrower than the t-bolt head length. The alignment portion a pair of opposing sides that are parallel to each other. The pair of opposing parallel sides project perpendicularly upward from the base portion and are oriented perpendicularly transverse with respect to the base portion sides. The alignment portion is positioned with respect to the base portion so that a top surface of the base portion presents a planar top surface on the opposing parallel sides of the alignment portion. The alignment portion

also includes an aperture aligned over the base portion slot for pass through a portion of the t-bolt.

[0006a] According to another aspect of the present disclosure, there is provided an apparatus for mounting solar panels, including: a t-bolt including a t-bolt body, and a t-bolt head, the t-bolt head including a t-bolt head planar bottom surface with the t-bolt body projecting perpendicularly therefrom; a rail including a rail top surface, a rail slot running longitudinally along the rail top surface, and a rail slot cavity below the rail slot and integral to and wider than the rail slot; a mounting device including a planar top surface, a planar bottom surface, a first portion with first portion parallel sides projecting vertically upward out of the planar top surface, a second portion with second portion parallel sides projecting vertically downward out of the planar bottom surface and aligned under and along the first portion parallel sides, a second portion slot oriented transversely across and through the second portion parallel sides, and an aperture through the second portion slot and the first portion, and the aperture sized to receive the t-bolt body; and the t-bolt, the mounting device, and the rail configurable into a first position where: the t-bolt is received by the aperture and vertically and rotational captive within the second portion slot, the t-bolt head planar bottom surface engages flush against the rail slot cavity, the second portion fully within the rail slot and the rail slot cavity, and the planar bottom surface of the mounting device engages flush against the rail.

[0006b] According to yet another aspect of the present disclosure, there is provided an apparatus for mounting solar panels to rails including: a t-bolt including a t-bolt body, and a t-bolt head, the t-bolt head including a t-bolt head planar bottom surface with the t-bolt body projecting perpendicularly therefrom; a rail including a rail top surface, a rail slot running longitudinally along the rail top surface, and a rail slot cavity below the rail slot and integral to and wider than the rail slot; a solar panel including a solar panel frame; a mounting device including a base portion fully within the rail slot and the rail slot cavity, a rigid alignment portion rigid joined to and projecting vertically upward from the base portion and resting on the rail top surface, a base portion slot in a base portion bottom surface and oriented transversely to a rail slot length, and an aperture positioned through the rigid alignment portion and the base portion slot; and the t-bolt, the mounting device, the solar panel, and the rail configurable into a first position where: the t-bolt is received by the aperture and vertically and rotationally captive within the base portion slot, the t-bolt head planar bottom surface engages flush against the rail slot cavity, the bottom of the solar panel frame engages flushly against the rail and over the base portion, and an edge of the solar panel oriented transverse to a rail length engages flushly against the rigid alignment portion.

[0007] This Summary has introduced a selection of concepts in simplified form that are described in greater detail in the Description. The Summary's purpose is to aid in understanding the Description. It is not intended to identify essential features or limit the scope of the claimed subject matter.

DRAWINGS

[0008] FIG. 1 shows solar panels, a rail, and a device for mounting, aligning, and grounding the solar panels to the rail, in partially exploded perspective view.

[0009] FIG. 2 shows a front view of a portion of the solar panels mounted, aligned, secured, and grounded to the rail with the mounting device with a mid-clamp.

[0010] FIG. 3 shows a front view of an end portion of one of the solar panels mounted, aligned, secured, and grounded to the rail and to each other, with the mounting device with an end-clamp.

[0011] FIG. 4 shows a portion of a solar panel mounted, aligned, secured, and grounded to the rail and to each other, with the mounting device and a mid-clamp in perspective view. The second solar panel removed for clarity.

- [0012] FIG. 5 shows, in exploded back perspective view, the mounting device with the solar panel end-clamp, and t-bolt, and nut.
- [0013] FIG. 6 shows, in exploded front perspective view, the mounting device with the solar panel end-clamp, t-bolt, and nut.
- [0014] FIG. 7 shows, in side-view, the t-bolt, and mounting device mounted into the rail slot but not secured.
- [0015] FIG. 8 shows the t-bolt, and mounting device secured to the rail slot.
- [0016] FIG. 9 shows an exploded bottom perspective view of the base portion and the t-bolt where the t-bolt is aligned for insertion into the rail slot.
- [0017] FIG. 10 shows a bottom perspective view of the t-bolt inserted into the mounting device where the t-bolt is aligned, as in FIG. 9, for insertion into the rail slot.
- [0018] FIG. 11 shows a bottom perspective view of the t-bolt 21 inserted into the mounting device 15 illustrated the relationship between the t-bolt 21 and the mounting device 15 when they are secured to the mounting rail.
- [0019] FIG. 12 shows an exploded perspective view of the mounting device and the grounding pins.

[0020] FIG. 13 shows an exploded perspective view of the mounting device with the grounding pins secured in the base portion.

[0021] FIG. 14 shows a top view of the mounting device.

[0022] FIG. 15 shows a sectional view of the mounting device of FIG. 14 taken along section lines 15-15.

[0023] FIG. 16 is a side view of the mounting device.

[0024] FIG. 17 is a bottom view of the mounting device.

#### DESCRIPTION

[0025] The following description is made with reference to figures, where like numerals refer to like elements throughout the several views, FIG. 1 shows, in partially exploded perspective view, a solar panel racking system 10 including solar panels 11, rails 13, and a mounting device 15 for mounting, aligning, and grounding the solar panels 11 to the rails 13. The mounting devices 15 are shown in a configuration where they are captive within the rail. The solar panels 11 illustrated are solar photovoltaic (PV) panels. These can alternatively be solar thermal panels. Also illustrated are solar panel end-clamps 17 and solar panel mid-clamps 19. The solar panel end-clamps 17 and solar panel mid-clamps 19 are secured to the mounting devices 15 and rails 13 by a combination of t-bolts 21 and nuts 23.

[0026] FIGS. 2-4 show portions of the metal frame of the solar panels 11 of FIG. 1 mounted, aligned, secured, and grounded to the rail 13. FIG. 2 shows a front view of a portion of the metal frames of two of the solar panels 11 mounted, aligned, secured, and grounded to the rail 13 with the mounting device 15 and a solar panel mid-clamp 19. FIG. 3 shows a front view of an end portion of the metal frame of one of the solar panels 11 mounted, aligned, secured, and grounded to the rail 13 with the mounting device 15 and the solar panel end-clamp 17. FIG. 4 shows, in perspective view, a portion of a solar panel 11 mounted, aligned, secured, and grounded to the rail 13 with the mounting device 15 and the solar panel mid-clamp 19. In FIGS. 2-3, a base portion 25 of the mounting device 15 is shown in hidden within the rail 13. This is represented by broken lines. The top surface of the base portion 25 is approximately level or in the same plane as the top of the rail to present a level or even surface to the bottom of the solar panel 11. Alternatively, the top surface of the base portion 25 can be below the level or plane of the top of the rail 13. The rail 13 would then present a stable mounting surface on either side of the base portion 25.

[0027] In FIGS. 2 and 4, the solar panel 11 is secured and mounted to rail 13 and the base portion 25 of the mounting device 15 by securing the solar panel mid-clamp 19 by the t-bolt 21 and the nut 23. In FIG. 3, the solar panel 11 is secured and mounted to rail 13 and the base portion 25 of the mounting device 15 by securing the solar panel end-clamp 17 by the t-bolt 21 and the nut 23. In FIGS. 2-4, the solar panels 11 are aligned perpendicular to the rails 13 by an alignment portion 27 of the mounting device 15. The

alignment portion 27 shown is a rectangular block projecting perpendicularly upward from base portion. In FIG. 4, the alignment portion also has two parallel opposing sides that are aligned perpendicular to the length of the base portion 25. This in turn, causes the two parallel opposing sides to be aligned perpendicular to the length of the rail 13. When the solar panels 11 are lined up against the two opposing sides of the alignment portion 27 that are perpendicular to the base portion 25, the solar panels are automatically aligned perpendicularly to the length of the rail 13.

[0028] In FIGS. 2-4, the metal frames of solar panels 11 are electrically connected to each other and grounded to the rails 13 by grounding pins 29 in the top of the base portion 25 of the mounting device 15. The grounding pins 29 under the frame of the solar panels 11 in FIGS. 2-3 are hidden from view, but shown for illustrative purposes. The frames of the solar panel 11 and the rails 13 are typically made of aluminum, but other metals can be used. Aluminum typically is anodized and forms a non-conductive oxide coating. The grounding pins 29 typically have a sharp top or pointed top surface that pierces the oxide coating of the aluminum, when the panel is tightened down by the nut 23 and either solar panel end-clamp 17 or solar panel mid-clamp 19 in order to complete the electrical connection. The top surface of the base portion 25 height is such that, when the base portion 25 is tightened down by the nut 23, the grounding pins 29 protrude with sufficient height to make electrical conductive contact with the metal frame of the solar panels 11.

**[0029]** In FIG. 2, the base portion 25 and a t-bolt head 31 are shown mounted inside a rail slot 33, all in hidden lines represented by broken or dashed lines. The base portion 25 includes a base portion slot 37 that is runs transverse to the length of the base portion 25 and is shown transverse to the rail 13. The t-bolt head 31 is shown resting in the base portion slot 37. The bottom of the grounding pins 29, also shown in hidden lines, and are shown engaged with the bottom of the rail slot 33. The t-bolt head 31 is so positioned in the base portion slot 37 and the bottom of the grounding pins 29 so positioned in relation to the base portion 25, so that there is sufficient tension between the grounding pins 29 and rail 13 for the grounding pins 29 to penetrate the oxide layer of the rail 13 when the nut 23 is tightened so that the solar panel mid-clamp 19 engages the solar panel 11 against the base portion 25.

**[0030]** FIGS. 5-8 shows, in several views, detail of how the mounting device 15 is secured to the rail 13. FIG. 5 shows, in exploded back perspective view, the mounting device 15 with the solar panel end-clamp 17, and t-bolt 21, and nut 23. FIG. 6 shows, in exploded front perspective view, the mounting device 15 with the solar panel end-clamp 17, t-bolt 21, and nut 23. In FIG. 7, the t-bolt 21 and mounting device 15 are mounted into the rail 13 but not secured. FIG. 8 shows the t-bolt 21 and mounting device 15 secured to the rail 13. In FIGS. 5 and 7, the t-bolt head is positioned lengthwise with respect to the rail. In FIG. 7, the t-bolt is inserted 21 into the rail 13. In this position, the alignment portion 27 and the base portion 25 are shown above the rail 13 surface; the t-bolt head 31 is free to move either vertically or horizontally. The bottom of the grounding

pins 29 are suspended above the bottom of the rail slots 33. Rotating the t-bolt 21, approximately 90-degrees either clockwise or counterclockwise as indicated by the rotational arrow in FIGS. 5 and 7 will lock the mounting device 15 into a rail slot 33 and secure the t-bolt 21 in an upright position. FIGS. 6 and 8 shows the t-bolt head 31 rotated approximately 90-degrees from its position in FIGS. 5 and 7, so that it is vertically captive within the rail slot 33. The base portion 25 of the mounting device 15 is fully within the rail slot 33 and the alignment portion is resting securely against the top of the rail 13. The top of the base portion 25 is approximately level with the top of the rail 13 and the alignment portion 27, resting on the top of the rail 13. The alignment portion 27 is shown having two sides parallel and two sides perpendicular to the length of the rail 13. The grounding pins 29 are engaged with the bottom of the rail slot with sufficient force or pressure to penetrate the oxide layer of the rail slot 33 to make an electrically conductive connection.

**[0031]** FIGS. 9-11 further illustrates how the t-bolt is locked into place within the mounting device 15. In addition, FIGS. 9-11 show the grounding pins 29 mounted through the bottom of the base portion 25. FIG. 9 shows an exploded bottom perspective view of the mounting device 15 and the t-bolt 21 where the t-bolt is aligned for insertion into the rail slot. FIG. 10 shows a bottom perspective view of the t-bolt 21 inserted into the mounting device 15 where the t-bolt 21 is aligned, as in FIG. 9, for insertion into the rail slot 33. FIG. 11 shows a bottom perspective view of the t-bolt 21 inserted into the

mounting device 15 illustrated the relationship between the t-bolt 21 and the mounting device 15 when they are secured to the mounting rail.

**[0032]** In FIG. 9, the t-bolt 21 is inserted through an aperture 35 in the alignment portion 27. The aperture is sized to receive the t-bolt and typically not threaded so that the t-bolt 21 can freely move through the aperture 35. The base portion 25 includes the base portion slot 37 shown aligned transversely across the length of the base portion 25. The aperture 35 is aligned over the base portion slot 37. The base portion slot 37 is approximately as wide as the width of the t-bolt head 31. This arrangement provides for the length of the t-bolt head 31 can be held transverse to the length of the base portion 25 with little or no rotation movement rotational or vertical movement. While the base portion slot 37 is shown aligned perpendicularly across the length of the base portion 25, any transverse angle can be used between 45-degrees and 135-degrees which allows the t-bolt 21 sufficient holding strength to withstand the rotational forces of the solar panels and other components. A perpendicular or 90-degree angle provides for the t-bolt head 31 of shortest length.

**[0033]** In FIG. 10, the t-bolt 21 is shown inserted into the mounting device 15, so that the length of the t-bolt head 31 is aligned with the length of the base portion 25. This allows the t-bolt 21 and base portion 25 to be inserted into the rail slot 33 as shown in FIG. 5, resulting in the configuration of FIG. 7. In FIG. 10, the t-bolt head 31 cannot be

inserted into the base portion slot 37 when positioned along the length of the base portion 25.

[0034] In FIG. 11, the t-bolt 21 is shown rotated approximately 90 degrees about its vertical axis, as depicted by the rotational arrow in FIG. 10. The t-bolt head 31 now is in the base portion slot 37. The mounting device 15 is now configured as shown in FIG. 8 with the bottom surface of the alignment portion 27 resting against the top surface of the rail 13. In FIGS. 8 and 10, the opposing ends along the length of the t-bolt head 31 extend beyond the width of the base portion 25. This causes the t-bolt head 31 to be held captive within the cavity of the rail slot 33 as shown in FIG. 8, and the base portion slot 37 prevents the t-bolt head 31 from rotating. This configuration creates a secure base for mounting the solar panel 11 and either solar panel end-clamp 17 or solar panel mid-clamp 19 of FIG. 1. In addition, this configuration allows the mounting device 15 and t-bolt 21, which can be held captive within the rail by simply rotating the t-bolt into the base portion slot 37 thereby locking the t-bolt in place. At the same time, allowing the mounting device 15 and t-bolt 21 to be inserted anywhere along the rail 13. This is in contrast to many other captive solar panel rail-mount devices that can be only inserted at the ends of the slots.

[0035] FIGS. 12-17 show the mounting device in several views. FIG. 12 shows an exploded perspective view of the mounting device 15 and the grounding pins 29. FIG. 13 shows an exploded perspective view of the mounting device 15 with the grounding

pins 29 secured in the base portion 25. FIG. 14 shows a top view of the mounting device 15. FIG. 15 shows a sectional view of the mounting device of FIG. 14 taken along section lines 15-15. FIG. 16 is a side view of the mounting device 15. FIG. 17 is a bottom view of the mounting device 15.

[0036] In FIG. 12, the grounding pins 29 can be inserted through apertures 39 on the top surface of the base portion 25 so that the bottom of the grounding pin 29 is positioned below the bottom of the base portion 25 so that the tip of the bottom of the grounding pins 29 can exert sufficient force to break the oxide layer of the rail 13 when the t-bolt head 31 is inserted into the rail slot 33 and tightened down with the nut 23 as described for FIGS. . The top of the grounding pins 29 rest slightly above the top surface of the base portion 25 so that the tip of the grounding pins 29 can penetrate the oxide layer of the solar panel frames but are also mounted sufficiently close to the top surface of the base portion 25 so that the solar panel frames can seat flush against the top surface of the rail 13. In FIGS. 13-17, the grounding pins 29 are shown mounted to the base portion 25 in various views.

[0037] In FIGS. 12-13, the alignment portion 27 is shown projecting upward from the base portion 25. The base portion 25 and alignment portion 27 are both illustrated as rectangular cuboids where the lengths of each of the rectangular cuboids are at right angles to each other. The base portion 25 and the alignment portion 27 can be cast, stamped, milled, or otherwise integrally formed from a single piece of metal.

Alternatively the base portion 25 and the alignment portion can be cast, formed, stamped, extruded, or milled from two separate pieces of metal and then rigidly joined together as a joined integral unit. For example, the base portion 25 and alignment portion can be joined by welding. While both the base portion 25 and the alignment portion 27 are illustrated as rectangular cuboids, the base portion 25 can be other shapes, for example, a truncated pyramid. The base portion 25 can be shaped so that its top surface is planar to the top surface of the rail, the top surface including a pair of opposing sides parallel to the length of the rail slot 33, the depth of the base portion 25 is no deeper than the depth of the rail slot 33 and its width is no wider than the width of the rail slot 33. The alignment portion 27 can be shaped so that the top and bottom surfaces are parallel and planar with the top surface of the base portion 25 and the top of the rail 13. The length of the alignment portion 27 along the rail slot 33 is narrower than the length of the base portion 25. The width of the alignment portion 27 is wider than the width of the base portion 25 so that a portion of the alignment portion 27 extends beyond the rail slot 33 and over laps the rail 13 on each side of the rail slot 33. Two of the opposing sides are parallel to each and project perpendicularly upward from the top surface of the top of the base portion 25.

[0038] In FIG. 14, the aperture 35 in the alignment portion 27 is shown centered in the alignment portion 27 and centered over the base portion 25. The grounding pins 29 are shown on the top surface of the base portion 25. FIG. 14 illustrates the base portion 25 and the alignment portion 27 having a rectangular shaped top surface where the respective lengths of the base portion 25 and alignment portion 27 are perpendicular to

each other. While shown as having rectangular shaped top surfaces, the base portion 25 and alignment portion can each have a trapezoid shape. The parallel sides of the base portion run along its length. The parallel sides of the alignment portion 27 run along its width and are perpendicular to the parallel sides of the base portion 25.

[0039] In FIG. 15 the grounding pins 29, aperture 35 in the alignment portion 27, the base portion slot 37 as well as the slot support base 41 are shown in cross-sectional relation with the base portion 25 and the alignment portion 27. In FIG. 16, the grounding pins 29, the aperture 35, the base portion slot 37, and the slot support base 41 are shown in relation with the base portion 25 and the alignment portion 27 in side-view. Referring to FIGS. 8, and 15-16, the slot support base of FIGS. 15-16 in combination with the base portion 25 is of a depth where when combined with the t-bolt of FIG. 8, holds the bottom of the t-bolt at a distance at or above the bottom of the rail slot 33 so that the t-bolt cannot rotate out of the rail slot 33.

[0040] In FIG. 17, the aperture 35 in the alignment portion 27, the alignment portion 27, and the base portion 25 are shown in relationship to each other in bottom view. Here the slot support base 41 can be view from within the base portion slot 37 and surrounding the aperture 35.

[0041] A device for mounting, aligning and grounding solar panels to roof mounted rails has been described. It is not the intent of this disclosure to limit the claimed invention to the examples, variations, and exemplary embodiments described in the

specification. Those skilled in the art will recognize that variations will occur when embodying the claimed invention in specific implementations and environments. It is possible to implement certain features described in separate embodiments in combination within a single embodiment. Similarly, it is possible to implement certain features described in single embodiments either separately or in combination in multiple embodiments. For example, FIGS. 5-6 illustrated the mounting device 15, t-bolt 21, and nut 23 combined with a solar panel end-clamp 17, a solar panel mid-clamp can also be used, as illustrated in FIG. 1. It is the intent of the inventor that these variations fall within the scope of the claimed invention. While the examples, exemplary embodiments, and variations are helpful to those skilled in the art in understanding the claimed invention, it should be understood that, the scope of the claimed invention is defined solely by the following claims and their equivalents.

CLAIMS

What is claimed is:

1. An apparatus for mounting solar panels, including:  
a t-bolt including a t-bolt body, and a t-bolt head, the t-bolt head including a t-bolt head planar bottom surface with the t-bolt body projecting perpendicularly therefrom;  
a rail including a rail top surface, a rail slot running longitudinally along the rail top surface, and a rail slot cavity below the rail slot and integral to and wider than the rail slot;  
a mounting device including a planar top surface, a planar bottom surface, a first portion with first portion parallel sides projecting vertically upward out of the planar top surface, a second portion with second portion parallel sides projecting vertically downward out of the planar bottom surface and aligned under and along the first portion parallel sides, a second portion slot oriented transversely across and through the second portion parallel sides, and an aperture through the second portion slot and the first portion, and the aperture sized to receive the t-bolt body;  
and  
the t-bolt, the mounting device, and the rail configurable into a first position  
where: the t-bolt is received by the aperture and vertically and rotational captive within the second portion slot, the t-bolt head planar bottom surface engages flush

against the rail slot cavity, the second portion fully within the rail slot and the rail slot cavity, and the planar bottom surface of the mounting device engages flush against the rail.

2. The apparatus of Claim 1 further including:
  - a solar panel including a frame bottom surface and a frame vertical edge oriented along a length of the rail; and
  - the frame bottom surface engages flushly against the rail and the planar top surface, and the frame vertical edge engages flushly against a side of the first portion parallel sides.
  
3. An apparatus for mounting solar panels to rails including:
  - a t-bolt including a t-bolt body, and a t-bolt head, the t-bolt head including a t-bolt head planar bottom surface with the t-bolt body projecting perpendicularly therefrom;
  - a rail including a rail top surface, a rail slot running longitudinally along the rail top surface, and a rail slot cavity below the rail slot and integral to and wider than the rail slot;
  - a solar panel including a solar panel frame;
  - a mounting device including a base portion fully within the rail slot and the rail slot cavity, a rigid alignment portion rigid joined to and projecting vertically

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upward from the base portion and resting on the rail top surface, a base portion slot in a base portion bottom surface and oriented transversely to a rail slot length, and an aperture positioned through the rigid alignment portion and the base portion slot; and

the t-bolt, the mounting device, the solar panel, and the rail configurable into a first position where: the t-bolt is received by the aperture and vertically and rotationally captive within the base portion slot, the t-bolt head planar bottom surface engages flush against the rail slot cavity, the bottom of the solar panel frame engages flushly against the rail and over the base portion, and an edge of the solar panel oriented transverse to a rail length engages flushly against the rigid alignment portion.

4. The apparatus of Claim 3, further including:

a base portion top surface;

a grounding pin projecting through both the base portion top surface and the base portion bottom surface; and

the grounding pin mechanically and electrically engaging the rail slot cavity and the solar panel frame.

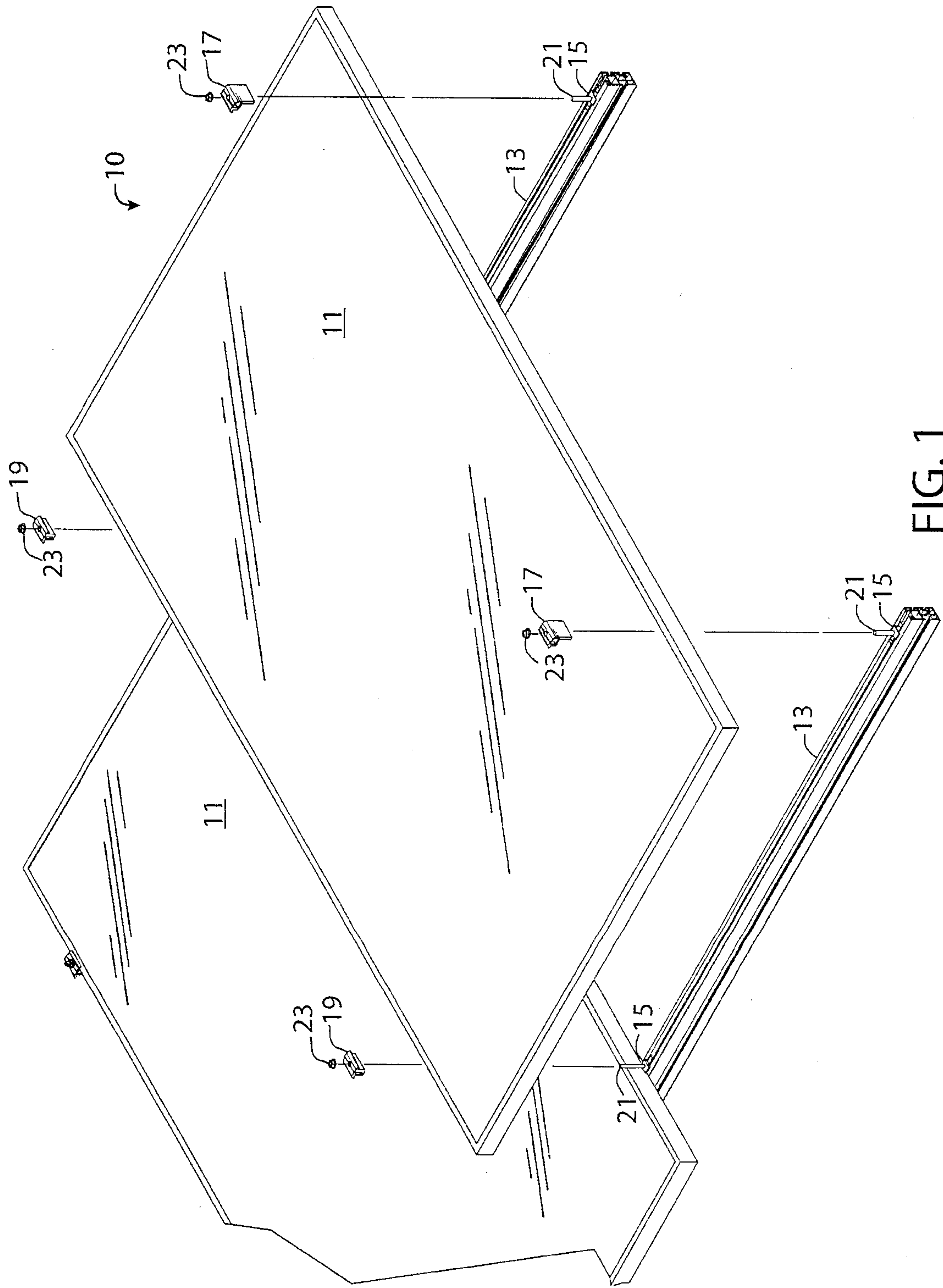


FIG. 1

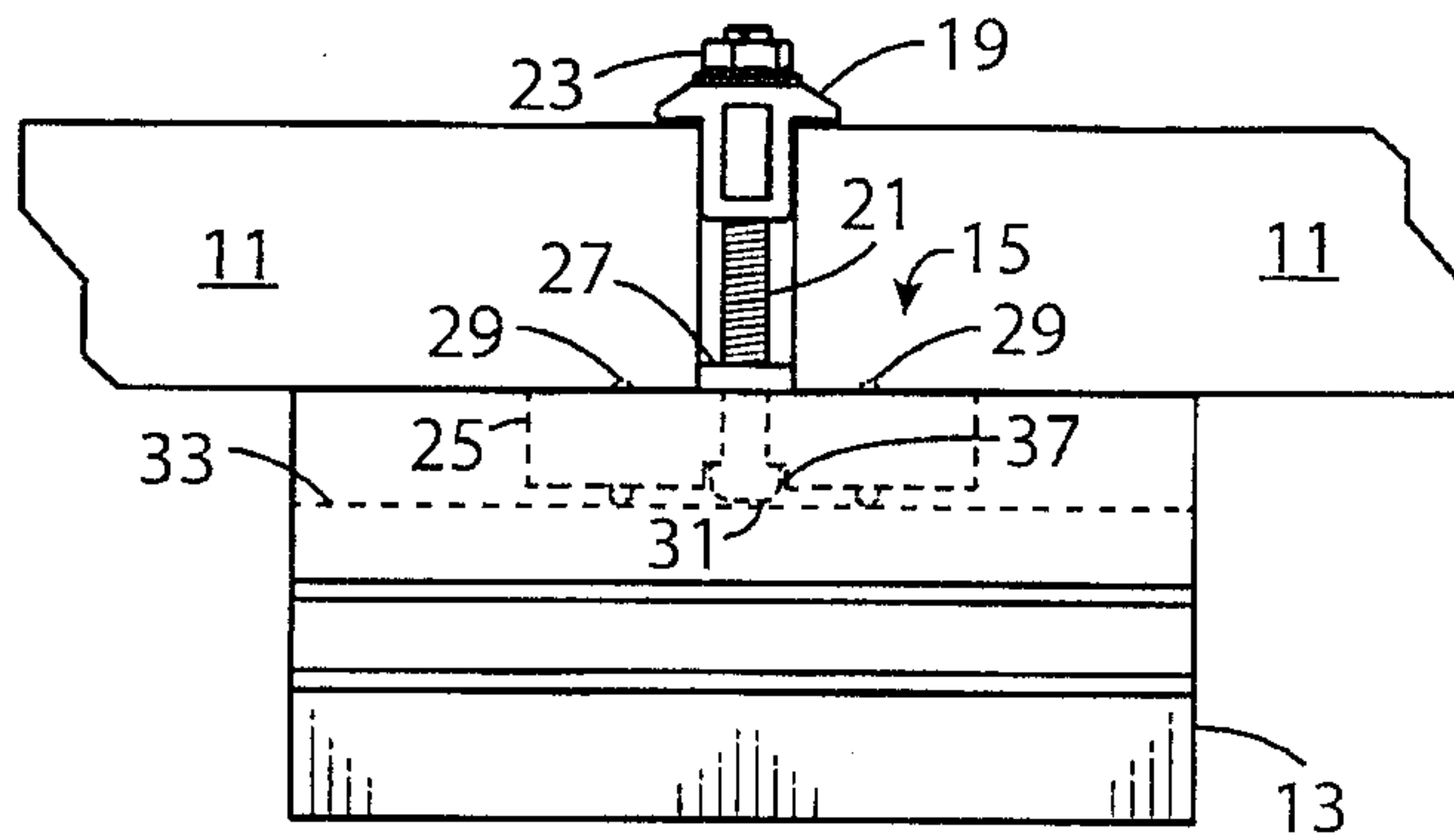


FIG. 2

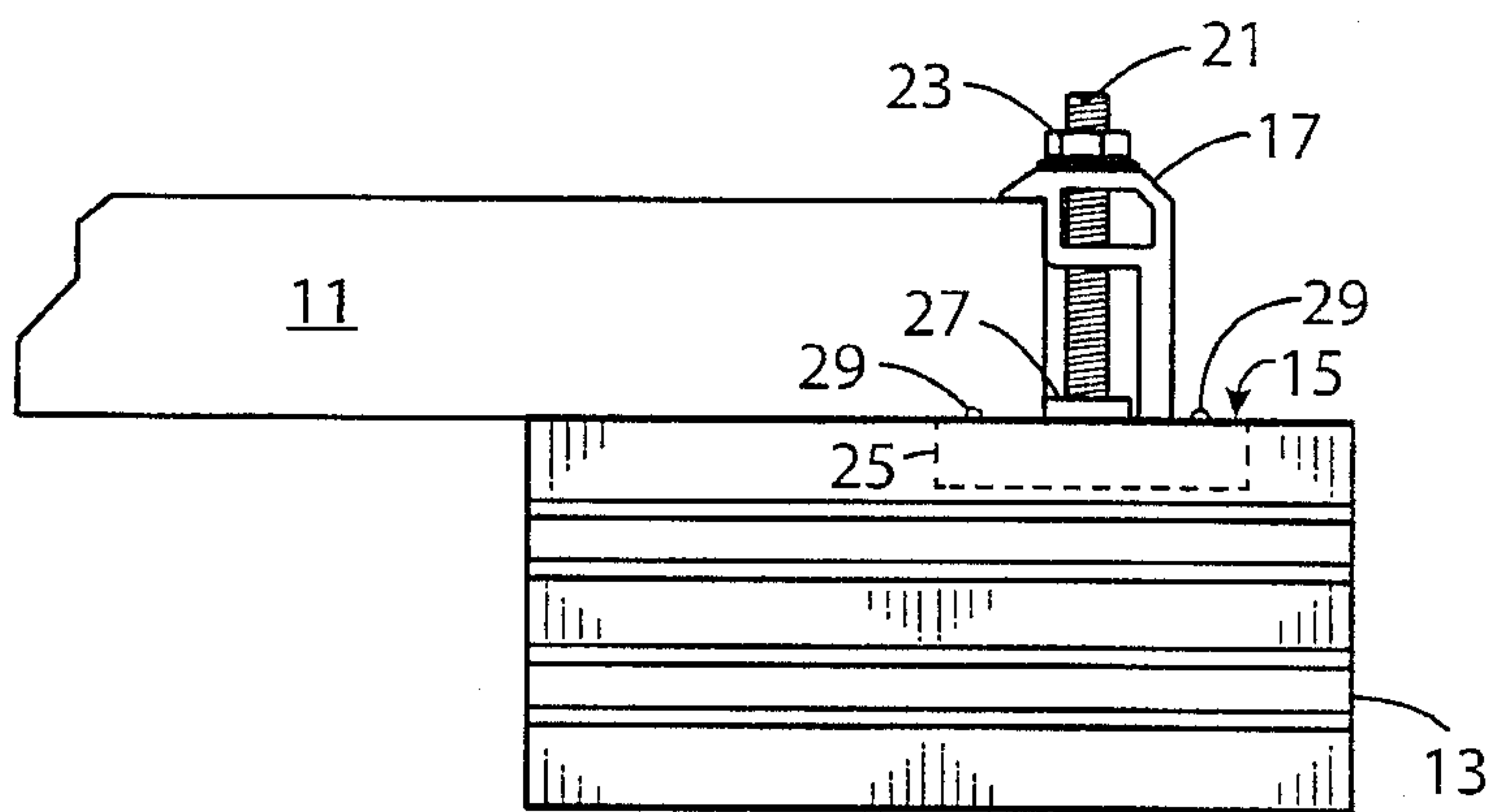


FIG. 3

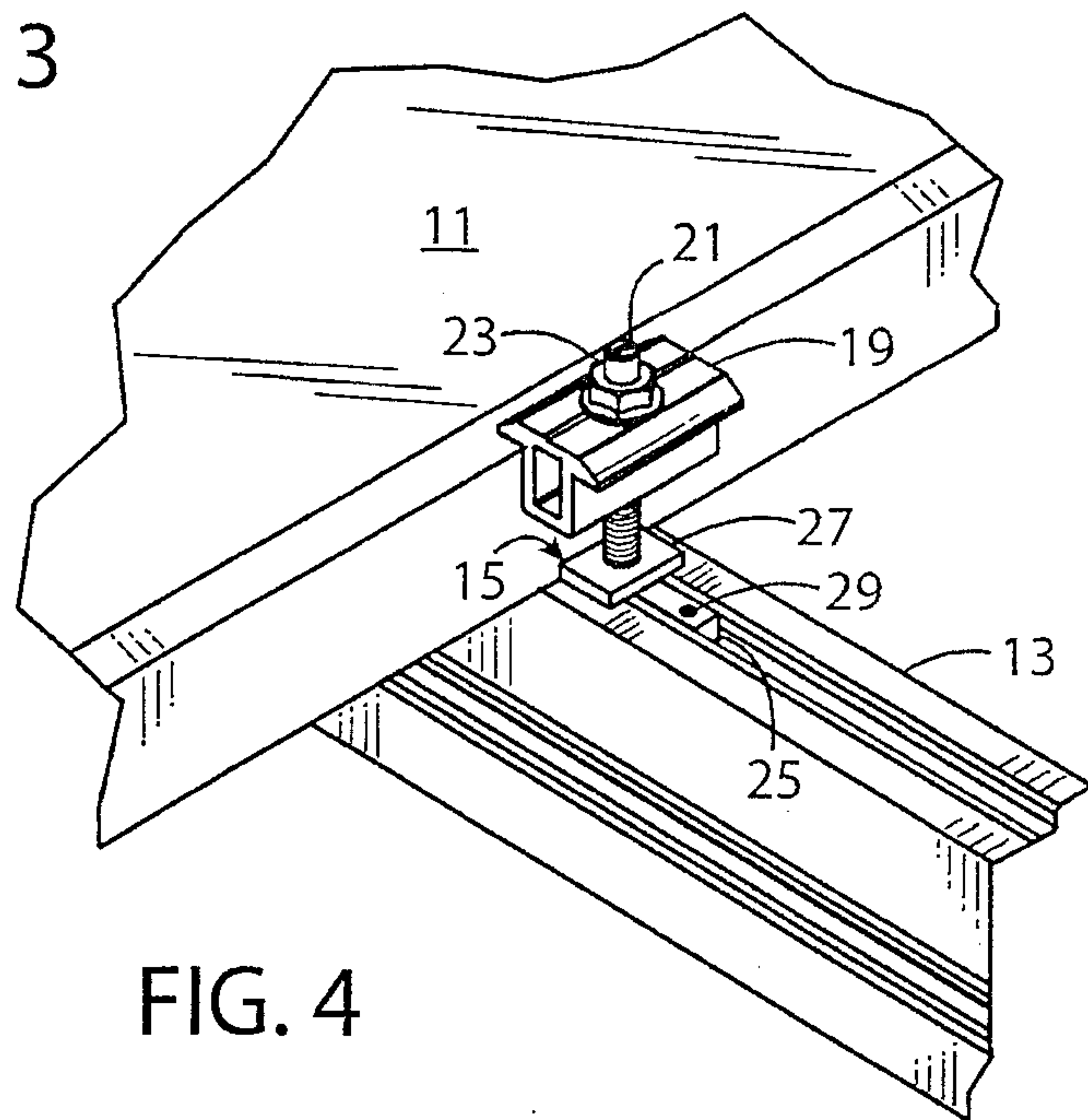


FIG. 4

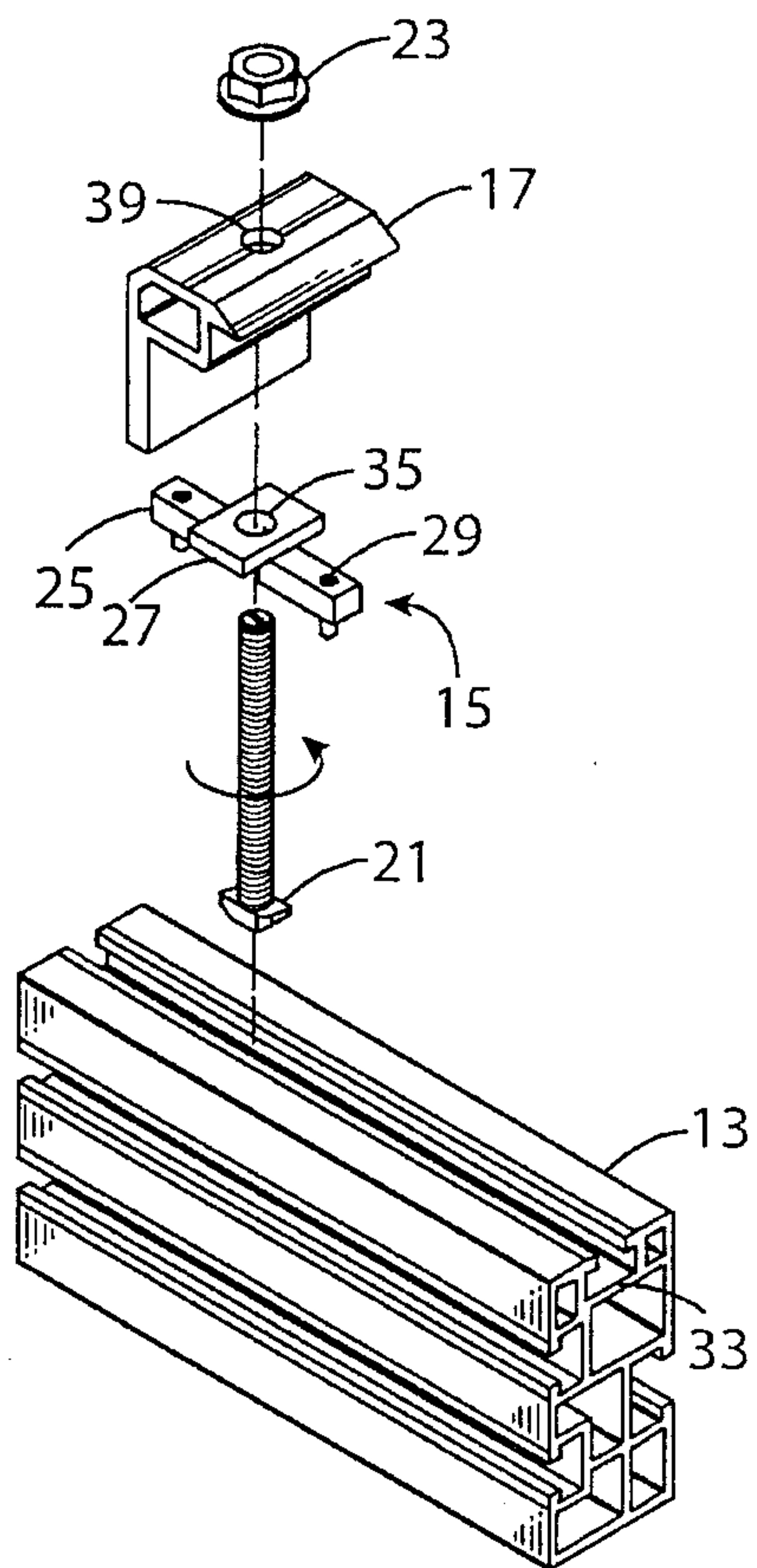


FIG. 5

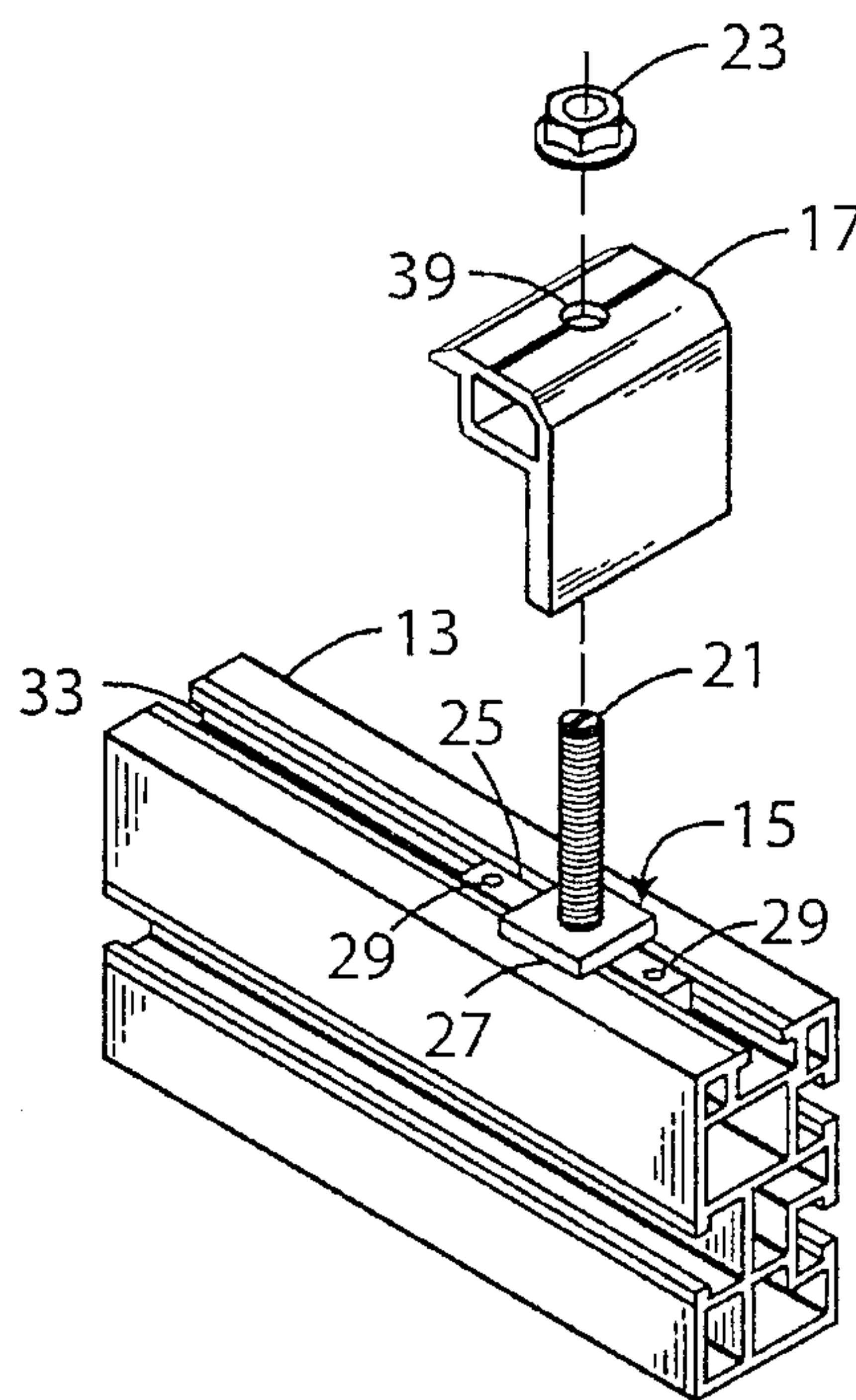


FIG. 6

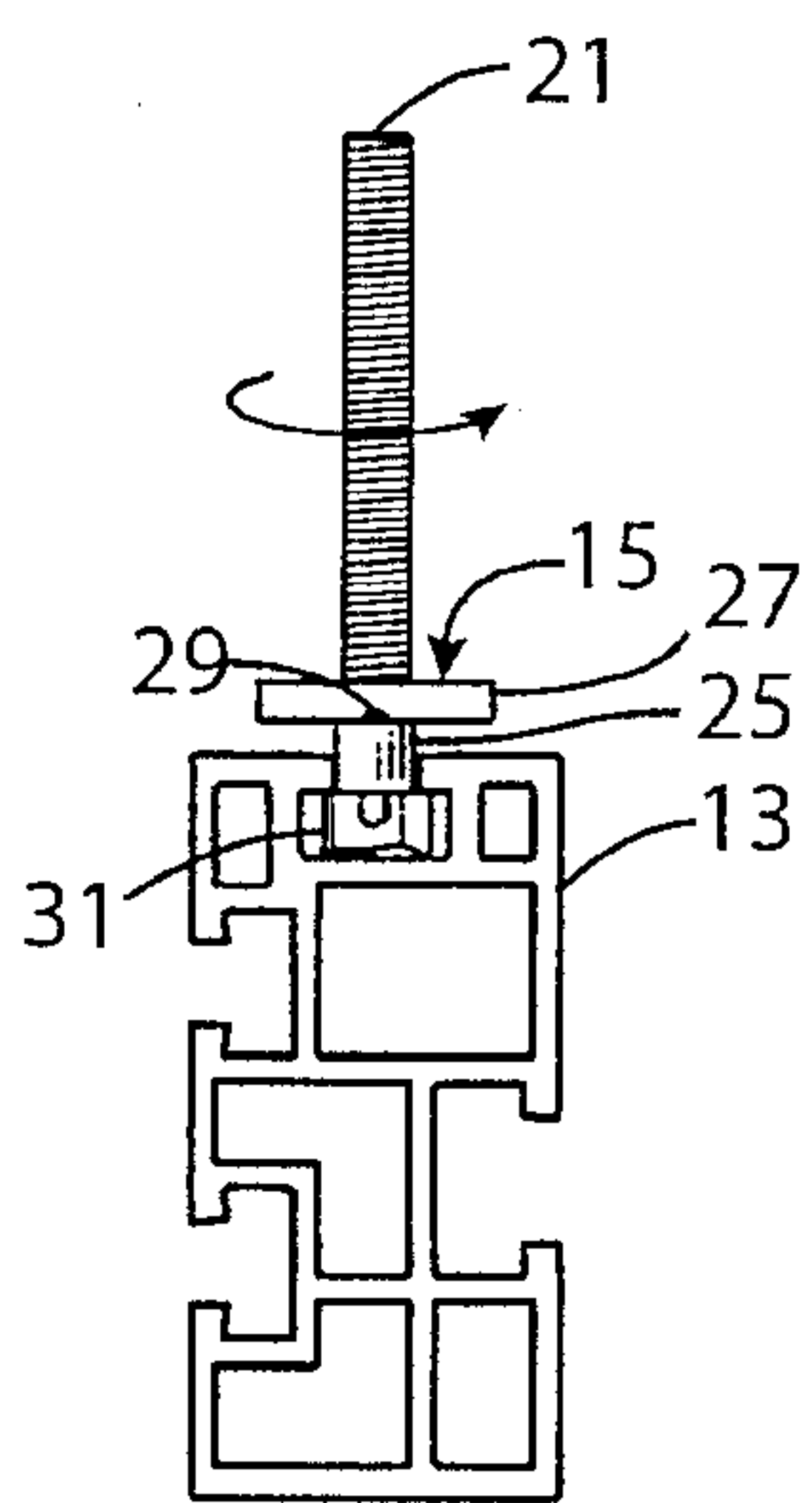


FIG. 7

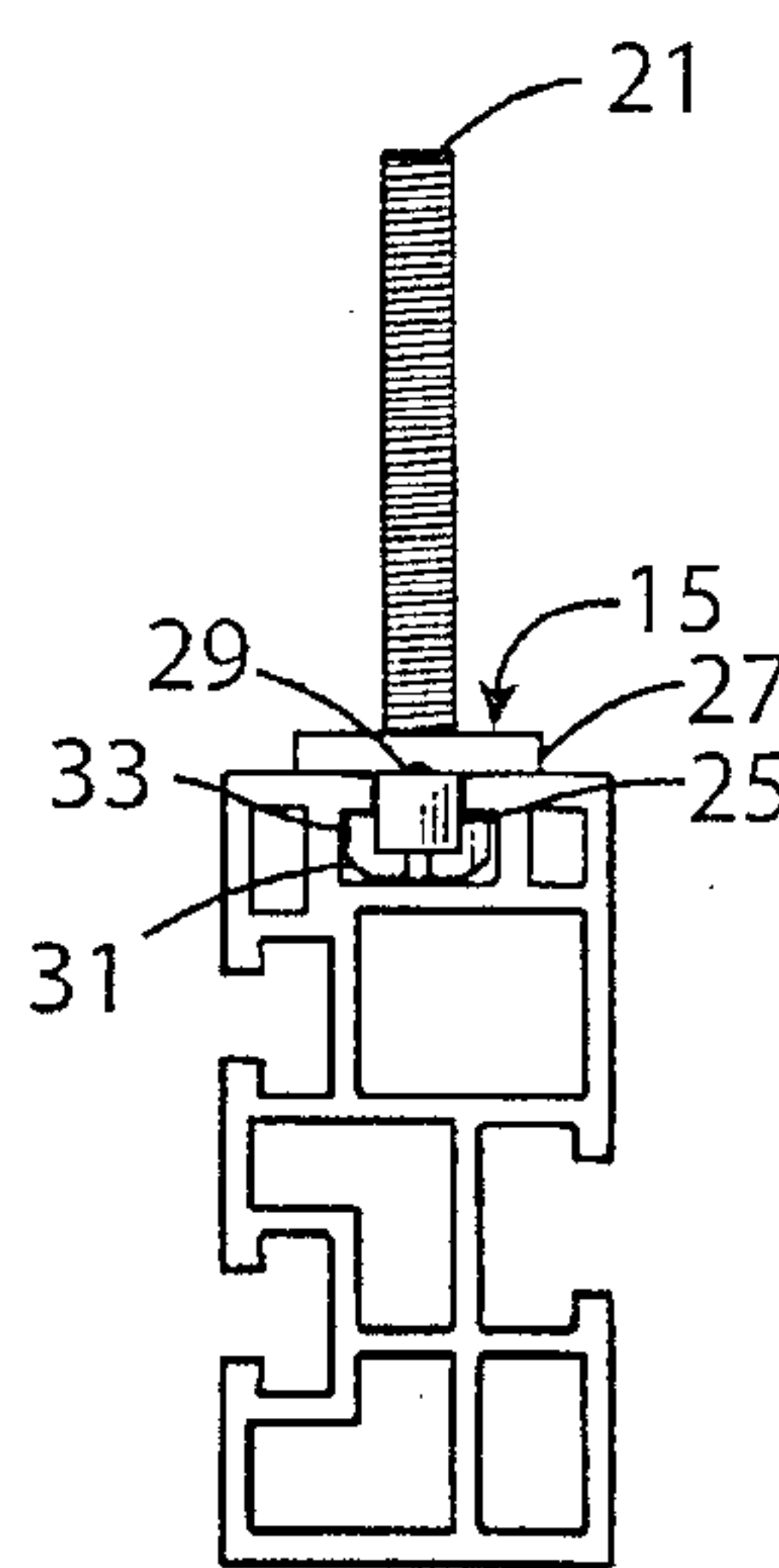


FIG. 8

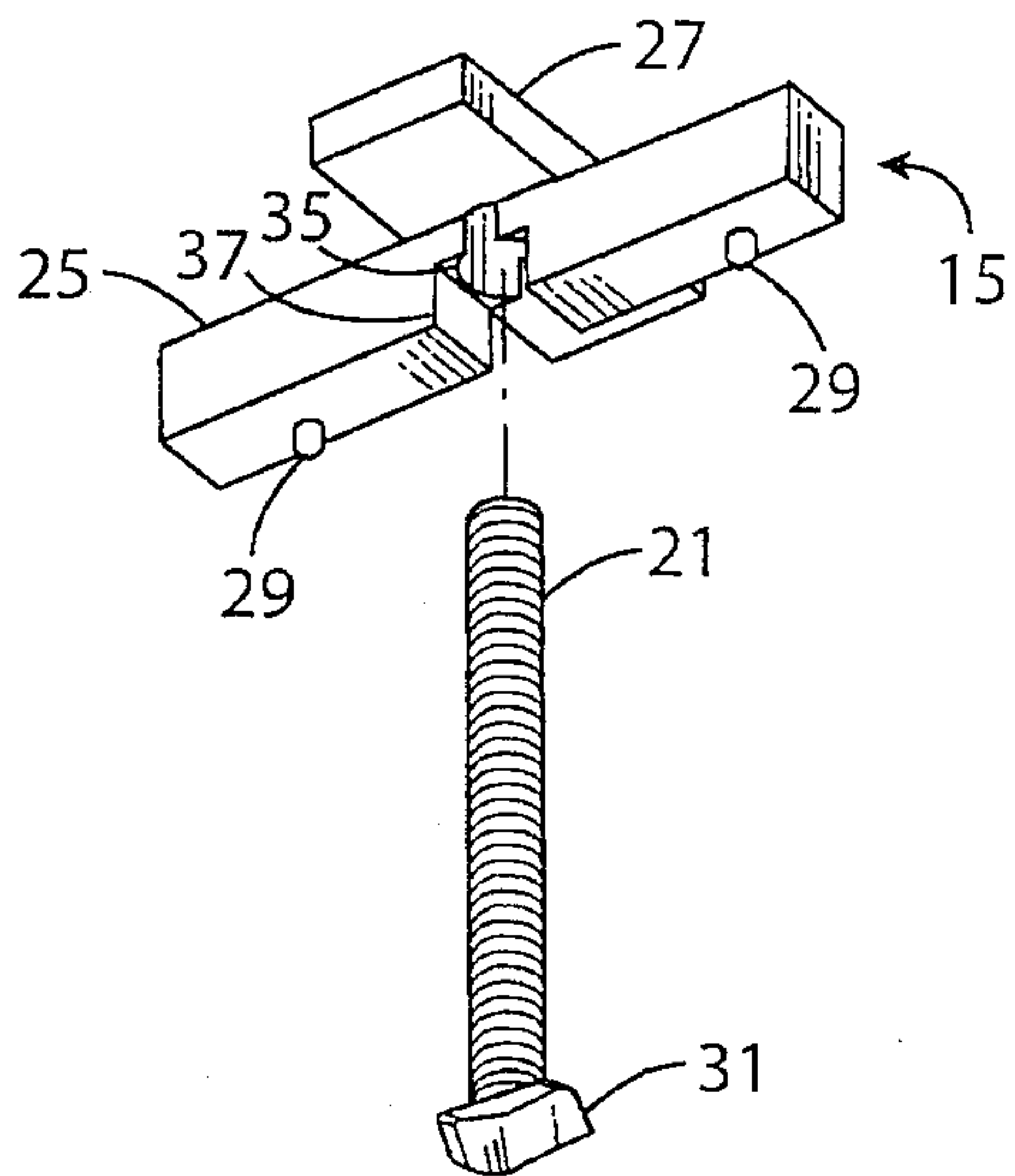


FIG. 9

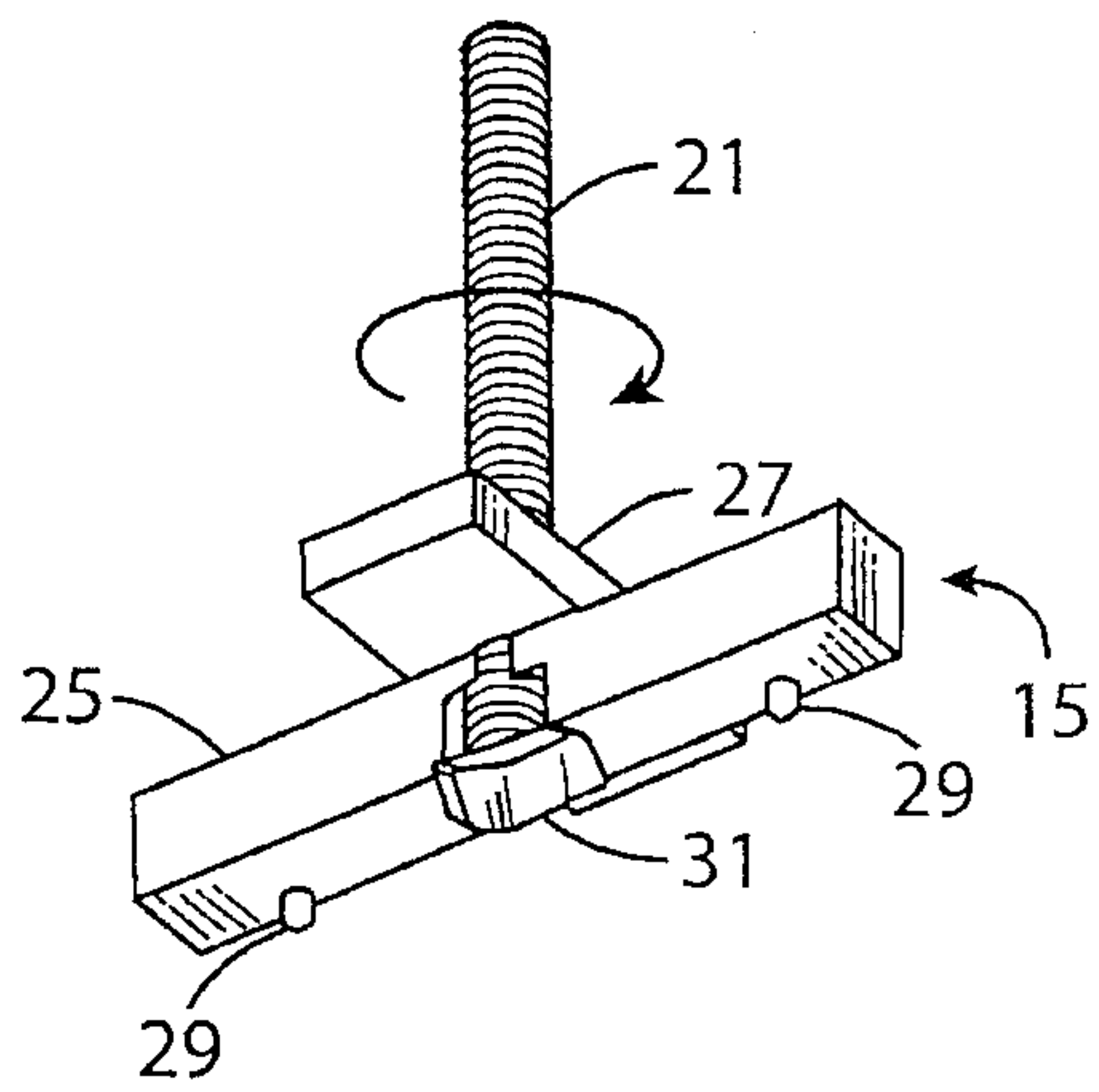


FIG. 10

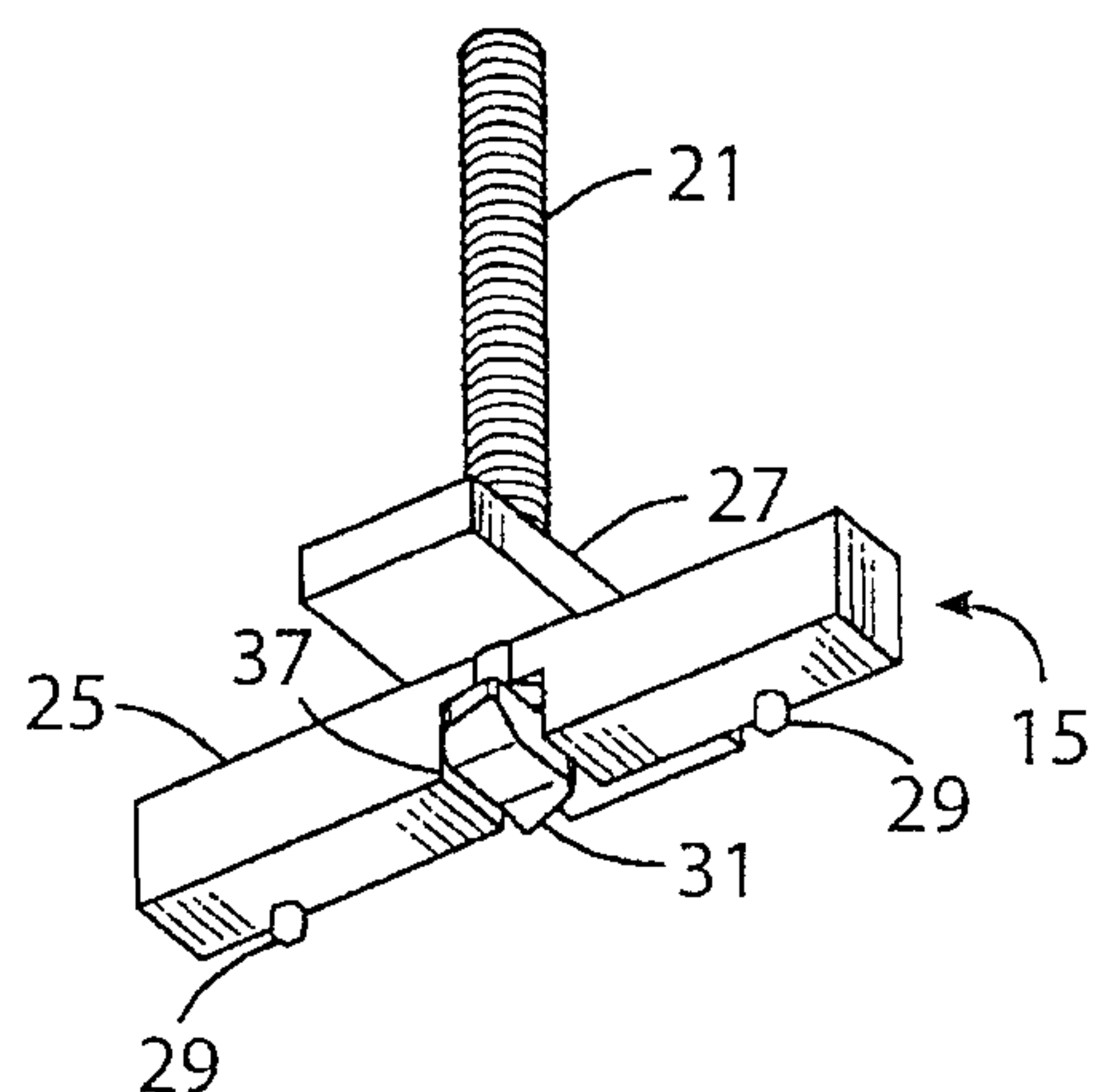


FIG. 11

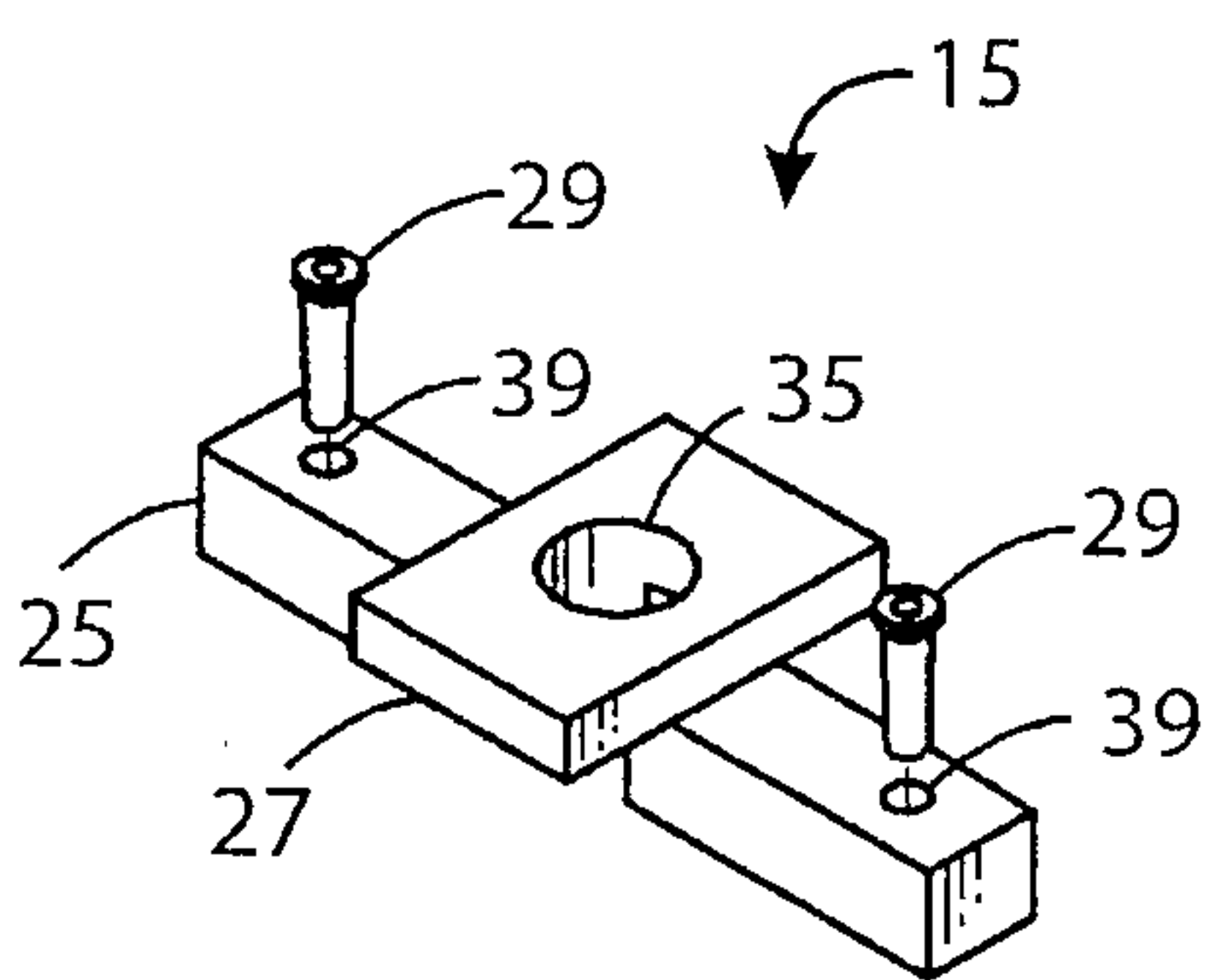


FIG. 12

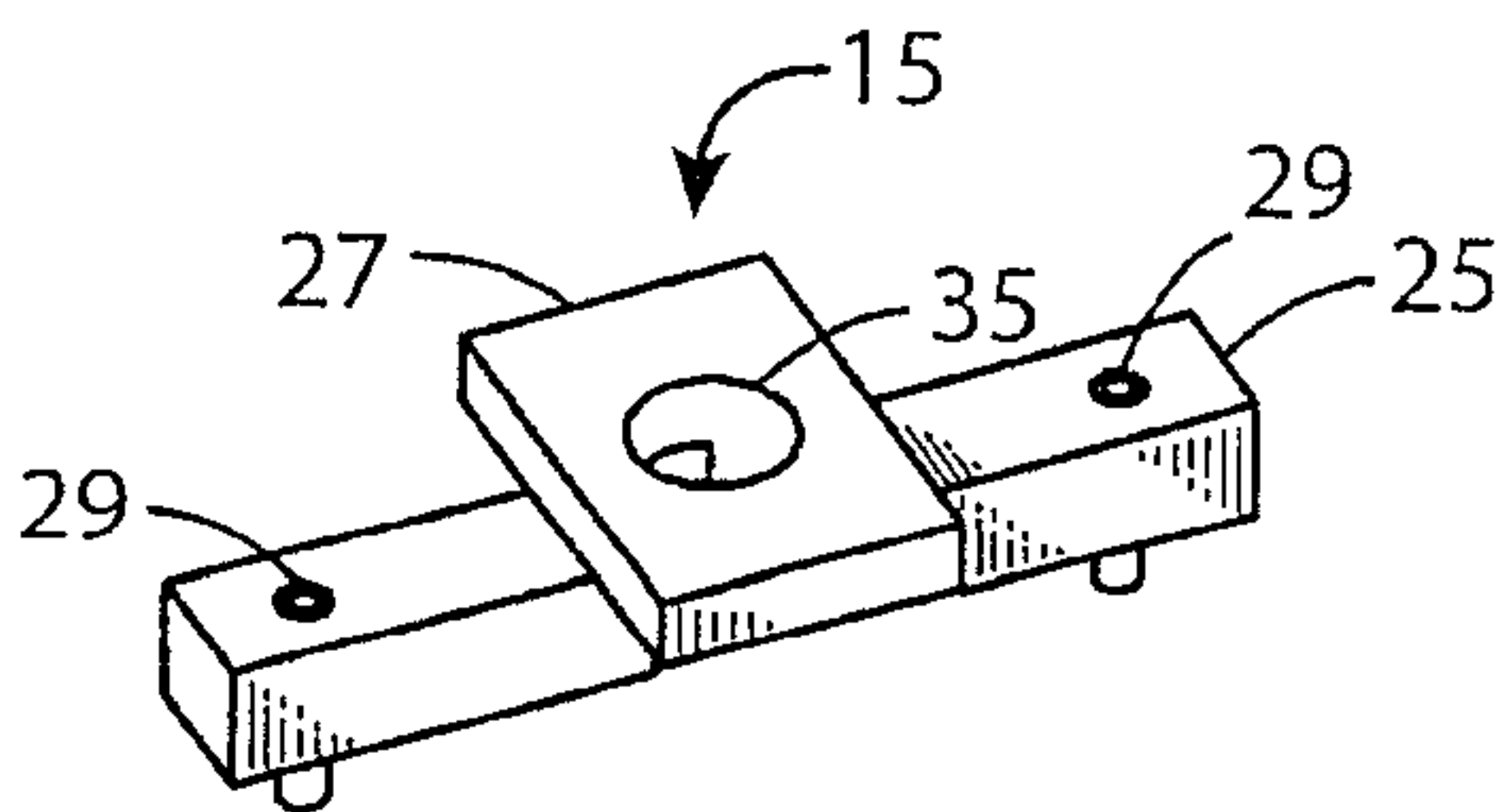


FIG. 13

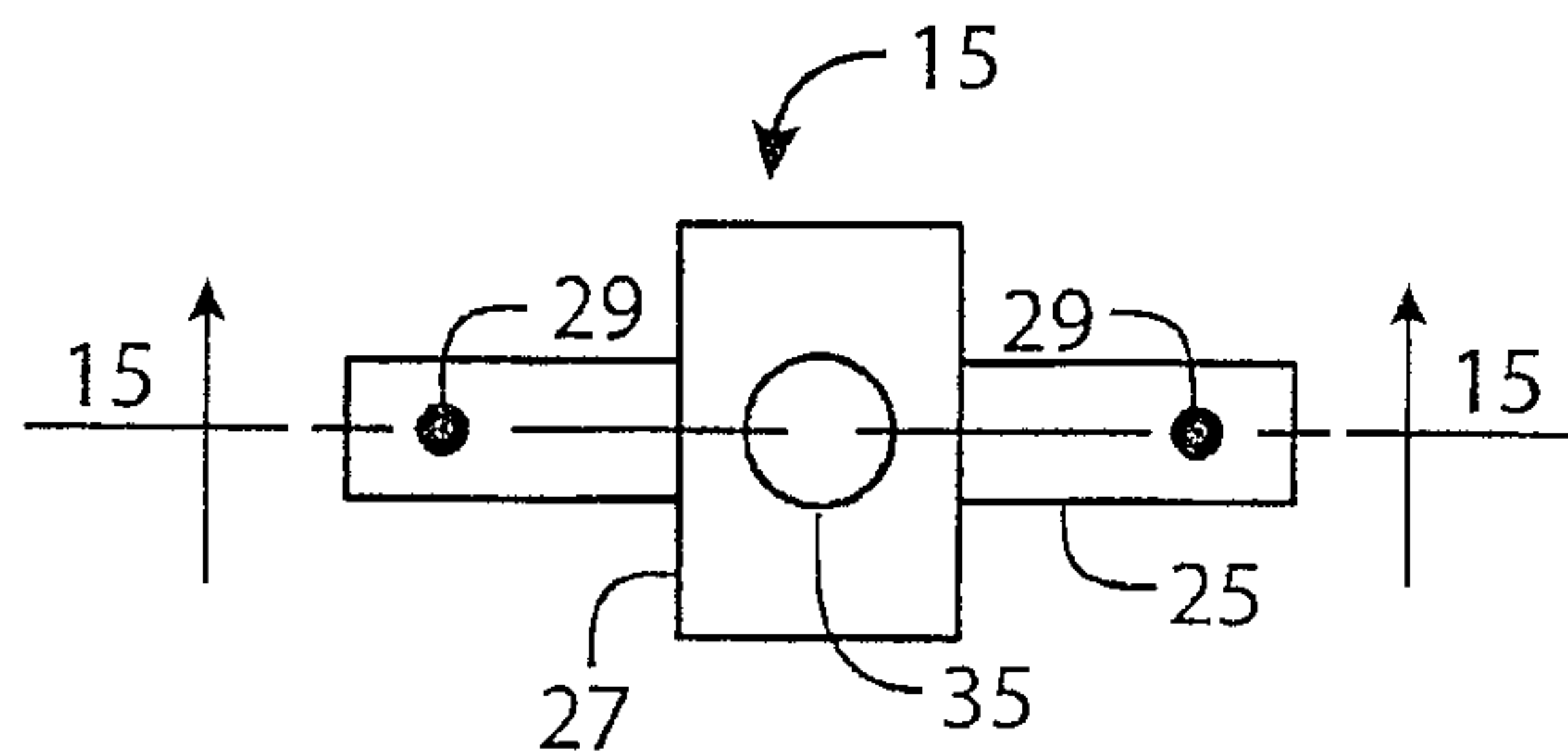


FIG. 14

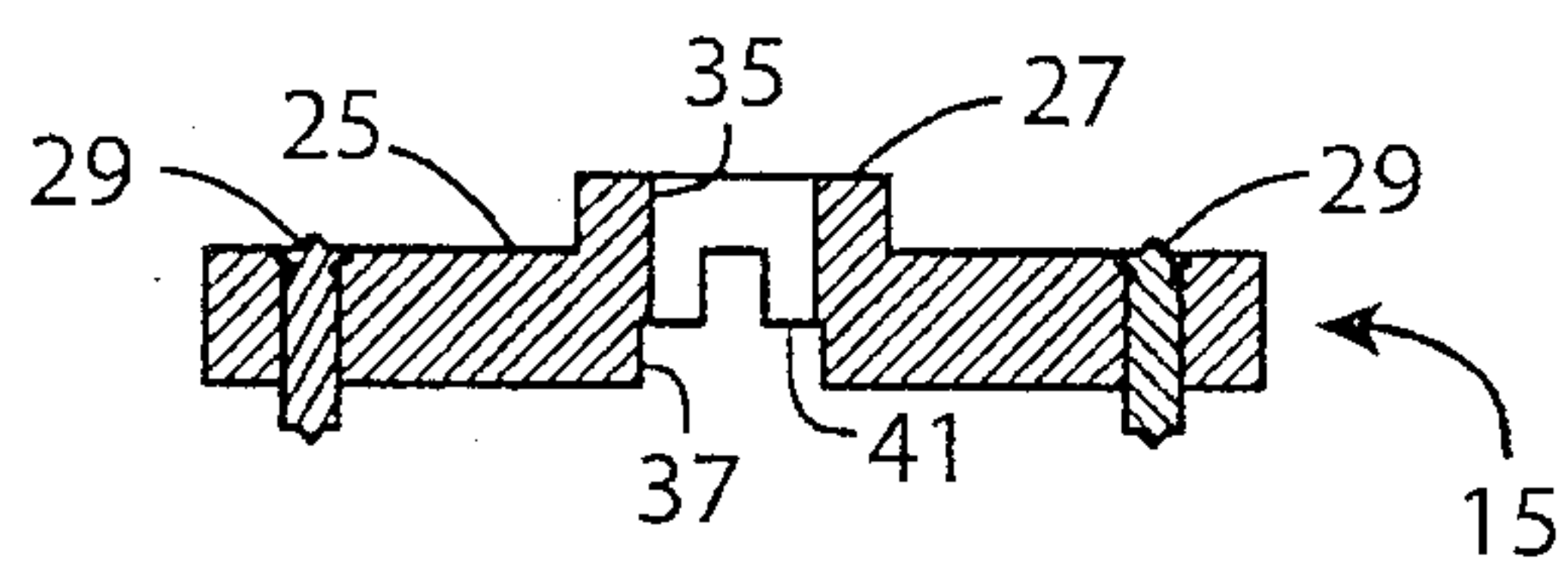


FIG. 15

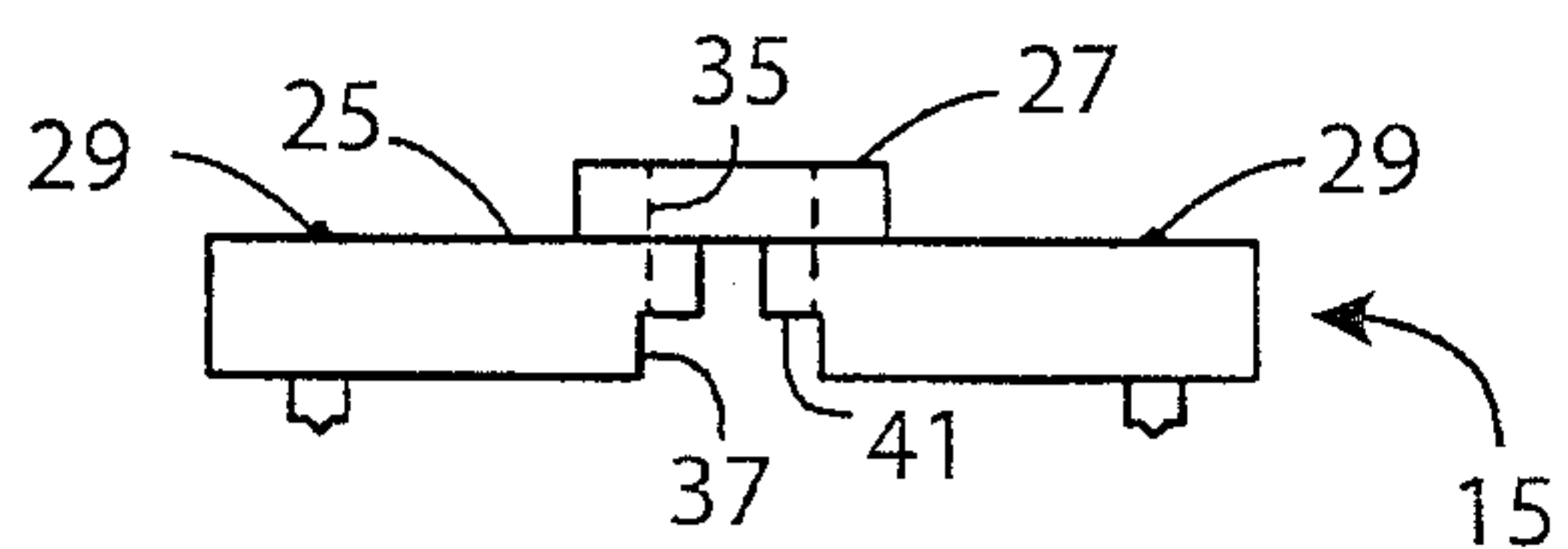


FIG. 16

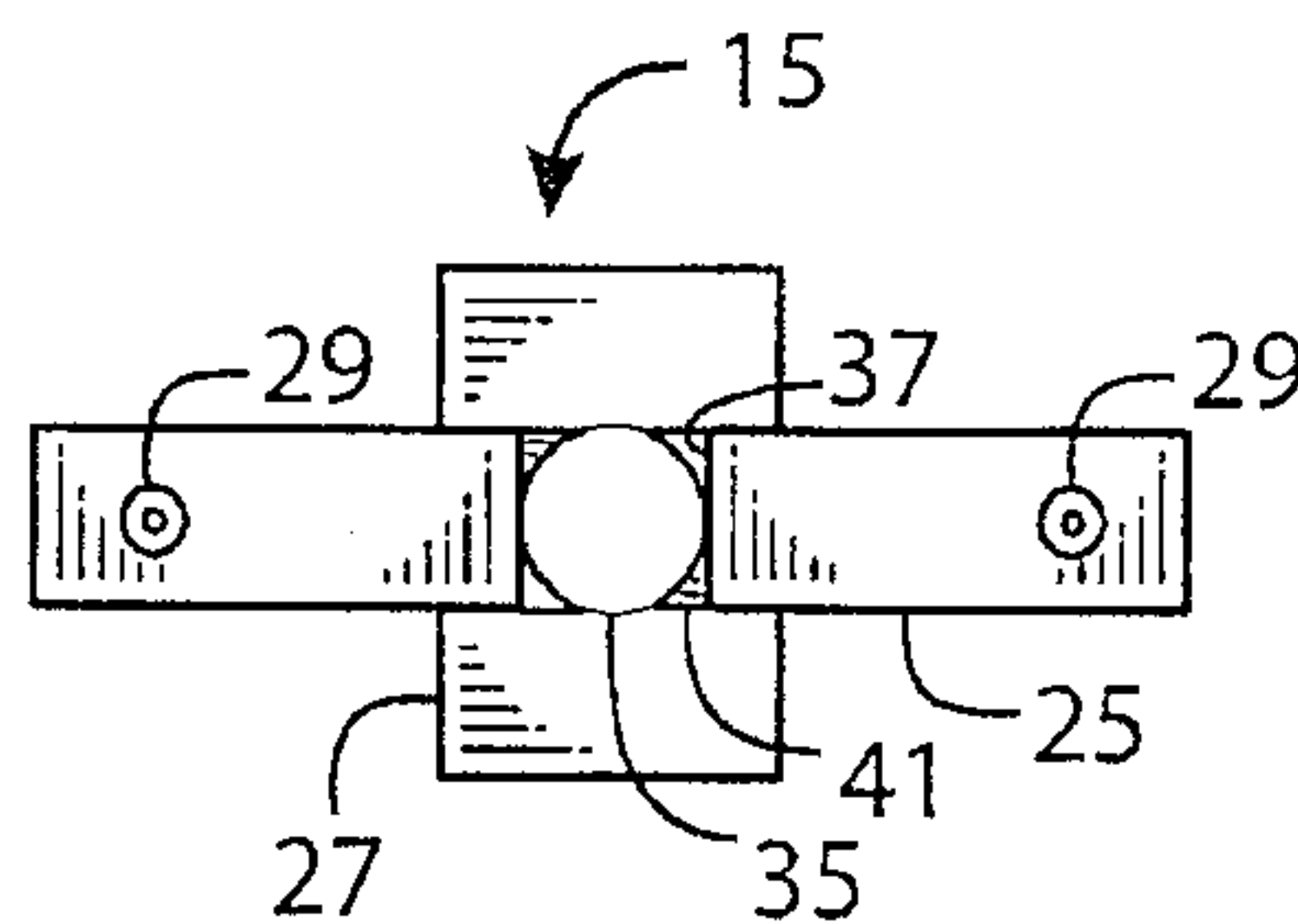


FIG. 17

