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(54) **ADJUSTABLE ATTACHMENT SYSTEM**

(76) Inventors: **Christopher A. Schultz**, Lake Elmo, MN (US); **Michel Michno**, Minneapolis, MN (US); **Tejav Dehghanyar**, Marina Del Rey, CA (US)

Correspondence Address:
DORSEY & WHITNEY LLP
INTELLECTUAL PROPERTY DEPARTMENT
SUITE 1500, 50 SOUTH SIXTH STREET
MINNEAPOLIS, MN 55402-1498 (US)

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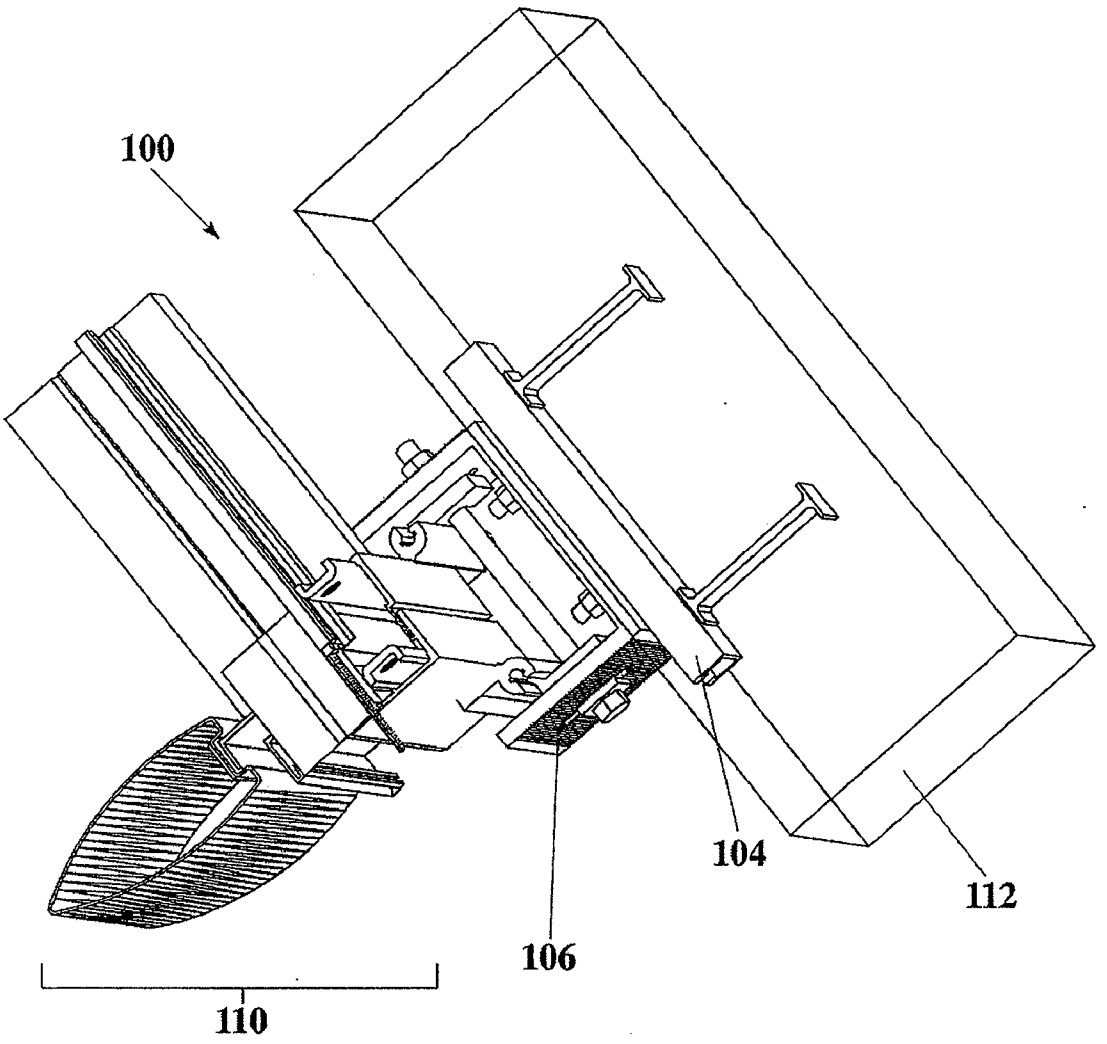
(57) **ABSTRACT**

An embed for embedding in a base is provided. The embed comprises a box defining a top face and at least one side face, the top face configured to be placed flush with an upper surface of the base, and the at least one side face configured to be placed flush with an edge of the base. The embed may be part of an adjustable attachment system comprising an embed for positioning in a base and a bridging clip configured for insertion in the embed and adapted for coupling to a unit. A kit is also described.



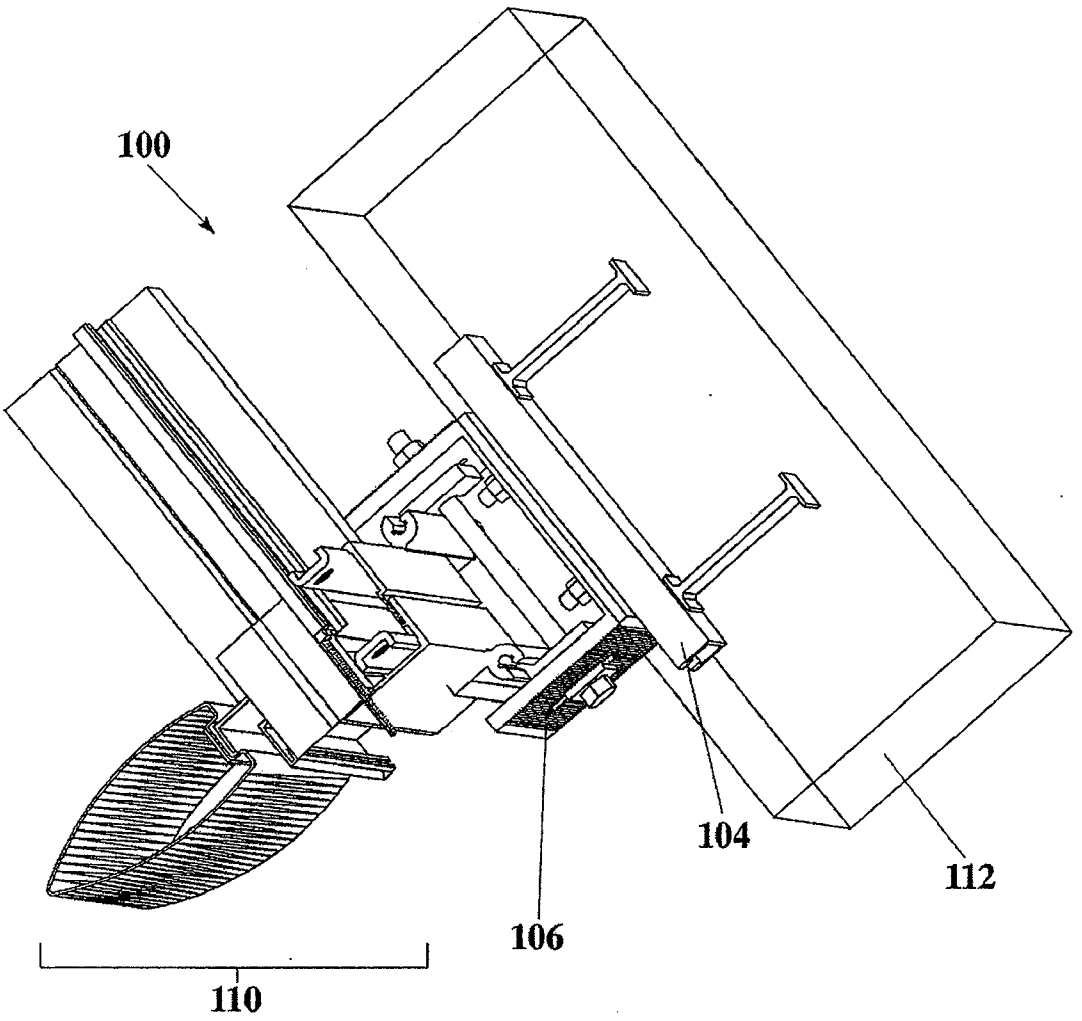
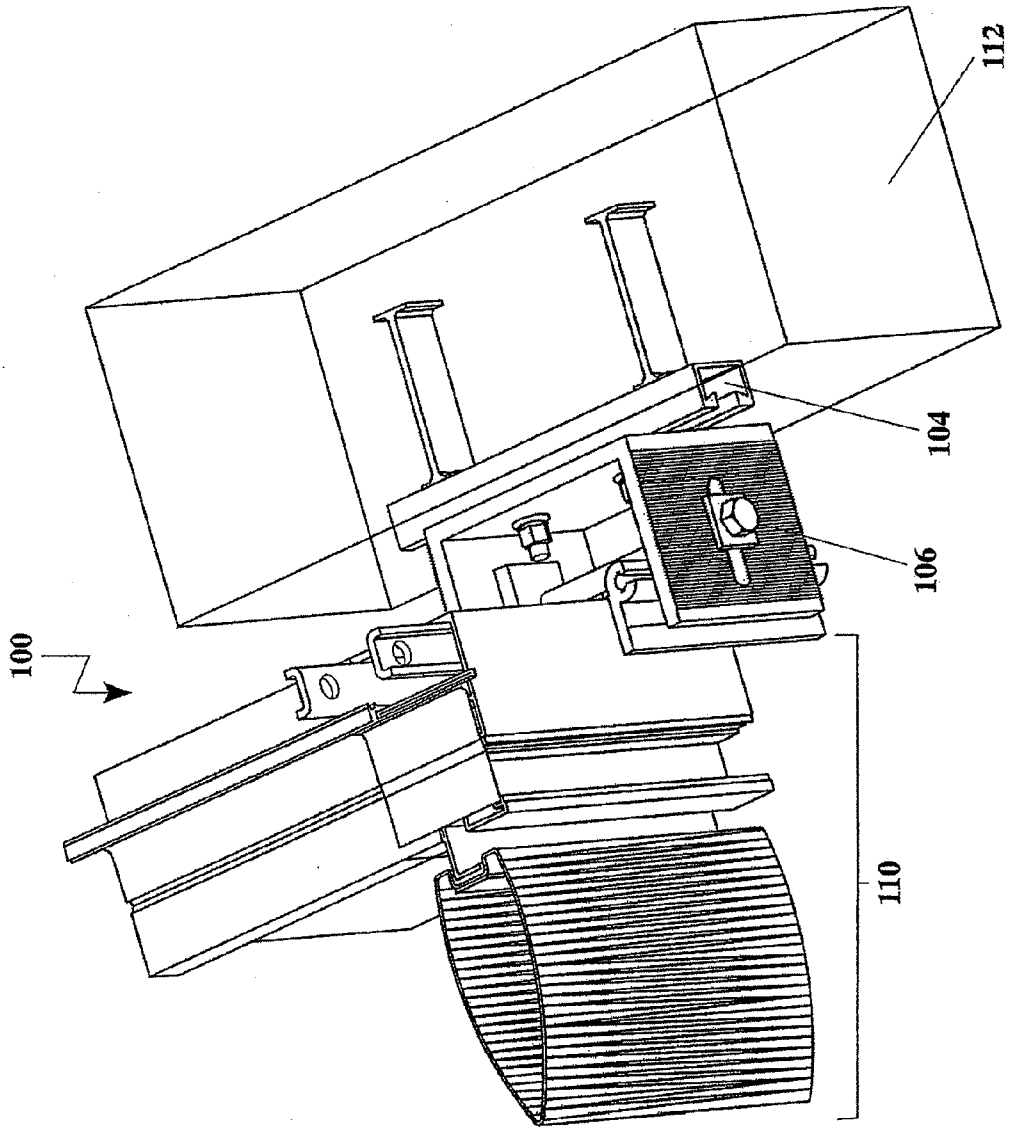


Figure 1



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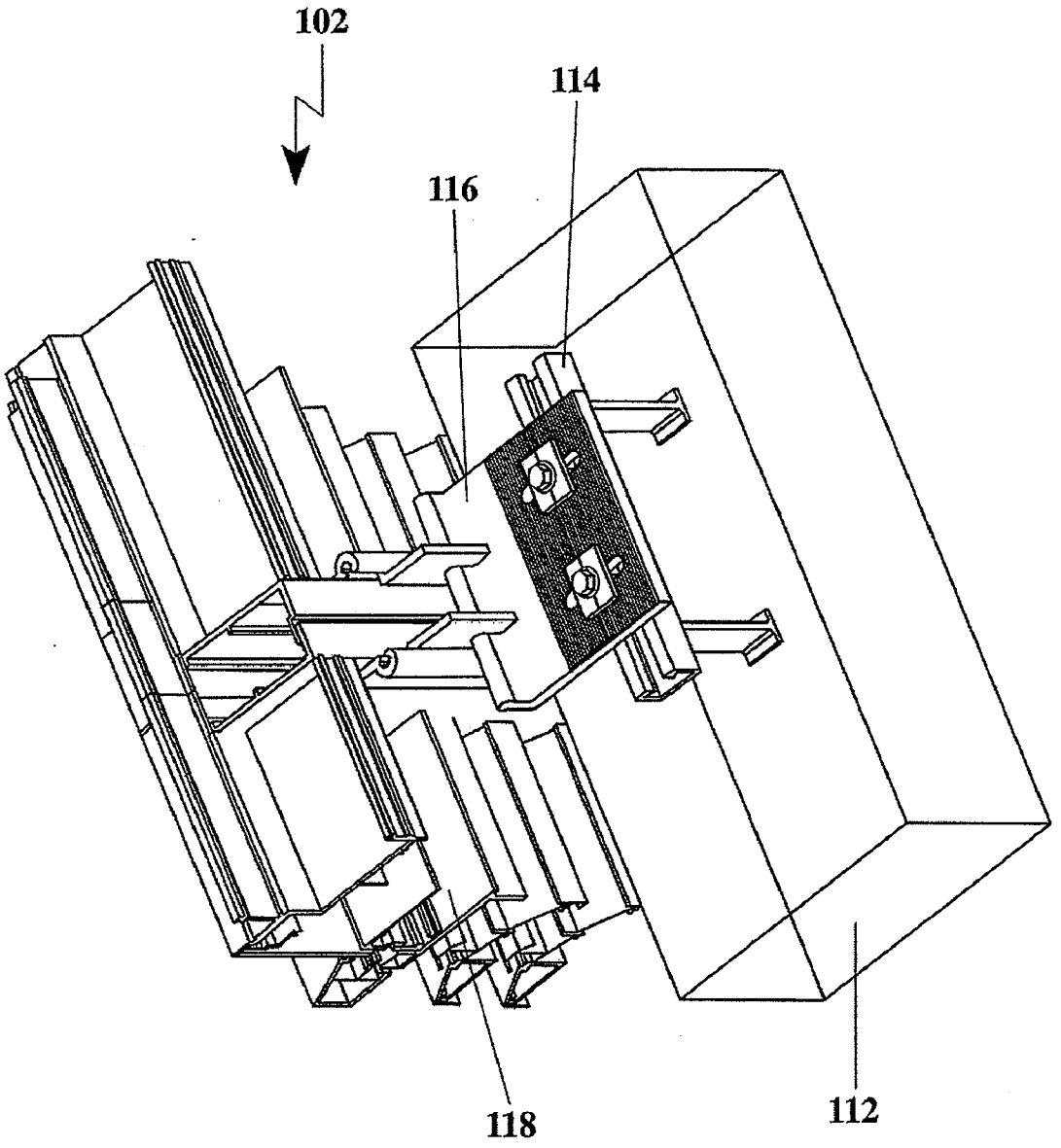

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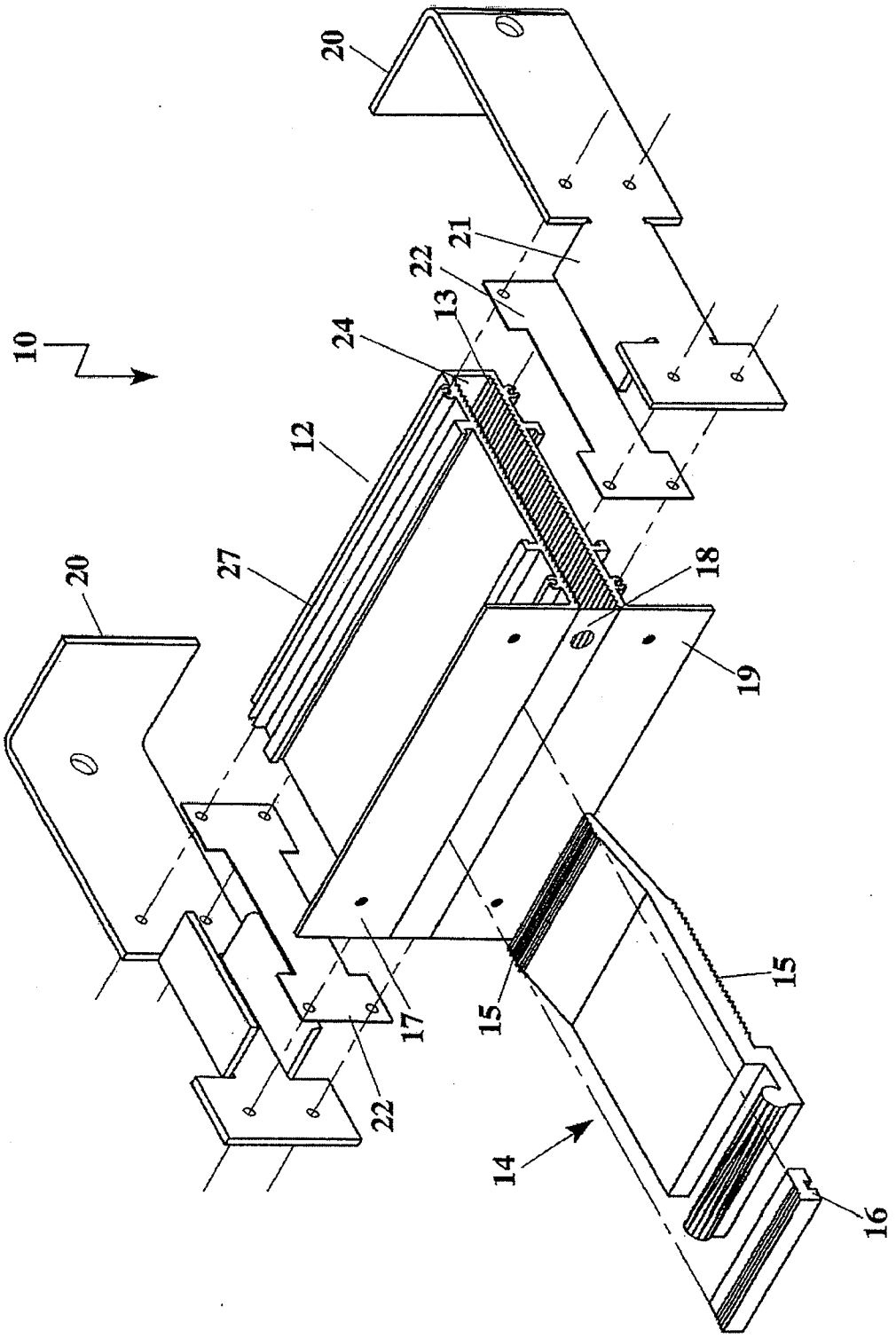

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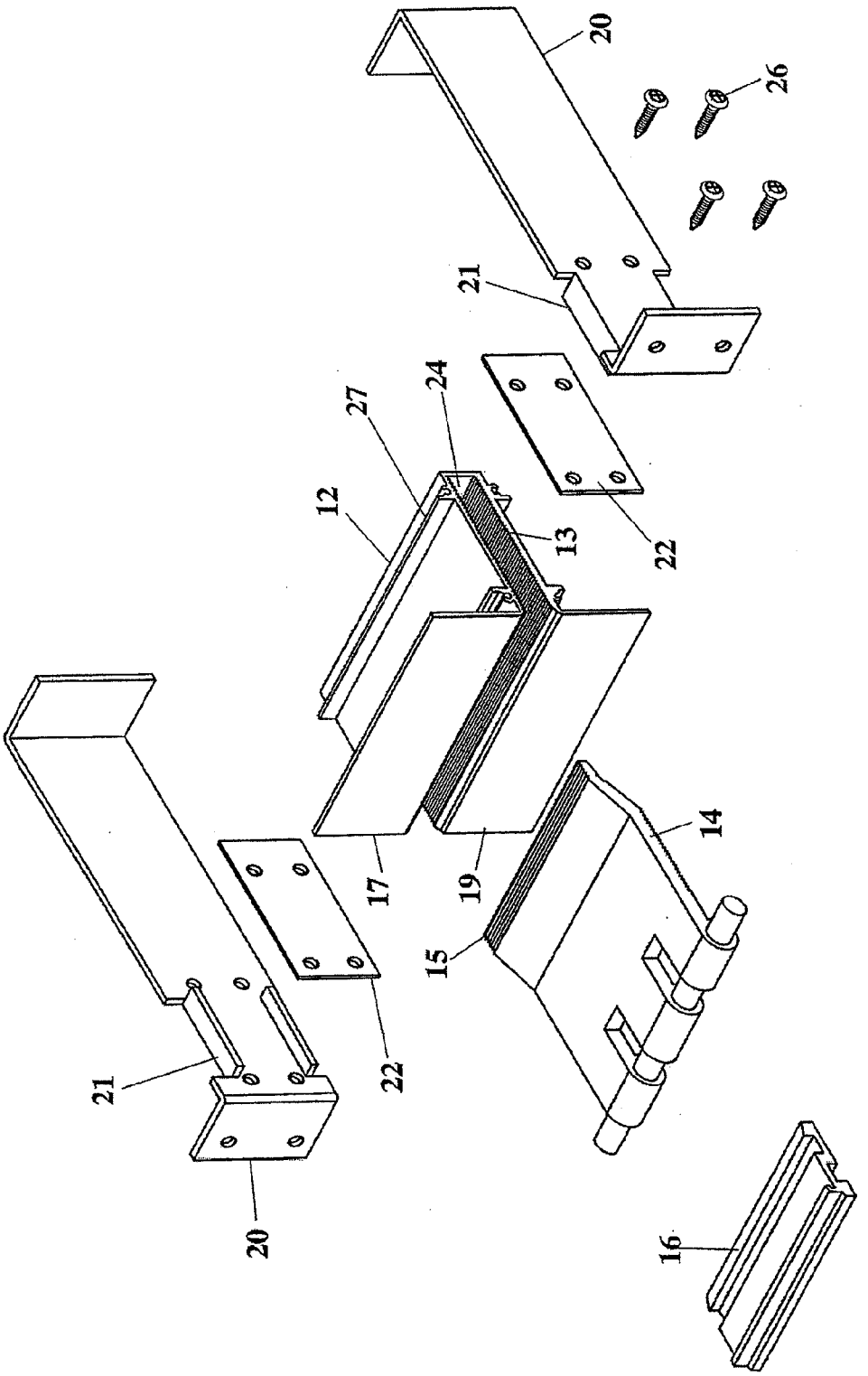

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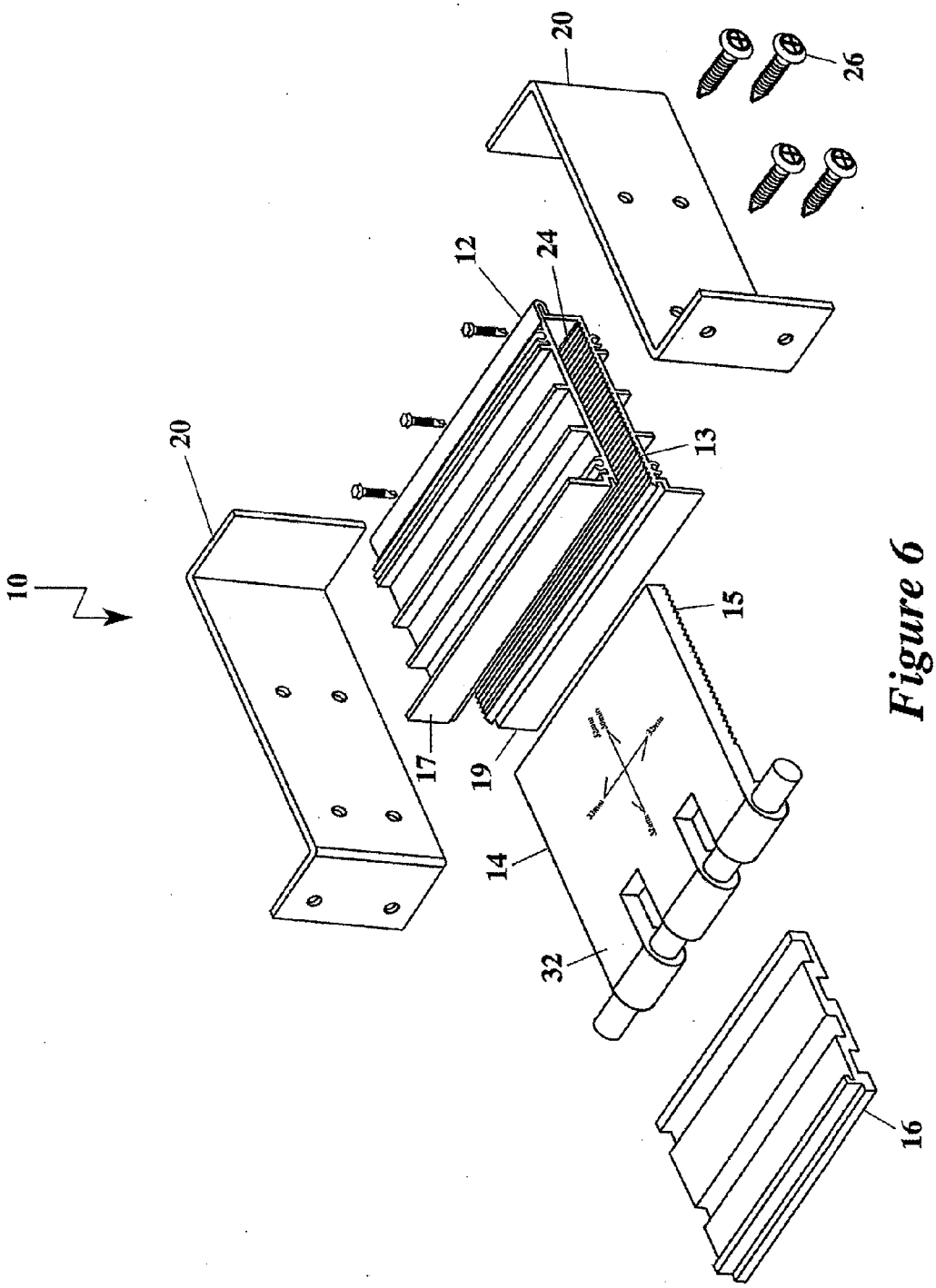

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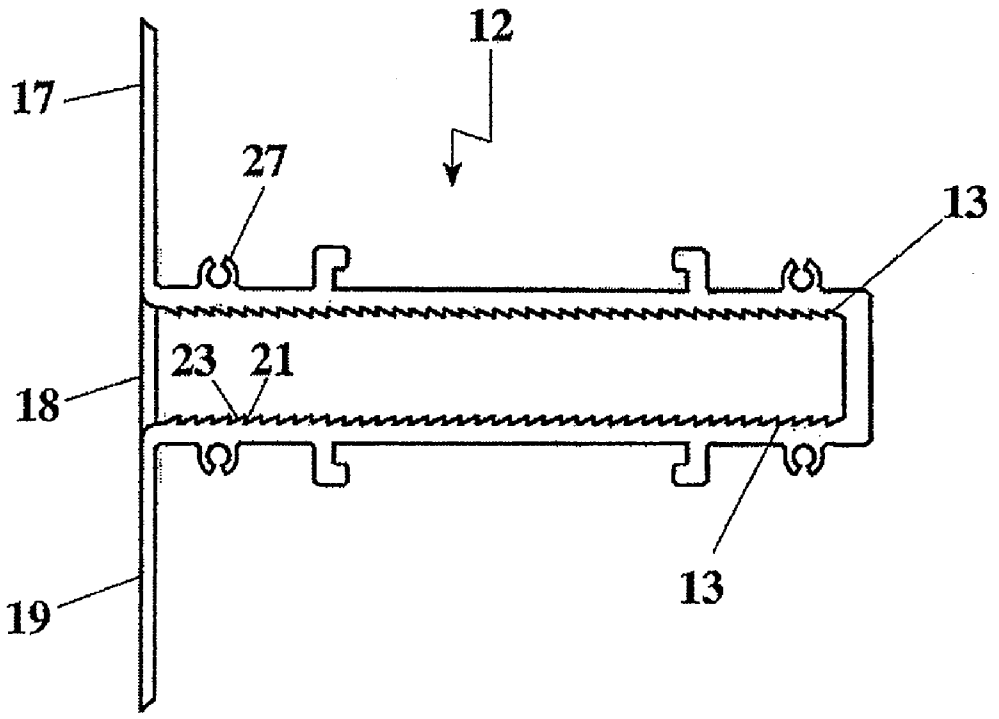

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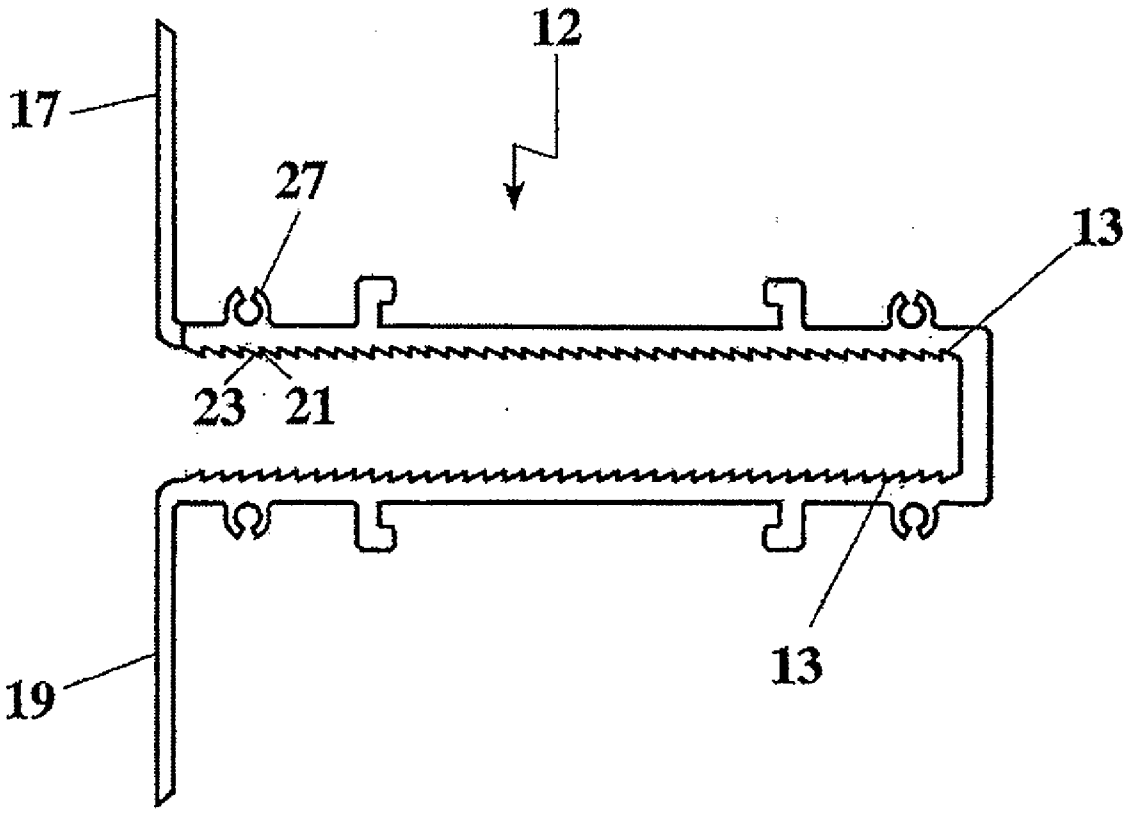

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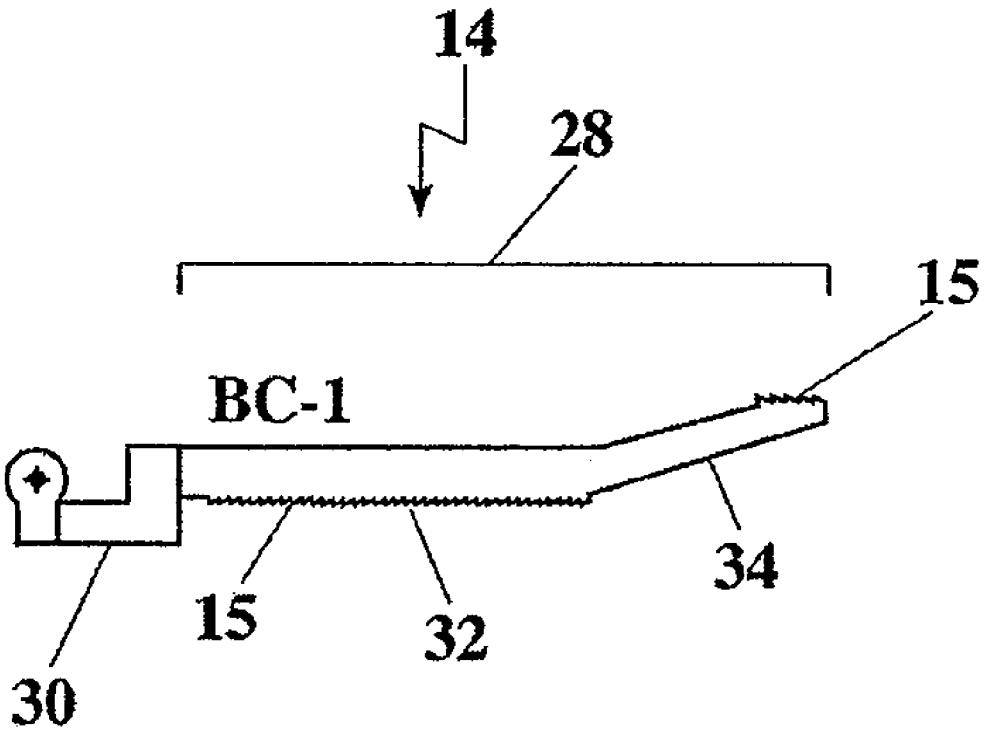

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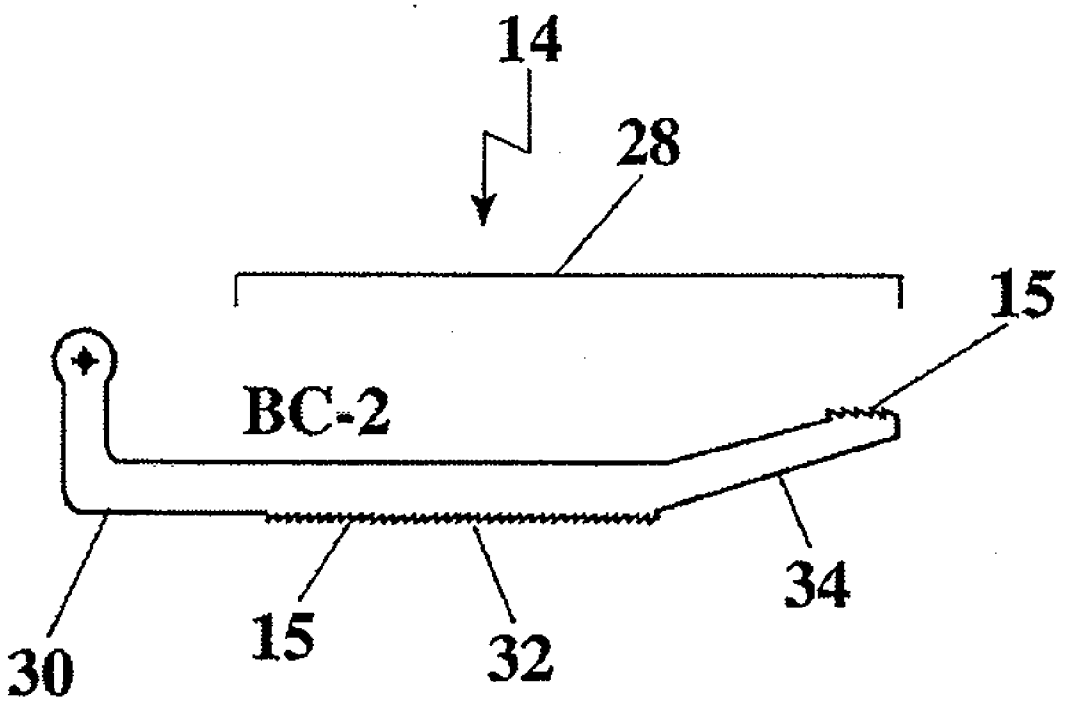

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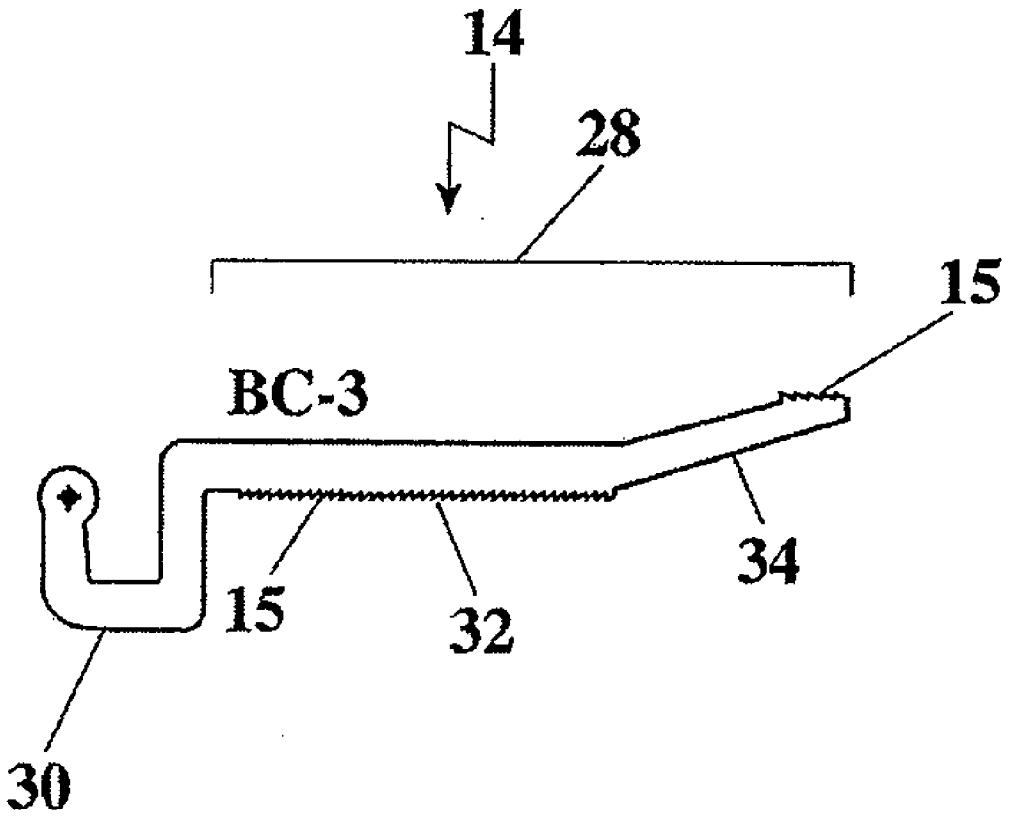

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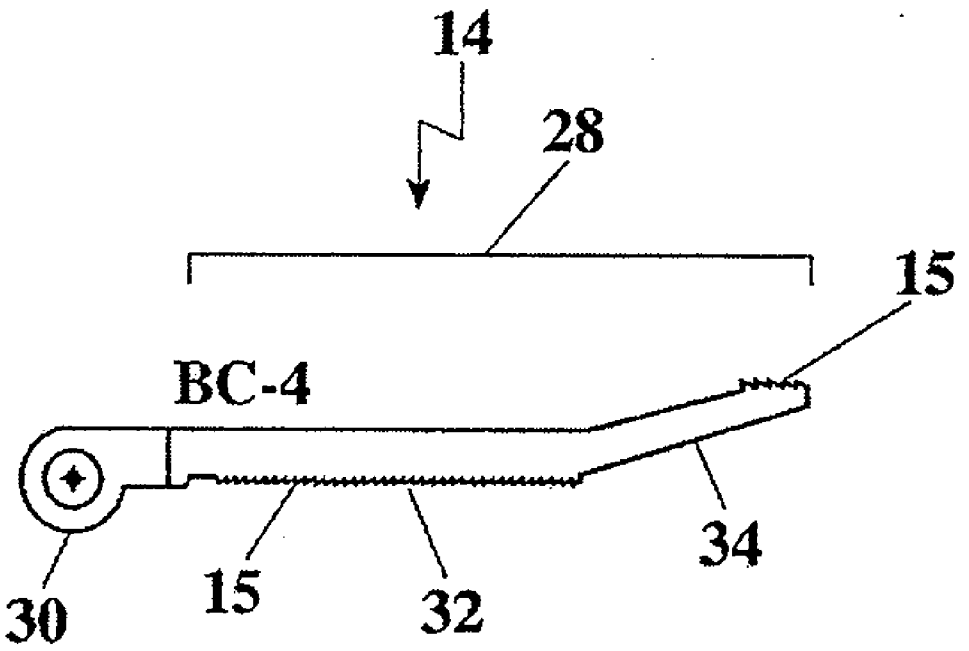

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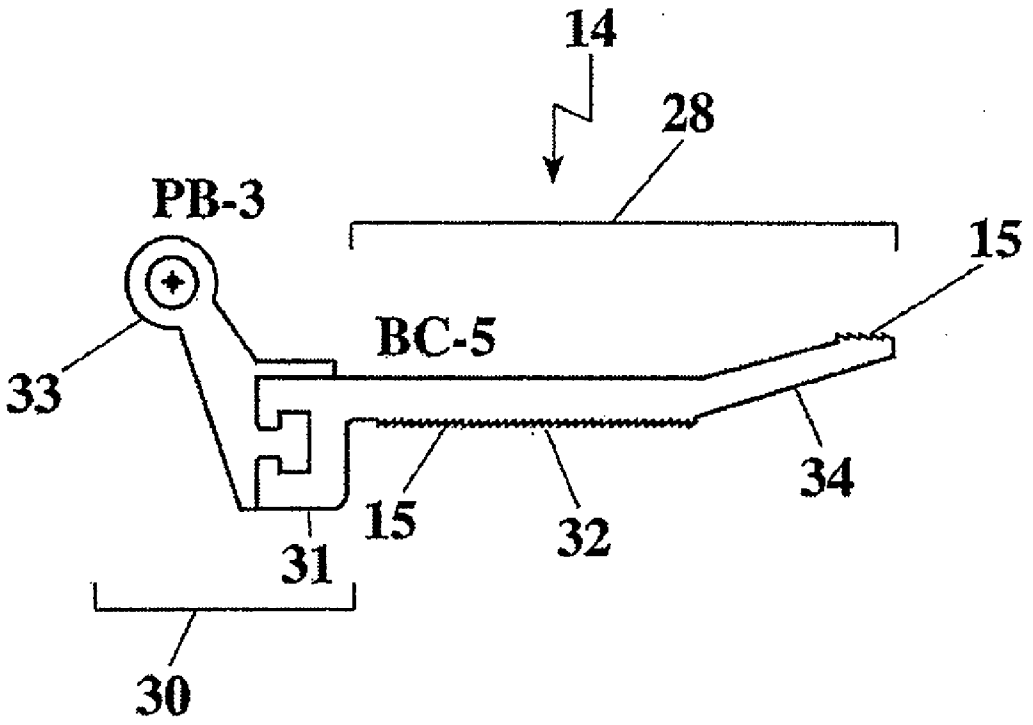

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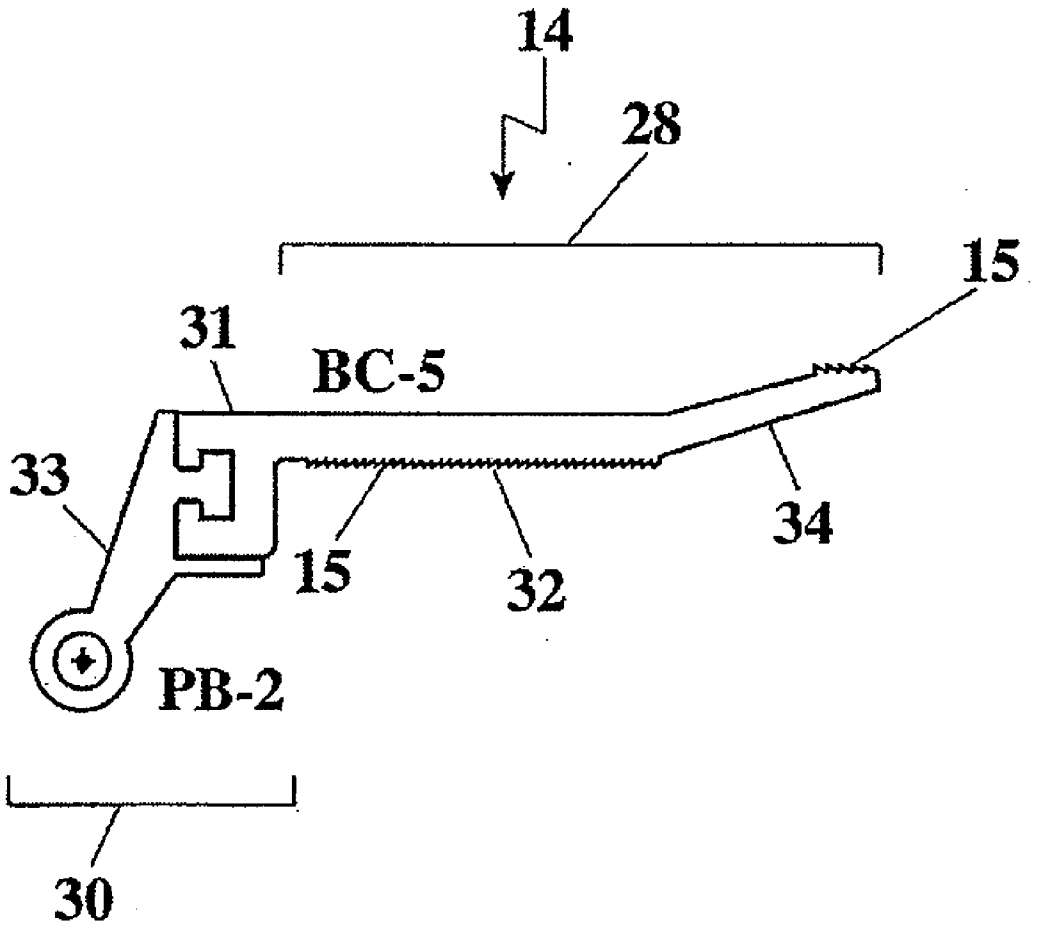

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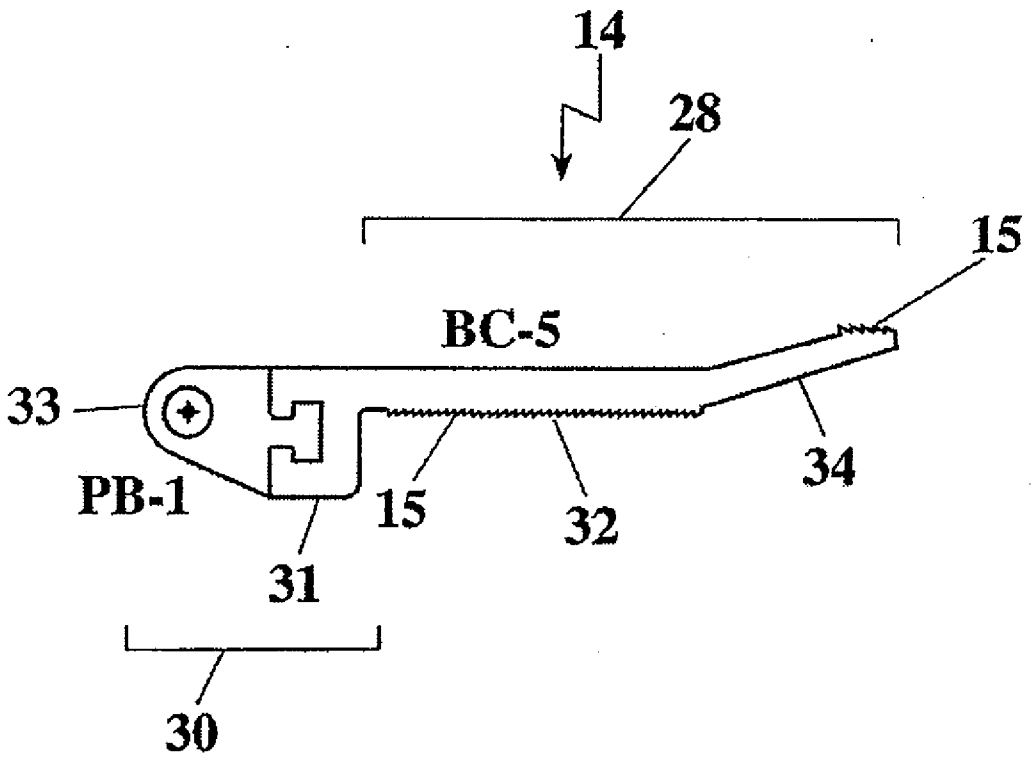

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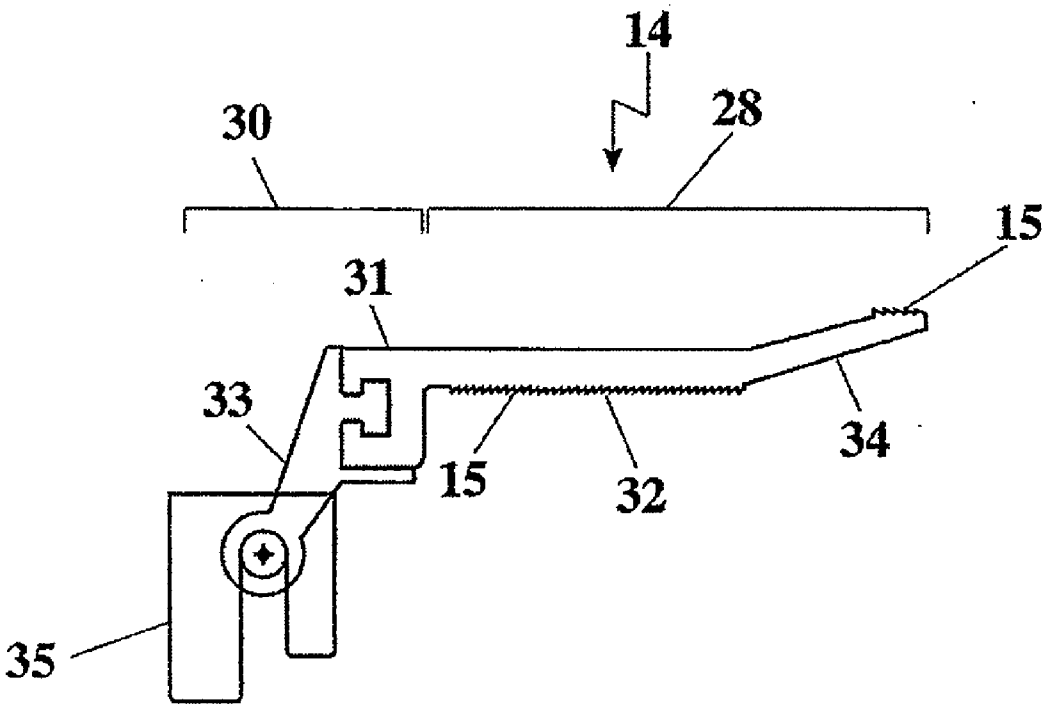

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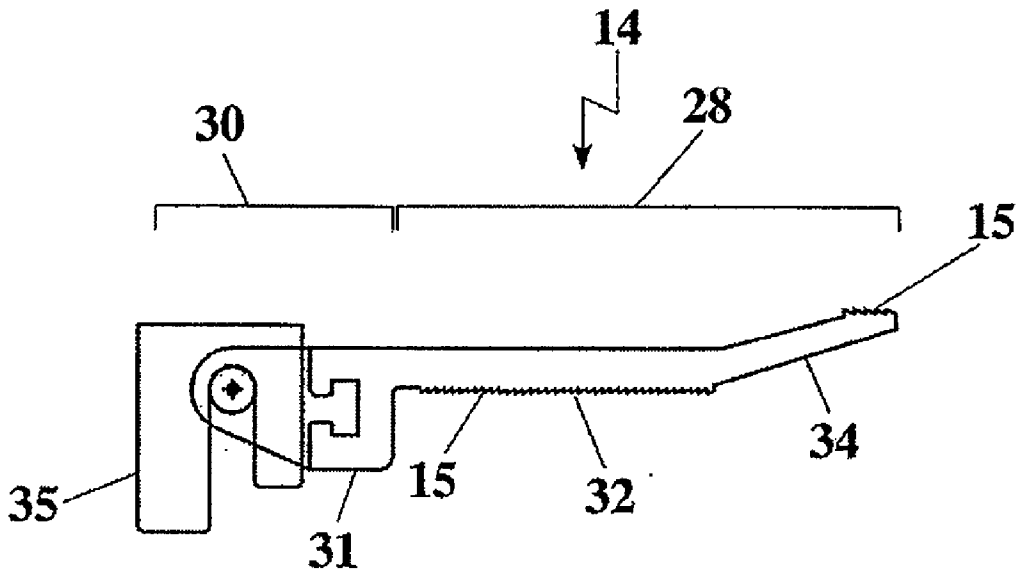

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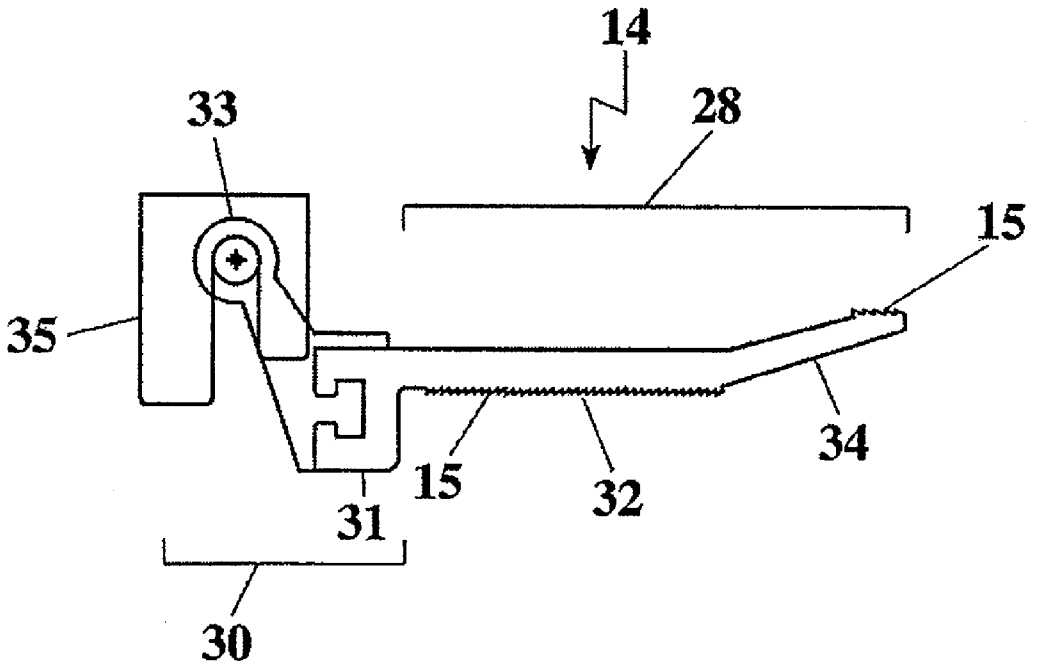

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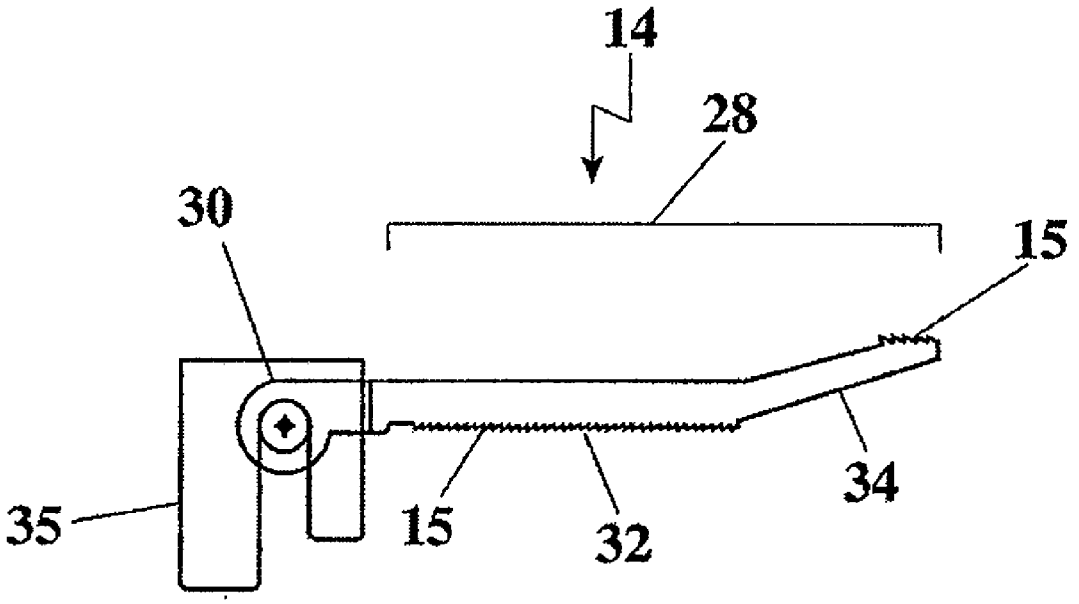

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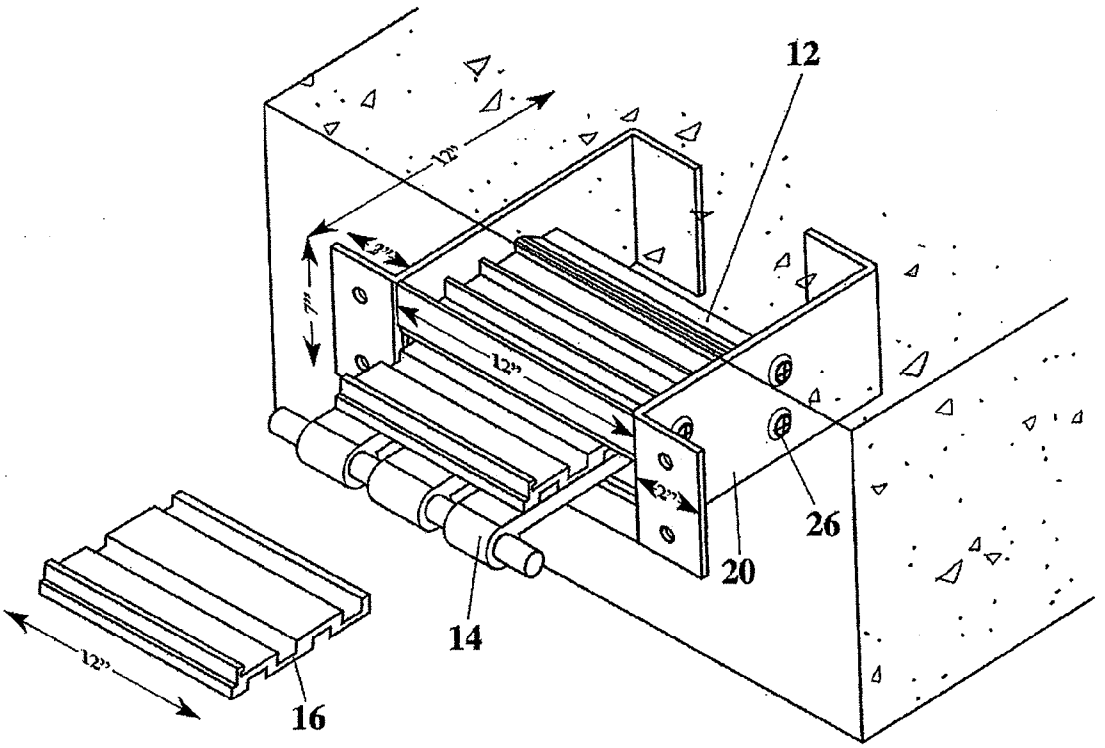

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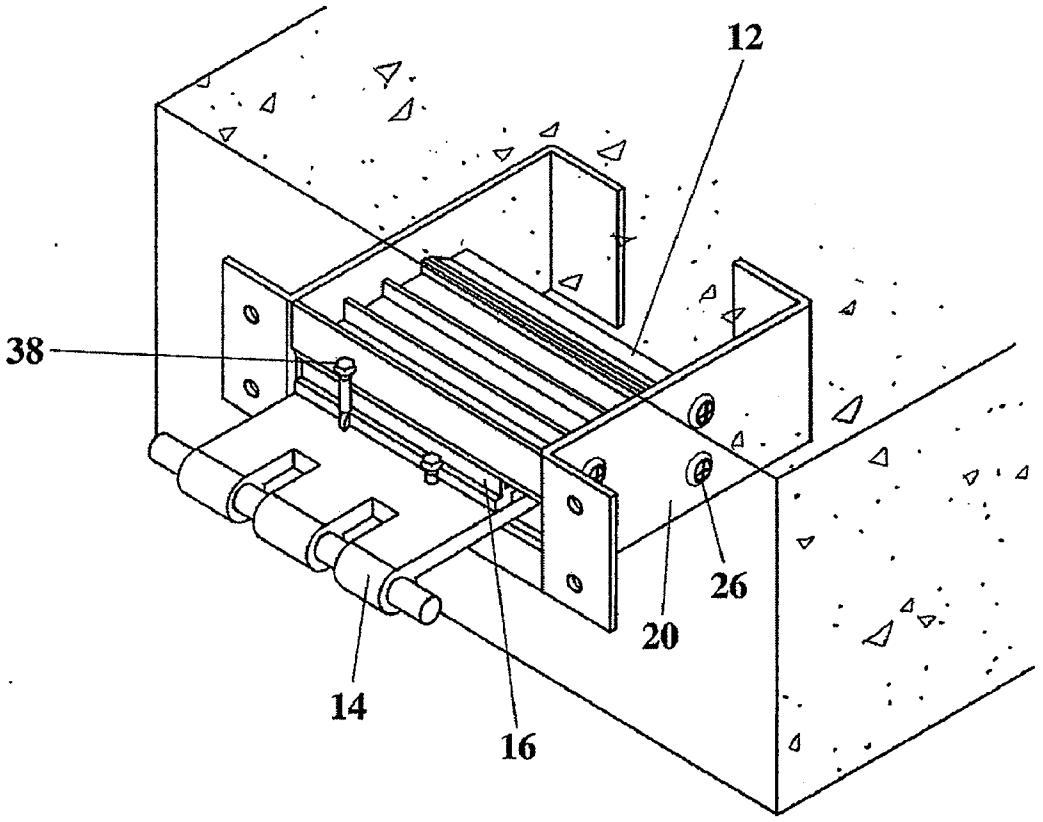

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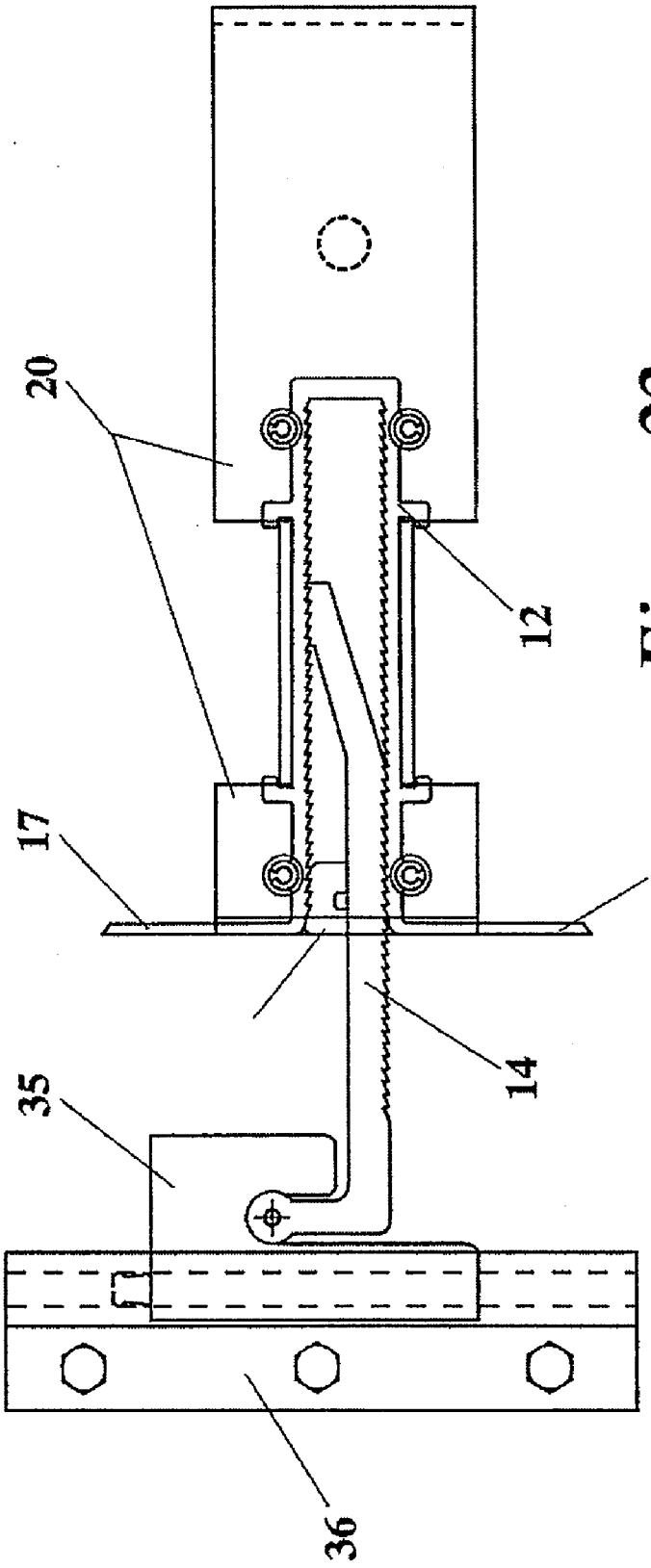

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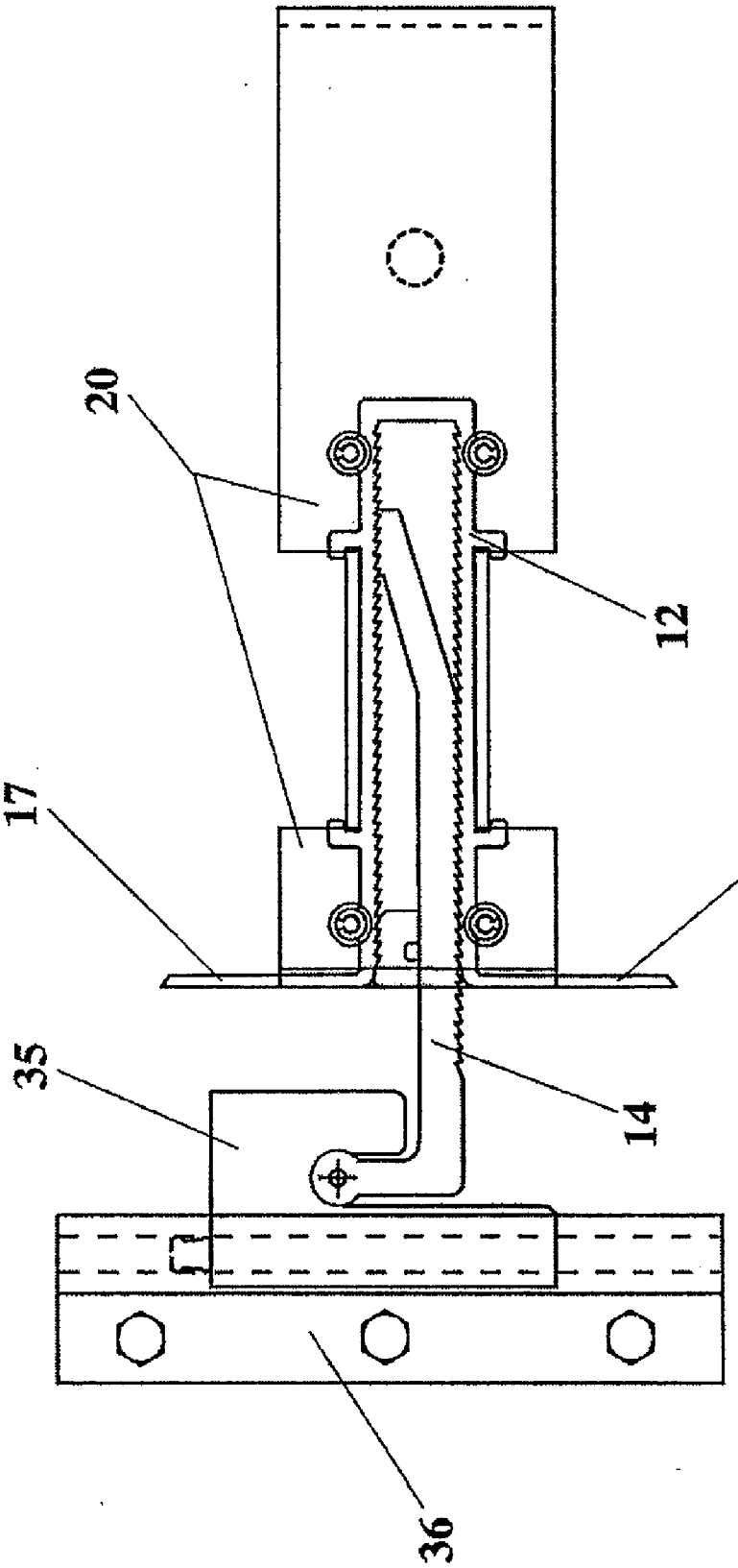

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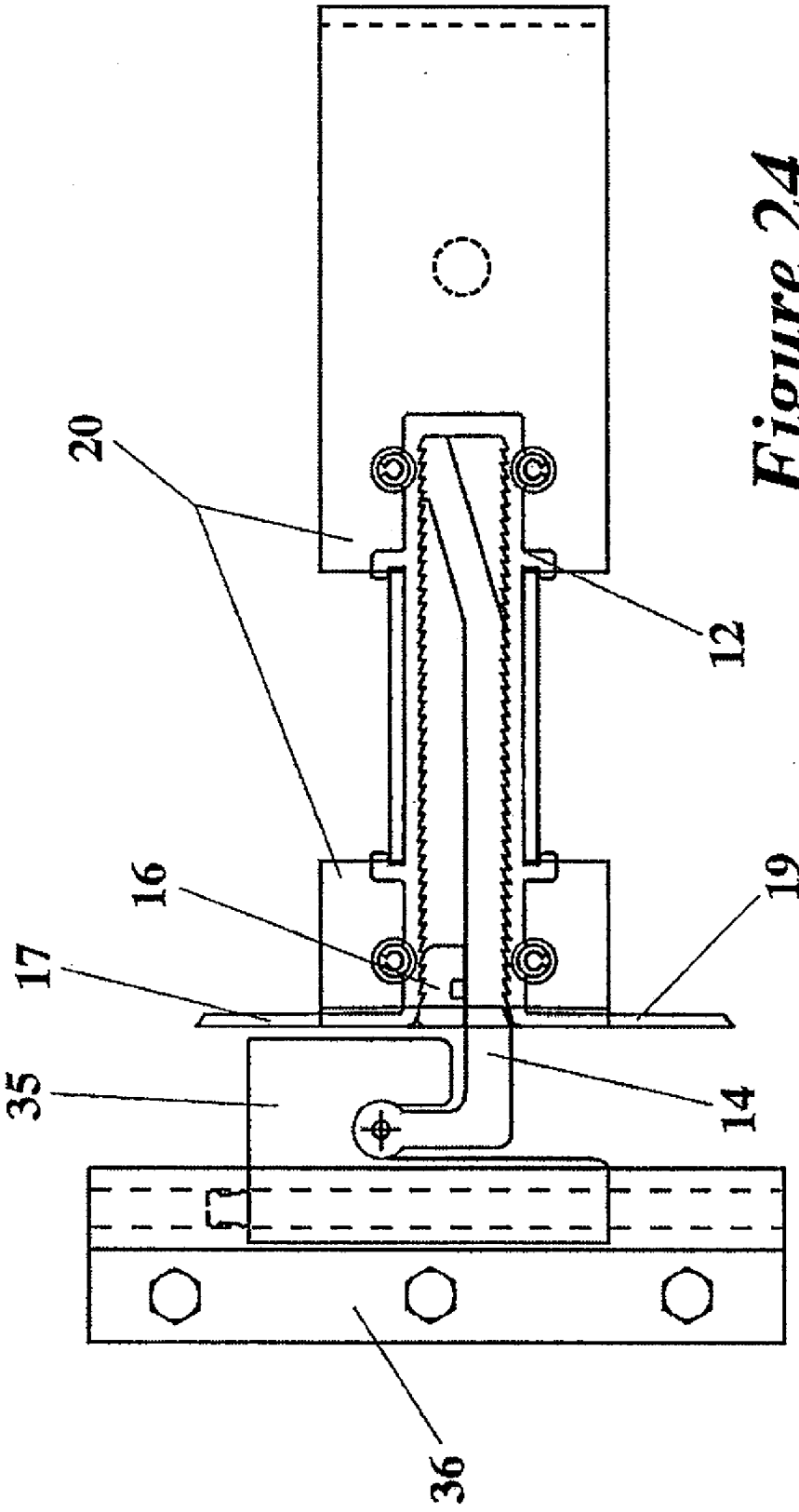

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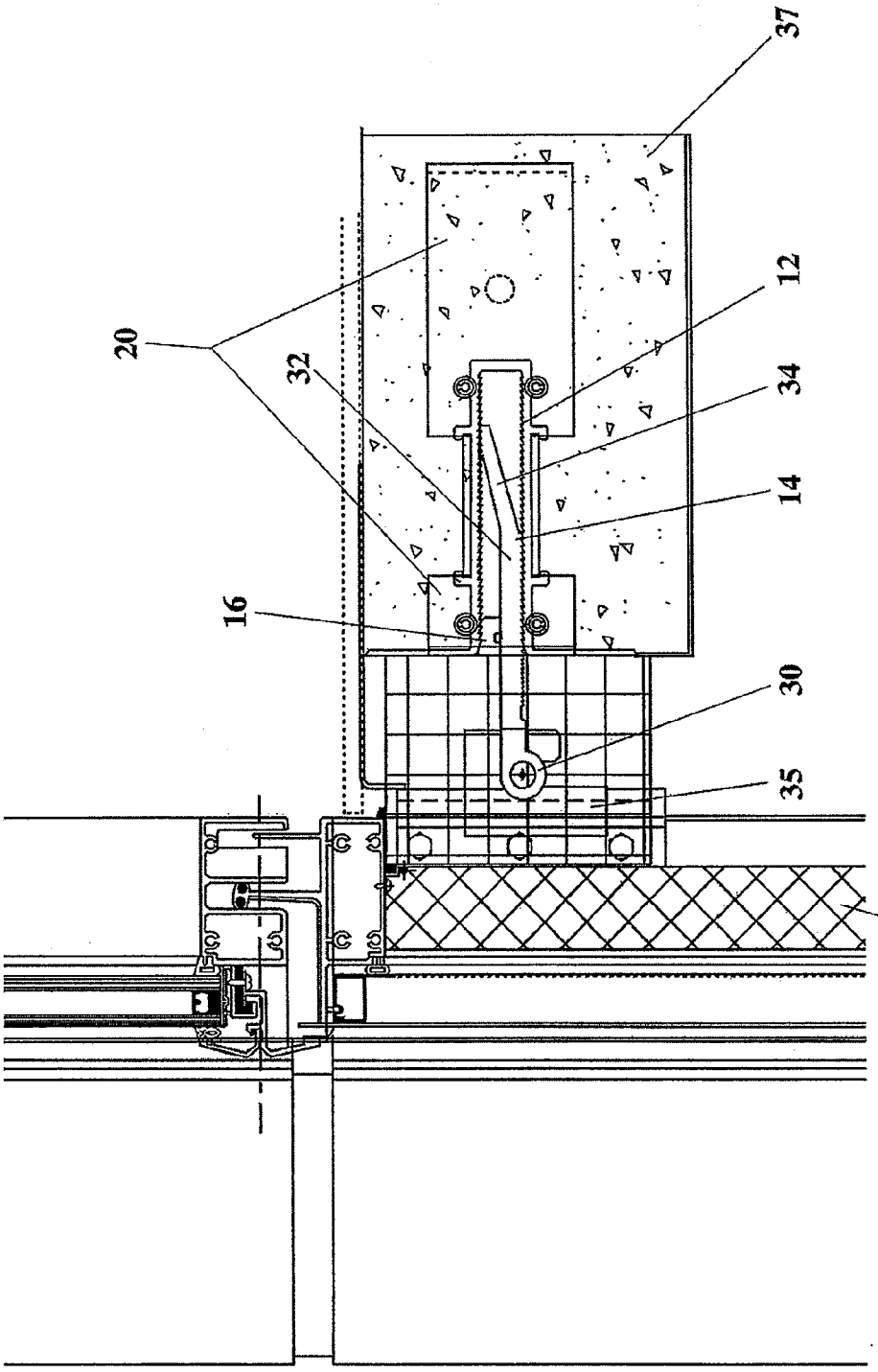

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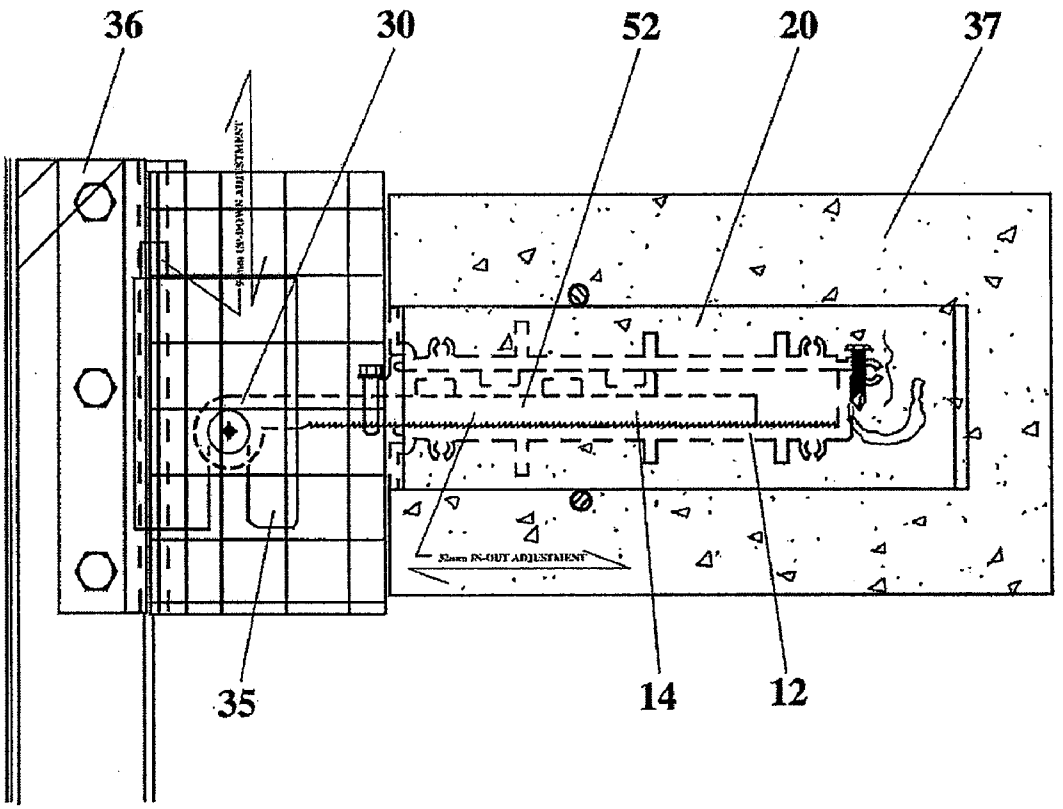

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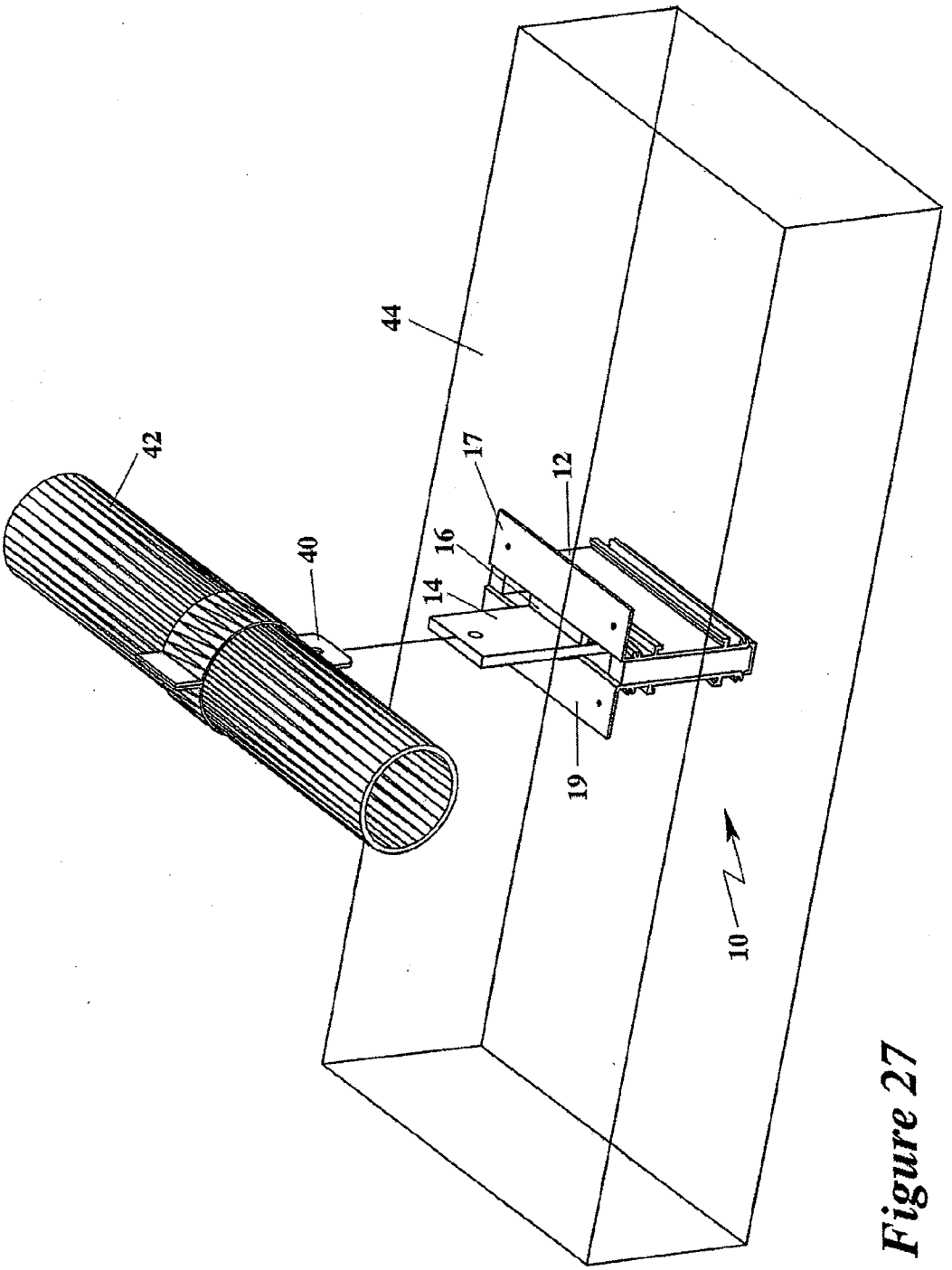

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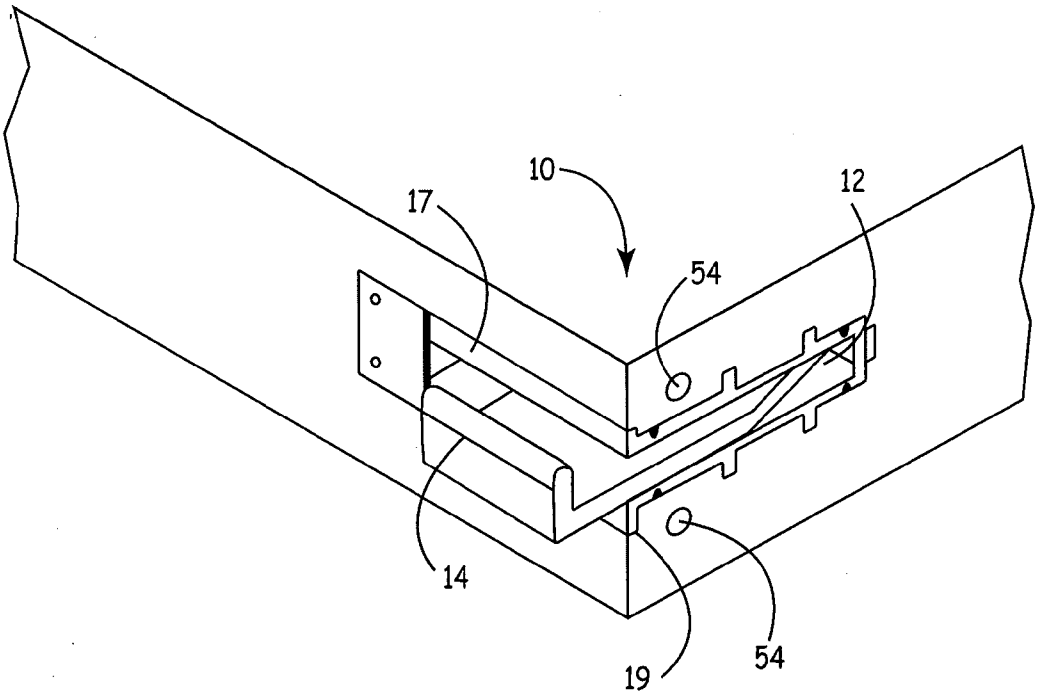
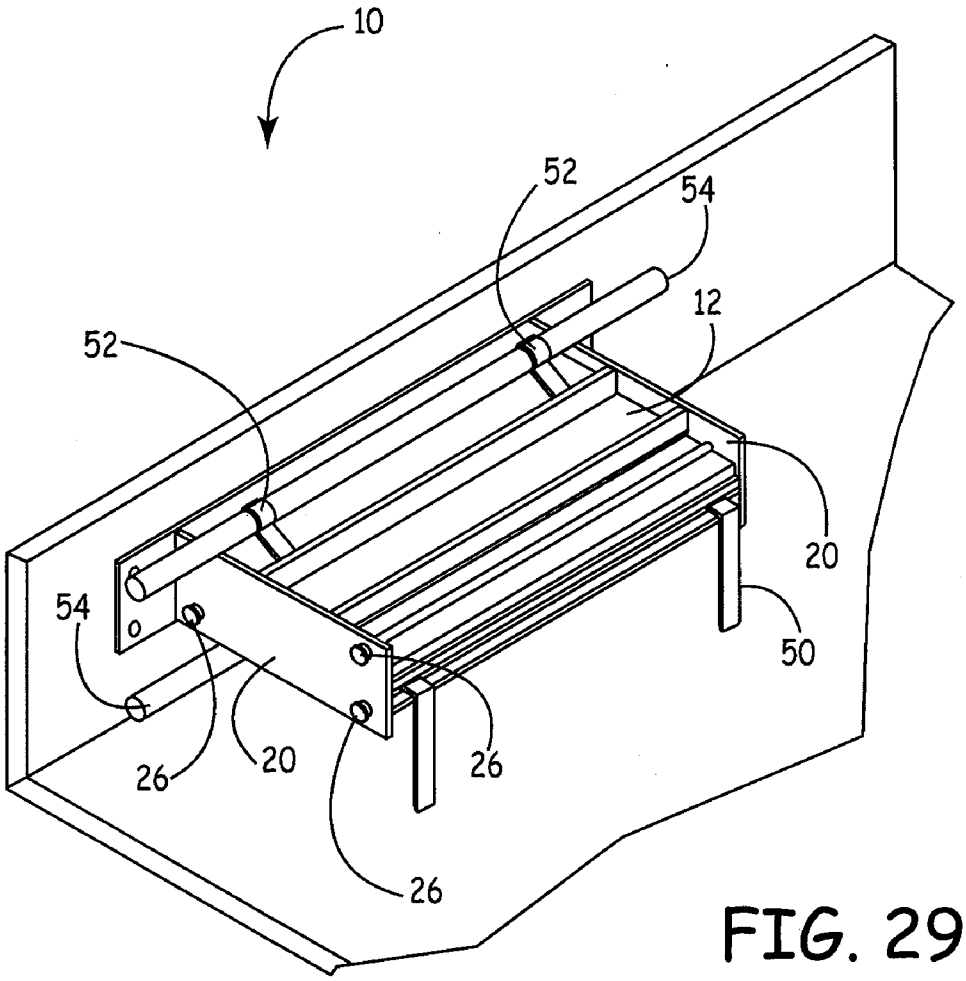


FIG. 28



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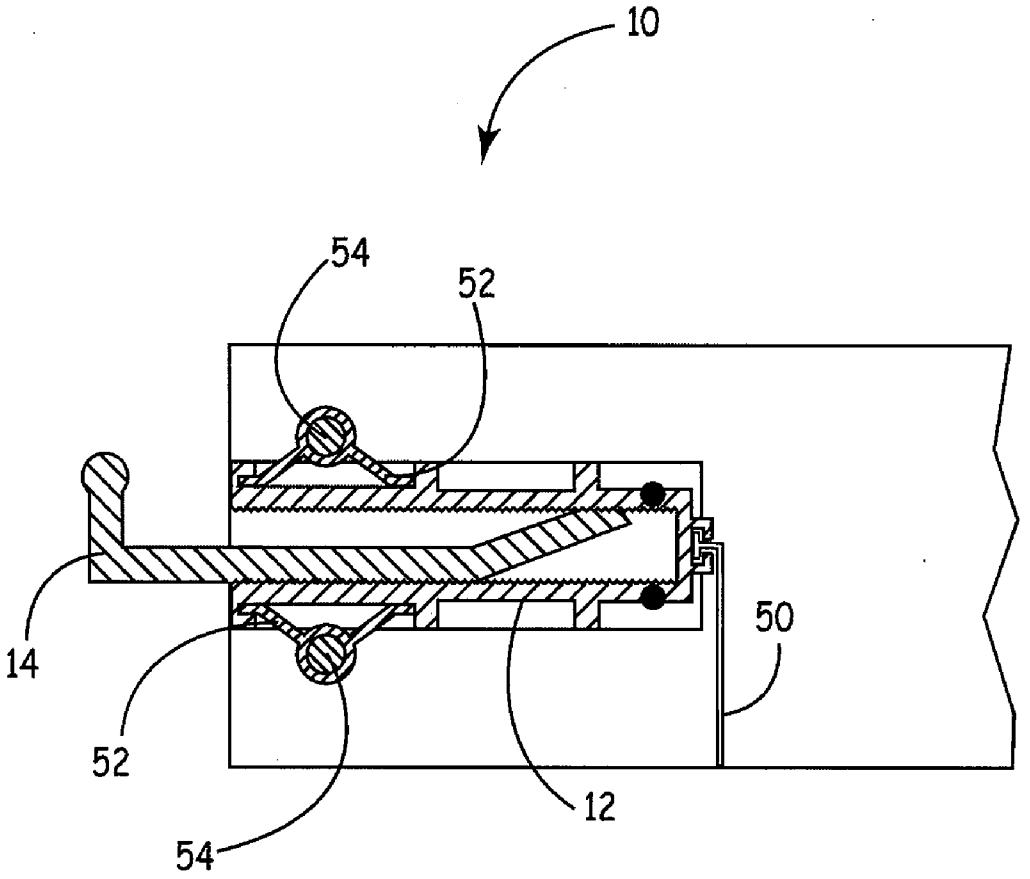

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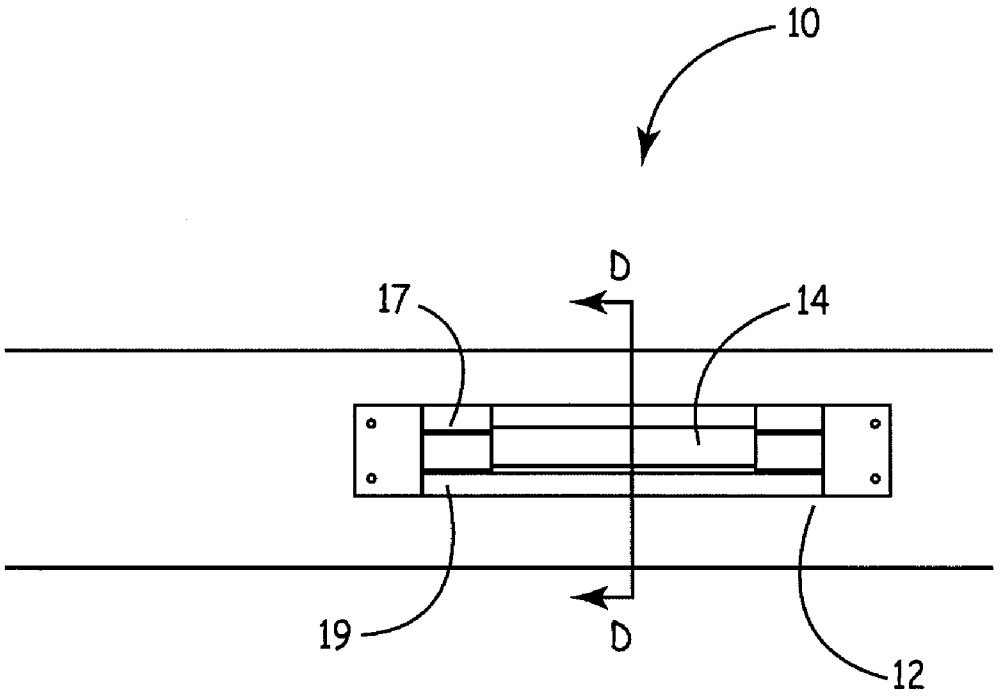

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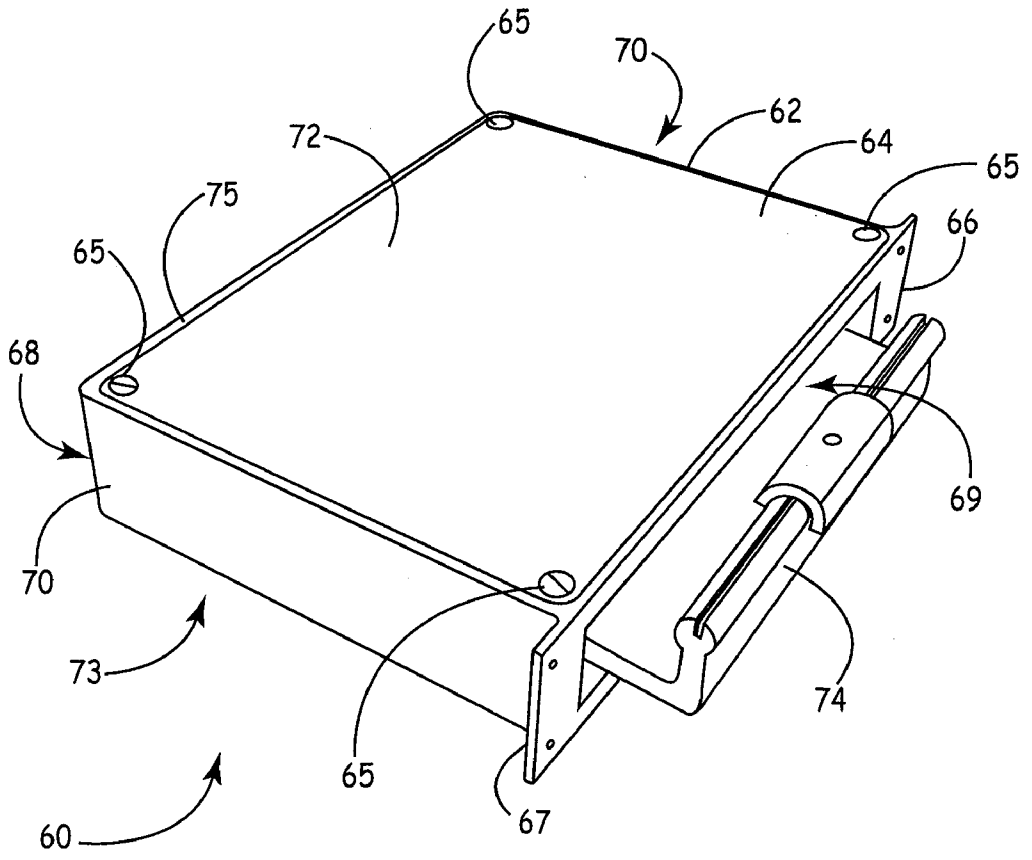


FIG. 32

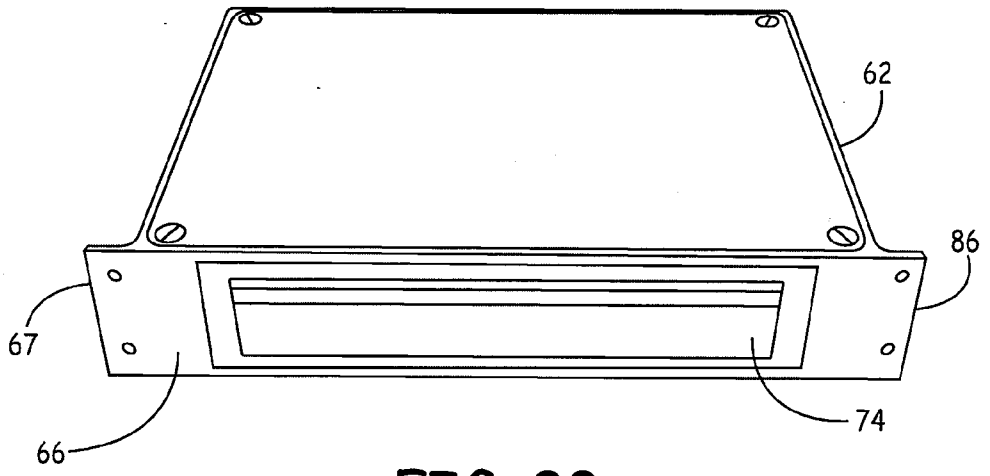


FIG. 33

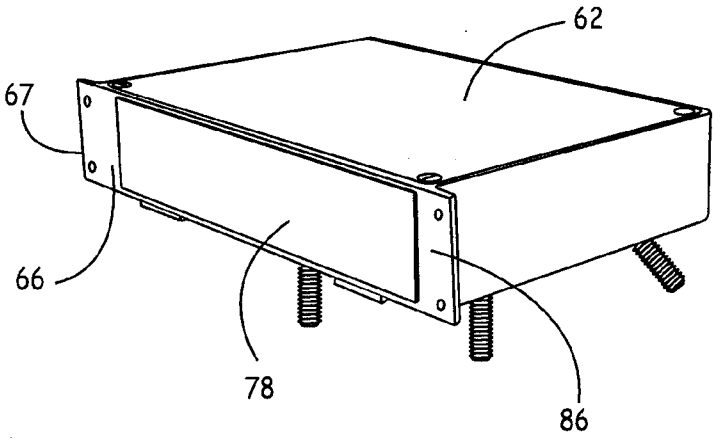


FIG. 34

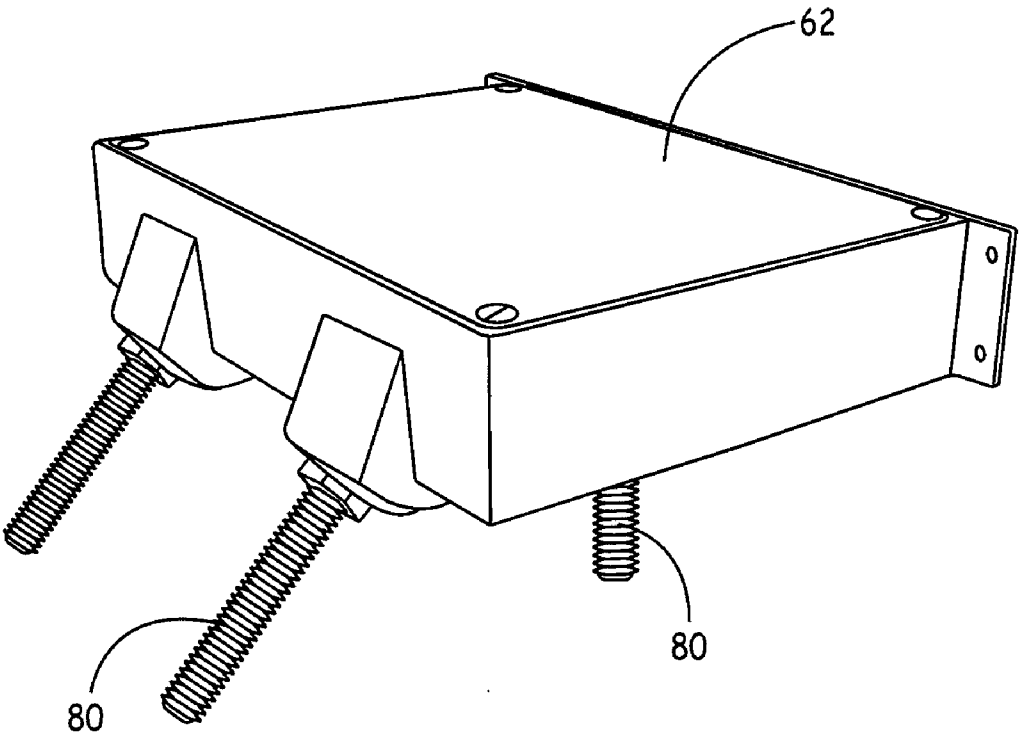
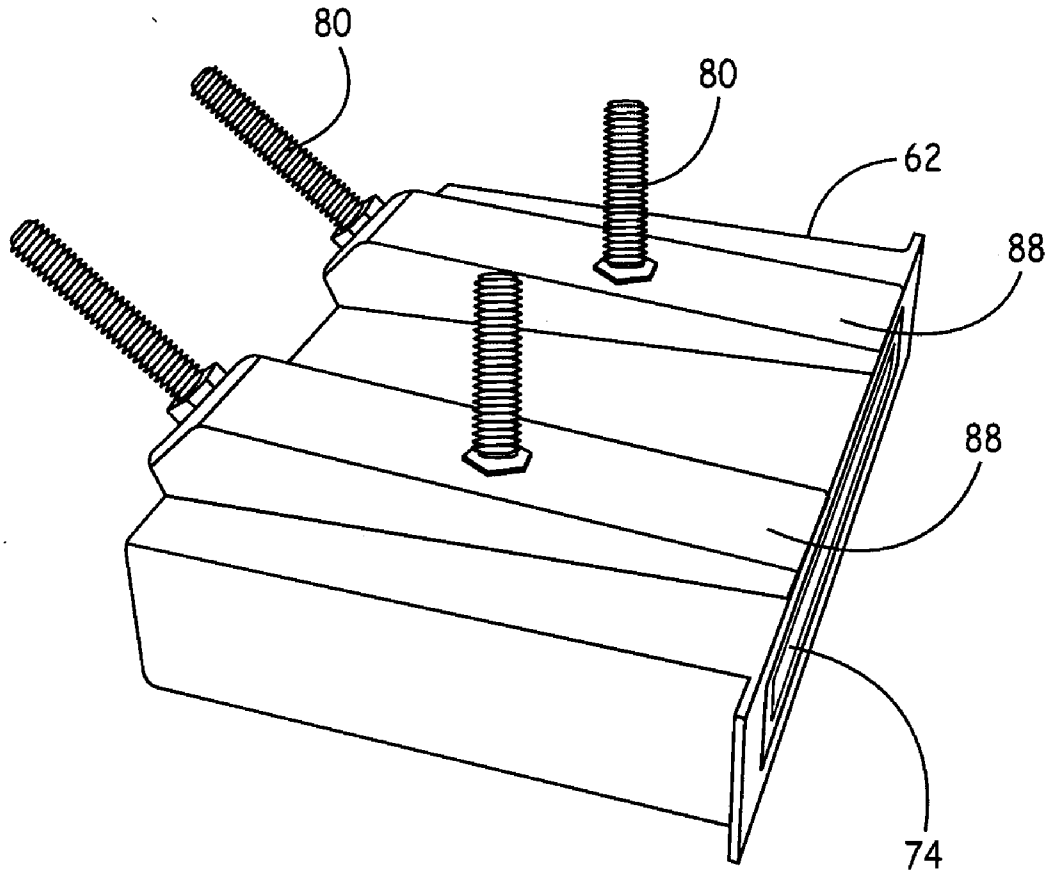


FIG. 35



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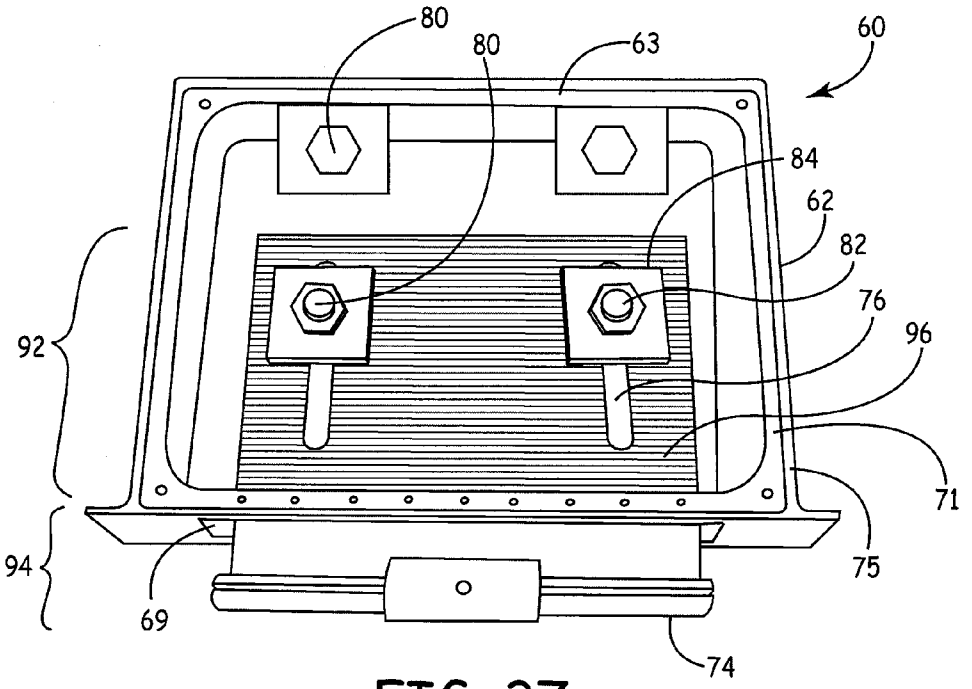
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FIG. 37

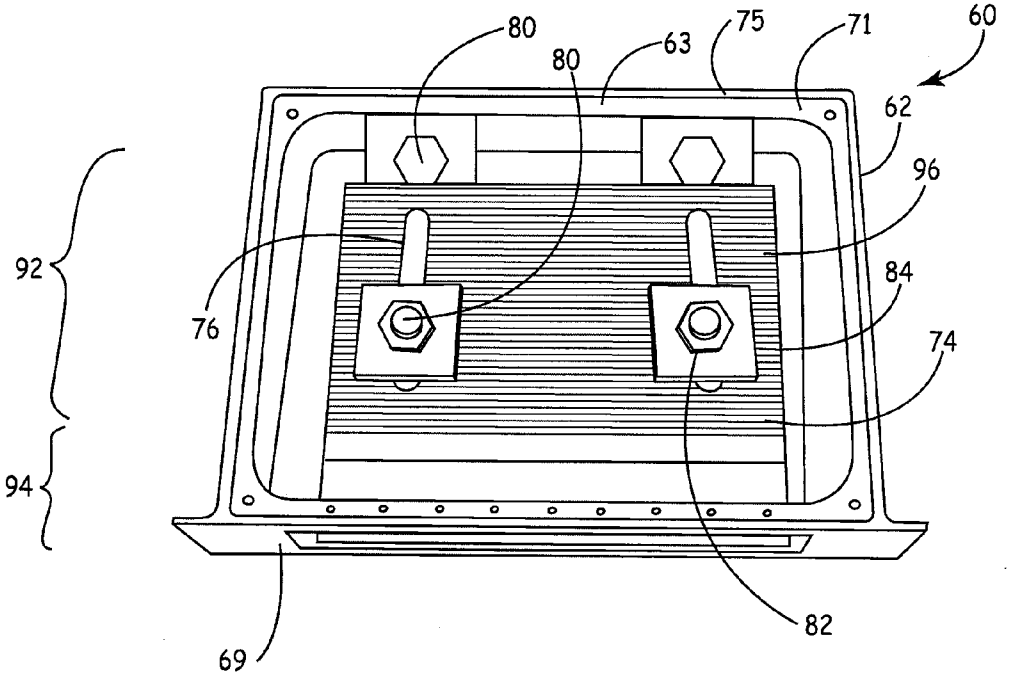
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FIG. 38

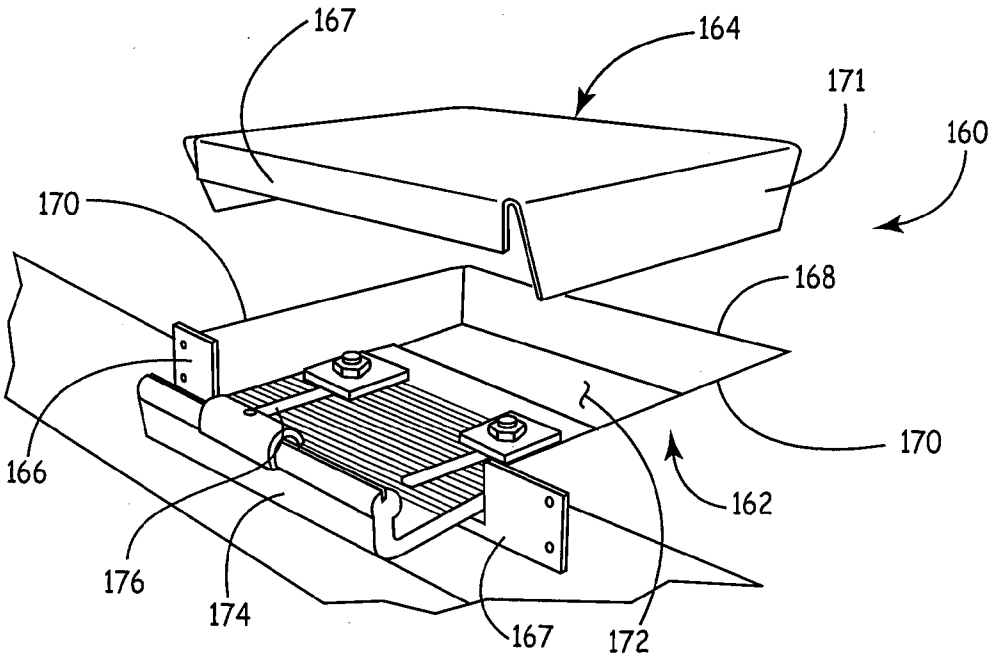
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FIG. 39

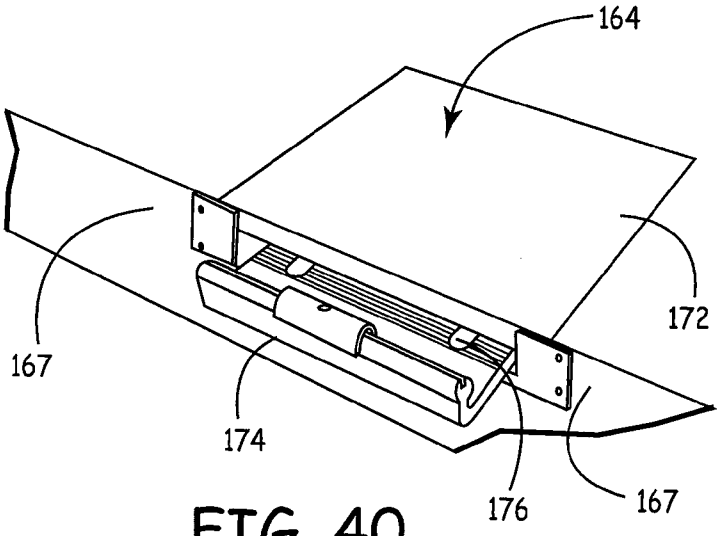
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FIG. 40

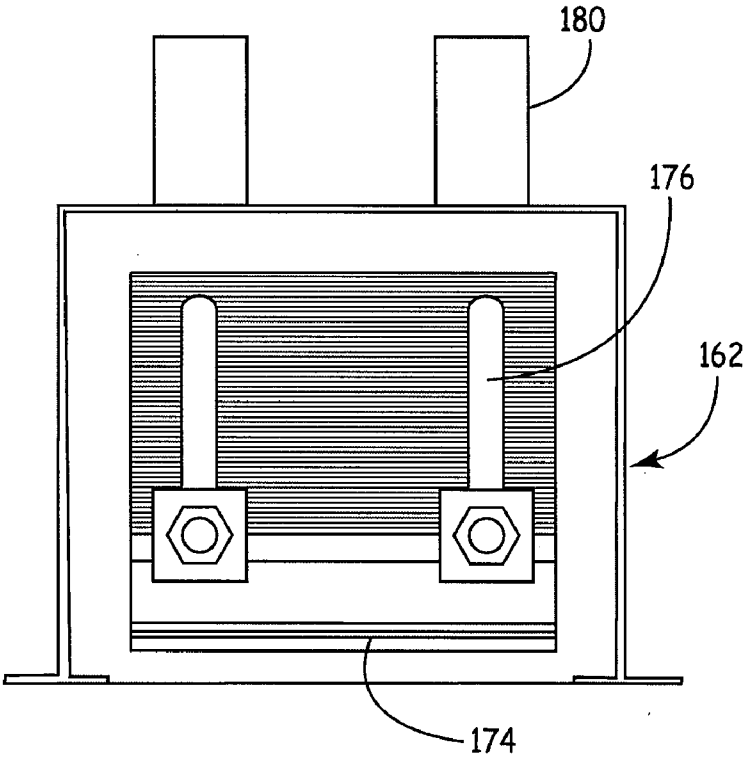

FIG. 41

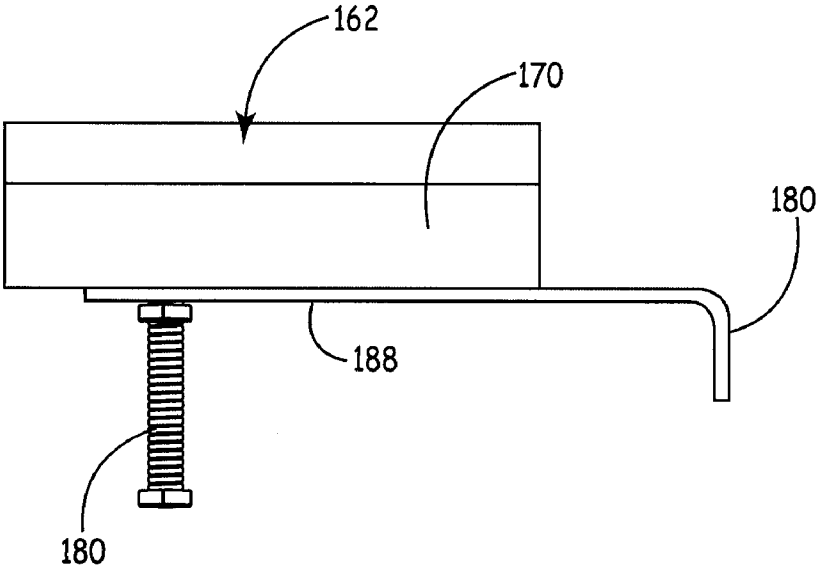

FIG. 42

ADJUSTABLE ATTACHMENT SYSTEM

CROSS-REFERENCE TO RELATED APPLICATION(S)

[0001] This application is a continuation-in-part application of U.S. patent application Ser. No. 11/208,444, filed Aug. 19, 2005. The subject matter of the above applications are incorporated herein by reference.

FIELD OF THE INVENTION

[0002] The present invention relates to an adjustable attachment system. More specifically, the present invention relates to an adjustable attachment system wherein a bridging clip adapted for receiving an attached component is placed in an embed and the positioning of the bridging clip may be adjusted in two orthogonal directions.

BACKGROUND OF THE INVENTION

[0003] Construction technology often employs unitized curtainwall units that are anchored to the building structure. A curtainwall system is a lightweight exterior cladding which is hung on the building structure, usually from floor to floor. It can provide a variety of exterior appearances. Curtainwalls are designed to accommodate structural deflections, control wind-driven rain and air leakage, minimize the effects of solar radiation, and provide for maintenance-free long term performance.

[0004] The curtainwall is an external, lightweight, generally non-loadbearing wall that is hung from a frame rather than built up from the ground; the framework it shields is usually of concrete or steel. Curtainwalls may be used with any suitable structure but are typically used in high-rise blocks. Typically light, the use of curtainwalls reduces the forces on the foundations, making the building lighter. Curtainwalls are a form of prefabricated construction and can be installed with relative ease, even at significant heights above the ground. Curtainwalls are frequently produced in a ready-to-install form, and thus can be installed as discrete building units.

[0005] One aspect of both the design and the installation of a curtainwall is its anchorage to the building structure. Generally, the curtainwall units are anchored to concrete floor slabs, columns and/or shear wall of building structures. Many types of anchor and a variety of methods are used.

[0006] Prior art attachment mechanisms for anchoring the curtainwall units to the building structure generally comprise manufactured plates, channel struts, and drilled anchor bolts. Strut type embeds are used in attachment to the face of slab, to columns, or to shear walls. The distance from the building frame face (slab, shear wall, or column) to the back of the curtainwall is desired at approximately at least 2.5 times the specified allowable concrete tolerance plus the bridging clips thickness. Embedded strut type embeds typically have limited, preset depth and thus have no capability for in/out adjustment perpendicular to the plane of the frame to absorb tolerance. Thus, strut type embeds have lateral adjustment only in the plane of the slab, column, or shear wall. In order to effect in/out adjustment, complex two-part primary bridging clips plus ancillary parts are used and must be bolted or welded together to form an assembly. The assembly is then bolted to the strut embed. Protrusions such as the protrusion of the assembly from the strut embed may encroach on the in/out tolerance desired with the distance from the building frame. Further, the two-part bridging clips used for strut type embeds generally interfere and or extend into the plane of the backside of the curtainwall units.

[0007] FIGS. **1-3** illustrate prior art anchor systems for attaching a curtainwall to a building frame. FIGS. **1** and **2** illustrate a face of slab anchor system **100**. FIG. **3** illustrates a top of slab anchor system **102**. As shown, the face of slab anchor system **100** comprises an embed anchor **104**, an adjustment piece **106**, and an attached piece **110**. The embed anchor **104** extends a preset amount into the slab **112**. In/out adjustability is provided by the adjustment piece **108**. The adjustment piece **108** extends from the face of the slab **112** and thus encroaches on the in/out tolerance of the distance of the attached piece **110** to the slab **112**. The attached piece **110** is coupled to the adjustment piece **106**.

[0008] The top of slab anchor system **102** of FIG. **3** illustrates an embed anchor **114**, an adjustment and attachment piece **116**, and an attached piece **118**. The embed anchor **114** is anchored in the top of the slab **112**. The adjustment and attachment piece **116** extends towards the face of the slab **112**. The amount of extension of the adjustment and attachment piece **116** determines whether the adjustment and attachment piece **116** is flush with the face of the slab **112** or extends beyond the face of the slab **112**. The attached piece **118** is coupled to the adjustment and attachment piece **116**. This coupling may be achieved directly or indirectly.

[0009] In the past, it has been desirable to locate an anchor in an easily accessible location on top of the floor slab because, while a location on the slab edge, or on the outward facing surface of the frame, is feasible, drilling and welding on the slab edge is more difficult and there is less room for adjustment to accommodate building frame variations. Curtainwall units must be anchored and fixed to a precise theoretical location in space irrespective to the frame's finished location. The difference between the two locations is referred to as tolerance. To bridge the difference in these locations, manufactured parts known as adjustable anchor clips (or adjustable secondary bridging clips) are employed. The clips are typically made utilizing slotted holes, shims or field welding to make the connection between the point of attachment on a building structure and a curtainwall unit.

BRIEF SUMMARY OF THE INVENTION

[0010] An embed, an adjustable attachment system, an adjustable attachment system kit, and method for attaching a unit to a base is provided.

[0011] In one embodiment, an embed for embedding in a base may include a box defining a top face and at least one side face, the top face configured to be placed flush with an upper surface of the base, and the at least one side face configured to be placed flush with an edge of the base. In another embodiment, the top face may include a substantially open top face configured to provide access to the inside of the embed. In another embodiment, the embed may include a lid configured to cover the open top face. In another embodiment, the top face may include a recessed shelf and a perimeter lip and the lid is recessed into the top face. In another embodiment, the lid may be removably attached to the embed. In another embodiment, the lid may be pivotably attached to the embed. In another embodiment, the side face may include a substantially open side face. In another embodiment, the open side face may be configured to receive a bridging clip. In another embodiment, the embed may include at least one anchor extending from the embed. In

another embodiment, the at least one anchor may be a threaded rod anchor. In another embodiment, the embed may be adapted for threaded engagement with the at least one anchor, the at least one anchor adjustably extending into the internal volume of the embed.

[0012] In another embodiment, an adjustable attachment system includes an embed for positioning in a base and a bridging clip configured for insertion in the embed and adapted for coupling to a unit. In another embodiment, the embed is in the shape of a box. In still another embodiment, the embed is adapted to be positioned flush with the upper and outer surfaces of a base. In still another embodiment, the system further includes at least one anchor extending from the embed. In yet another embodiment, the bridging clip further comprises teeth on an upper surface. In yet another embodiment, the system includes at least one washer with teeth on a bottom surface adapted to engage the teeth of the bridging clip. In still another embodiment, the system includes a peel strip.

[0013] In another embodiment, an adjustable attachment system kit includes an embed box with a removably attachable lid, a bridging clip, at least one nut, and at least one washer. In another embodiment, the embed includes at least one threaded rod anchor extending into the internal volume of the embed. In another embodiment, the bridging clip includes slotted holes for receiving the at least one threaded rod anchor. In still another embodiment, the bridging clip includes teeth on an upper surface and the at least one washer includes teeth on a lower surface adapted to engage the teeth of the bridging clip. In yet another embodiment, the at least one nut is adapted for threaded engagement with the anchor.

[0014] The adjustable attachment system comprises an embed, a bridging clip and a locking strip. The embed and bridging clip are configured for the bridging clip to be inserted within the embed and the bridging clip and the embed to engage one another. The locking strip is configured for insertion in a space between the bridging clip and the embed to fix the bridging clip in place. The bridging clip may further be adapted for receiving an attachment piece. The embed is anchored to the base and the bridging clip is coupled, directly or indirectly, to the unit to be attached. For attaching a curtainwall unit to a building frame, the embed is anchored in the frame and the bridging clip is coupled to the curtainwall unit.

[0015] The method of attaching a unit to a base comprises placing the embed in a base. For example, the embed may be placed in a concrete form and concrete poured into the form. A bridging clip is inserted in the embed, and positioned at a desired position within the embed. A locking strip is inserted in a space between the bridging clip and the embed. The unit is coupled to the bridging clip. Optionally, an attachment piece may be used to couple the unit to the bridging clip.

[0016] While multiple embodiments are disclosed, still other embodiments of the present invention will become apparent to those skilled in the art from the following detailed description, which shows and describes illustrative embodiments of the invention. As will be realized, the invention is capable of modifications in various aspects, all without departing from the spirit and scope of the present invention. Accordingly, the drawings and detailed description are to be regarded as illustrative in nature and not restrictive.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] FIG. **1** illustrates a prior art anchor for attaching a curtainwall unit to a building frame.

[0018] FIG. **2** illustrates a prior art anchor for attaching a curtainwall unit to a building frame.

[0019] FIG. **3** illustrates a prior art anchor for attaching a curtainwall unit to a building frame.

[0020] FIG. **4** illustrates an exploded perspective view of an adjustable attachment system in accordance with one embodiment of the present invention.

[0021] FIG. **5** illustrates an exploded perspective view of an adjustable attachment system in accordance with one embodiment of the present invention.

[0022] FIG. **6** illustrates an exploded perspective view of an adjustable attachment system in accordance with one embodiment of the present invention.

[0023] FIG. **7** illustrates a side view of an embed for use with an adjustable attachment system in accordance with one embodiment of the present invention.

[0024] FIG. **8** illustrates a side view of an embed for use with an adjustable attachment system in accordance with one embodiment of the present invention.

[0025] FIG. **9** illustrates a side view of a bridging clip for use with an adjustable attachment system in accordance with one embodiment of the present invention.

[0026] FIG. **10** illustrates a side view of a bridging clip for use with an adjustable attachment system in accordance with one embodiment of the present invention.

[0027] FIG. **11** illustrates a side view of a bridging clip for use with an adjustable attachment system in accordance with one embodiment of the present invention.

[0028] FIG. **12** illustrates a side view of a bridging clip for use with an adjustable attachment system in accordance with one embodiment of the present invention.

[0029] FIG. **13** illustrates a side view of a bridging clip for use with an adjustable attachment system in accordance with one embodiment of the present invention.

[0030] FIG. **14** illustrates a side view of a bridging clip for use with an adjustable attachment system in accordance with one embodiment of the present invention.

[0031] FIG. **15** illustrates a side view of a bridging clip for use with an adjustable attachment system in accordance with one embodiment of the present invention.

[0032] FIG. **16** illustrates a side view of a bridging clip for use with an adjustable attachment system in accordance with one embodiment of the present invention.

[0033] FIG. **17** illustrates a side view of a bridging clip for use with an adjustable attachment system in accordance with one embodiment of the present invention.

[0034] FIG. **18** illustrates a side view of a bridging clip for use with an adjustable attachment system in accordance with one embodiment of the present invention.

[0035] FIG. **19** illustrates a side view of a bridging clip for use with an adjustable attachment system in accordance with one embodiment of the present invention.

[0036] FIG. **20** illustrates a side view of a locking strip **16** being inserted into an adjustable attachment system in accordance with one embodiment of the present invention.

[0037] FIG. **21** illustrates a side view of a locking strip **16** being fixed into place in an adjustable attachment system in accordance with one embodiment of the present invention.

[0038] FIG. **22** illustrates a side view of an assembled adjustable attachment system with a curtainwall hanging therefrom in accordance with one embodiment of the present invention.

[0039] FIG. **23** illustrates a side view of an assembled adjustable attachment system with a curtainwall hanging therefrom in accordance with one embodiment of the present invention.

[0040] FIG. **24** illustrates a side view of an assembled adjustable attachment system with a curtainwall hanging therefrom in accordance with one embodiment of the present invention.

[0041] FIG. **25** illustrates a side view of an assembled adjustable attachment system positioned in a frame with a curtainwall hanging therefrom.

[0042] FIG. **26** illustrates a side view of an assembled adjustable attachment system positioned in a frame with a curtainwall hanging therefrom.

[0043] FIG. **27** illustrates an exploded perspective view of an adjustable attachment system for attaching a pipe to a base in accordance with one embodiment of the present invention.

[0044] FIG. **28** illustrates a front perspective view of an alternative embodiment of an adjustable attachment system in accordance with one embodiment of the present invention.

[0045] FIG. **29** illustrates a rear perspective view of the embodiment of FIG. **28**.

[0046] FIG. **30** illustrates a side cross-sectional view of the embodiment of FIG. **28**.

[0047] FIG. **31** illustrates a front view of the embodiment of FIG. **28**.

[0048] FIG. **32** illustrates an isometric top/front/side view of an adjustable attachment system in accordance with one embodiment of the present invention.

[0049] FIG. **33** illustrates an isometric top/front view of an adjustable attachment system in accordance with one embodiment of the present invention.

[0050] FIG. **34** illustrates an isometric top/front/side view of an adjustable attachment system in accordance with one embodiment of the present invention.

[0051] FIG. **35** illustrates an isometric top/rear/side view of an adjustable attachment system in accordance with one embodiment of the present invention.

[0052] FIG. **36** illustrates an isometric bottom/front/side view of an adjustable attachment system in accordance with one embodiment of the present invention.

[0053] FIG. **37** illustrates an isometric top/front view of an adjustable attachment system in accordance with one embodiment of the present invention.

[0054] FIG. **38** illustrates an isometric top/front view of an adjustable attachment system in accordance with one embodiment of the present invention.

[0055] FIG. **39** illustrates an isometric top/front/side view of an adjustable attachment system in accordance with one embodiment of the present invention.

[0056] FIG. **40** illustrates an isometric top/front/side view of an adjustable attachment system in accordance with one embodiment of the present invention.

[0057] FIG. **41** illustrates an isometric top view of an adjustable attachment system in accordance with one embodiment of the present invention.

[0058] FIG. **42** illustrates an isometric side view of an adjustable attachment system in accordance with one embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0059] An adjustable attachment system is provided for attaching a unit to a base. While the adjustable attachment system is discussed in reference to attaching a curtainwall unit to a building frame, the adjustable attachment system may be used to attach any unit to any base. For example, the adjustable attachment system may be used to attach a pipe to a base. Further, the attachment system may be used to attach any unit to any surface of a base. For example, the adjustable attachment system may be used to attach a unit to a top surface, bottom surface, or side surface of a base.

[0060] The adjustable attachment system permits adjustment in two orthogonal directions, in/out and laterally. Additionally, up/down adjustment may be provided using attachment pieces. The adjustable attachment system comprises an embed, a bridging clip, and a locking strip. The bridging clip may be connected to the embed without the use of bolts and nuts or field welding. The bridging clip thus does not require holes, slots or notches. The adjustable attachment system simplifies locating a curtainwall anchor in the outward facing surface of the frame. Using the adjustable attachment system, the speed of erection and placement of curtainwall units is increased while costs are decreased.

[0061] FIGS. **4**, **5**, and **6** illustrate exploded views of alternate embodiments of an adjustable attachment system **10**. As shown, the adjustable attachment system **10** comprises an embed, a bridging clip (or anchor plate) **14**, and a locking strip (or wedge block) **16**. A peel strip **18**, described more fully below, may be provided along a front face of the embed **12**.

[0062] The embed **12** is positioned in a recess in an outward facing surface of base, as described more fully below. The outward facing surface may be any surface of the base. Thus, for example, the outward facing surface may be a top surface, a bottom surface, or a side surface. The bridging clip **14** is inserted into the embed **12** to a desired in/out position. Teeth **13** are provided along at least one of an upper and lower inner surface of the embed **12**. Corresponding teeth **15** are provided along at least one of an upper and lower surface of the bridging clip **14**. Once the bridging clip **14** is in the desired in/out position, the teeth **15** on the bridging clip **14** are engaged with the teeth **13** of the embed **12**. Thus, teeth **15** provided along an upper surface of the bridging clip **14** engage teeth **13** provided along an upper inner surface of the embed **12**. Similarly, teeth **15** provided along a lower surface of the bridging clip **14** engage teeth **13** provided along a lower surface of the embed **12**. The position of the bridging clip **14** in the embed **12** may be adjusted laterally. When the desired position is achieved, the locking strip **16** is inserted between the bridging clip **14** and the embed **16** to fix the bridging clip **14** in place. In alternative embodiments, a locking strip may not be used.

[0063] Thus, adjustment of the bridging clip **14** is allowed in two orthogonal directions, in/out and laterally. The bridging clip **14** may be connected to the embed **12** without using bolts and nuts or field welding (though bolts, nuts, field welding or other construction techniques may be used if desired).

[0064] End closure arms **20** (or anchor plates) may provided with the adjustable attachment system. FIGS. **4**, **5**, and **6** each illustrate alternate embodiments of the end closure arms **20**. The end closure arms **20** operate to seal the interior of the embed **12** from leakage of material along the sides **24** of the embed **12**. The end closure arms **20** further provide increased gripping surface along the embed **12**. Thus, if the embed **12** is used with a concrete structure and concrete is poured around the embed **12**, the concrete has the increased gripping surface of the end closure arms **20** for engagement.

[0065] In the embodiments of FIGS. **4** and **5**, end seals **22** are provided for positioning between the embed **12** and the end closure arms **20**. Thus, after assembled for positioning

within the recess, sides **24** of the embed **12** are coupled to the end seals **22** and the end seals **22** are in turn coupled to the end closure arms **20**. The embed **12**, end seals **22** and end closure arms **20** may be coupled to one another in any suitable manner. For example, fasteners such as screws **26** may be used. Alternately, the embed **12**, end seals **22** and end closure arms **20** may be welded together.

[0066] The configuration of the end closure arms **20** and the end seals **22** may vary. FIGS. **4**, **5**, and **6** illustrate various configurations of the end closure arms **20** and the end seals **22** but other configurations, as would be known to one skilled in the art, may be used. In FIGS. **4** and **5**, the end closure arms **20** comprise supporting extensions **21** extending laterally over the embed **12**. In those embodiments, the profile of the end closure arms **20** thus varies along a portion of the end closure arms **20**. In FIG. **4**, the end seal **22** correspondingly has a varied profile. In contrast, in FIG. **5**, the end seal **22** has a profile that remains substantially unchanged over the entire length thereof. In FIG. **6**, no end seal **22** is used and the profile of the end closure arms **20** remains substantially unchanged over the entire length thereof.

[0067] In alternate embodiments, only the end seals **22** may be used to seal the sides **24** of the embed **12**. Alternately, other means of sealing the sides **24** of the embed **12** may be employed. For example, the embed **12** may be manufactured with closed sides **24**.

[0068] The embed **12** may be provided with a peel strip **18**. The peel strip **18** seals a front portion **26** of the embed **12**. The embed **12**, may thus be positioned in the recess with the peel strip **18** intact. FIG. **7** illustrates an embed **12** with the peel strip **18** intact. In attaching a curtainwall to a building frame, the embed is positioned in a concrete form and concrete is poured. Once positioned and once surrounding concrete is hardened and/or there is a reduced risk of intrusion of materials through the front portion **26** of the embed **12**, the peel strip **18** may be removed. FIG. **8** illustrates an embed **12** with the peel strip **18** removed. The embed **12** and peel strip **18** may be provided in any configuration suitable for removal of the peel strip **18** from the front portion **26** of the embed **12**. For example, perforations or grooves may be provided along the border of the peel strip **18** with the embed **12**. Provision of a peel strip **18** enables the embed **12** to be extruded as a hollow rather than a semi-hollow. In lieu of a peel strip, a plug may be provided along the front portion **26** of the embed **12**. For example, a closed cell foam plug may be used to seal the interior of the embed **12** along the front portion **26** of the embed **12**.

[0069] As can be seen in FIGS. **4-8**, the embed **12** has a front facing portion including lips **17** and **19**. The extension of the lips **17** and **19** may vary. Further, the extension of the upper lip **17** may be different from the extension of the lower lip **19**. The lips **17**, **19** extend along the outward facing surface of the frame. The embed **12** may further be provided with rebar holes **27** for receiving a rebar rod to reinforce the embed **12**.

[0070] Teeth **13** and **15** are provided along a surface of the bridging clip **14** and a surface of the embed **12**. The teeth **13** and **15** engage one another to fix the bridging clip **14** within the embed **12**. In alternate embodiments, other means of engaging the bridging clip **14** with the embed **12** may be used. For example, the bridging clip **14** may be fastened to the embed **12** using conventional fasteners, other friction fitting, or any suitable means.

[0071] The teeth **13** of the embed **12** and the teeth **15** of the bridging clip **14** may be configured in any engaging configuration so long as the teeth **13** engage with the teeth **15**. In one embodiment, as seen most clearly in FIGS. **7** and **8**, the teeth **13** of the embed **12** comprise an upwardly extending portion **21** and a slanted surface **23**, the slanted surface **23** extending from a base point along the embed **12** to the top point of the upwardly extending portion **21**. As shown, the slanted surfaces **23** extend rearwardly away from the front facing portion of the embed **12**. The corresponding teeth **15** on the bridging clip **14** comprise an upwardly extending portion and a slanted surface wherein the slated surface extends forwardly towards a front facing portion of the bridging clip **14**. Thus, the teeth **15** of the bridging clip **14** slide along the surface of the teeth **13** of the embed **12**. Once in position, the teeth **15** of the bridging clip **14** engage the teeth **13** of the embed **12** and the bridging clip **14** cannot be removed merely by pulling on bridging clip **14**. To remove the bridging clip **14**, the bridging clip must be lifted or otherwise positioned to disengage the teeth **15** of the bridging clip **14** from the teeth **13** of the embed **12**.

[0072] FIGS. **28-31** illustrate an alternative embodiment of an attachment system **10**. As shown, the attachment system **10** comprises an embed **12** and a bridging clip **14**. The embed **12** is positioned in a recess in an outward facing surface of a base. FIG. **29** illustrates a rear view of the attachment system **10**, showing the embed **12** as positioned in a base.

[0073] The bridging clip **14** is inserted into the embed **12** to a desired in/out position. Teeth are provided along at least one of an upper and lower inner surface of the embed **12**. Corresponding teeth are provided along at least one of an upper and lower surface of the bridging clip **14**. Once the bridging clip **14** is in the desired in/out position, the teeth on the bridging clip **14** are engaged with the teeth of the embed **12**. Thus, teeth provided along an upper surface of the bridging clip **14** engage teeth provided along an upper inner surface of the embed **12**. Similarly, teeth provided along a lower surface of the bridging clip **14** engage teeth provided along a lower surface of the embed **12**. The teeth of the embed **12** and the teeth of the bridging clip **14** may be configured in any engaging configuration so long as the teeth engage with the teeth. In alternative embodiments, other configurations of engagement structures may be provided on the embed **12** and the bridging clip **14**.

[0074] The position of the bridging clip **14** in the embed **12** may be adjusted laterally. When the desired position is achieved, a locking strip may be inserted between the bridging clip **14** and the embed **12** to fix the bridging clip **14** in place. In alternative embodiments, a locking strip may not be used.

[0075] End closure arms **20** (or anchor plates) may provided with the adjustable attachment system. The end closure arms **20** operate to seal the interior of the embed **12** from leakage of material along the sides **24** of the embed **12**. The end closure arms **20** further provide increased gripping surface along the embed **12**. The embed **12**, end seals **22** and end closure arms **20** may be coupled to one another in any suitable manner. For example, fasteners such as screws **26** may be used. Alternately, the embed **12**, end seals **22** and end closure arms **20** may be welded together.

[0076] The embed **12** has a front facing portion including lips **17** and **19**. In the embodiments of FIGS. **28-31**, the lips are relatively low profile. The extension of the lips **17** and **19** may vary. Further, the extension of the upper lip **17** may be

different from the extension of the lower lip **19**. The lips **17**, **19** extend along the outward facing surface of the frame.

[0077] The embed **12** may include embed guides **50**. The guides **50** serve as a tool to help gage uniform up/down placement of the embed. As shown, two guides **50** are included. In alternative embodiments, more or fewer guides **50** may be provided.

[0078] In the embodiment of FIGS. **29-31**, slide fasteners **52** are provided on a top surface and a bottom surface of the embed **12**. Reinforcement elements or rebars **54** may be provided at a location on the base where structural reinforcement is desired. Such reinforcement may be desirable, for example, in concrete forms. The embed **12** may be positioned on the base relative to the reinforcement elements **54**. Slide fasteners **52** may be used to fasten the reinforcement elements **54** to the embed **12**. As shown, a reinforcement element **52** is provided on an upper surface of the embed **12** and on a lower surface of the embed **12**. In alternative embodiments, a single reinforcement element **54** may be used.

[0079] FIGS. **9-19** illustrate various embodiments of a bridging clip **15**. As shown, the bridging clip **14** comprises an insertion portion **28** and an end portion **30**. The insertion portion **28** comprises a planar portion **32** and an angled portion **34**. In the embodiments shown, the angled portion **34** angles upwardly. A lower surface of the planar portion **32** and an upper surface of the angled portion **34** include teeth **15**. Alternately, the bridging clip **14** may be configured with an angled portion extending downwardly, teeth **15** being provided on a lower surface of the angled portion **32** and an upper portion of the planar portion **28**. Further, only one of the planar portion **30** and the angled portion **32** may be provided with teeth.

[0080] Each of FIGS. **9-15** illustrate alternate embodiments of end portions **30** of a bridging clip **14**. The configuration of the end portion **30** and/or the provision of an attachment piece may be used to afford further adjustability to the adjustable attachment system. FIGS. **13-15** illustrate bridging clips **14** having end portions **30** comprising a hook portion **31** and an extending portion **33**. In FIGS. **13-15**, the hook portions **31** are substantially the same with the end portion **30** being varied for engagement with attachment pieces **35**.

[0081] FIGS. **16-19** illustrate attachment pieces **35** engaged with the end portions **30** of the bridging clips **14**. After positioning of the adjustable attachment system **10** in the frame, an attachment piece **35** may be provided to engage the end portion **30** of the bridging clip **14**. Thus, the configuration of the end portion **30** determines the placement of the unit from the adjustable attachment system **10**. Thus, for example, the unit may be placed at a slightly varying distance from the adjustable attachment system **10**. Further, the unit may be hung such that the upper limit of the attachment piece **35** is at the same plane as the adjustable attachment system **10** (see, for example, FIGS. **17** and **19**), is above the plane of the adjustable attachment system (see, for example, FIG. **18**), or is below the plane of the adjustable attachment system (see, for example, FIG. **16**).

[0082] Referring back to FIG. **6**, a bridging clip **14** is shown having only a planar portion **32**.

[0083] Each of FIGS. **4**, **5**, and **6** illustrate alternate embodiments of a locking strip **16**. Any suitable configuration of locking strip **16** may be used so long as it operates to fix the bridging clip **14** into the embed **12** in the desired position. Permanent fixtures may be used to permanently fix the locking strip **16** in place. FIGS. **19** and **20** illustrate the locking strip **16** being inserted between the embed **12** and the bridging clip **14** and the locking strip **16** being fixed in place using fasteners **38**.

[0084] FIGS. **22**, **23**, and **24** show assembled adjustable attachment system with a curtainwall unit **36** hanging therefrom. Each of FIGS. **22**, **23**, and **24** show a bridging clip **14** at a different position. FIG. **22** illustrates an in/out position of the bridging clip **14** within the embed **12** wherein the attachment piece **35** and attached curtainwall unit **36** hang some distance from the outward facing surface of the frame. FIG. **23** illustrates an in/out position of the bridging clip **14** within the embed **12** wherein the attachment piece **35** and attached curtainwall unit **36** hang a distance from the outward facing surface of the frame less than the distance of FIG. **22**. FIG. **23** illustrates an in/out position of the bridging clip **14** within the embed **12** wherein the bridging clip **14** is at its maximum depth within the embed **12** and, thus, the attachment piece **35** and attached curtainwall unit **36** hang a minimal distance from the outward facing surface of the frame.

[0085] FIGS. **25** and **26** illustrate adjustable attachment systems **10** positioned in a frame **37** with an attachment piece **35** and attached curtainwall unit **36** hanging therefrom. In the embodiment of FIG. **25**, the bridging clip **14** comprises an insertion portion having a planar portion **32** and an angled portion **34**. In the embodiment of FIG. **26**, the bridging clip **14** comprises an insertion portion having only a planar portion **32**.

[0086] The embed **12** may be manufactured of any suitable material. For example, the embed **12** may be manufactured of extruded or cast aluminum or cast or forged steel. Thus, the embed **12** may be manufactured using any suitable process including extrusion (as a hollow or a semi-hollow), casting, and forging. Further, the embed **12** may be manufactured of plastic or other materials. The surfaces of the embed **12** that are exposed to the frame may be pretreated to resist corrosion or galvanic reaction. Thus, the embed may be covered with an isolation material. For example, when the embed **12** is to be placed in a concrete frame, the surfaces of the embed **12** to be exposed to the concrete may be pretreated with bituminous paint, dielectric isolator tape, or other protecting coating. The bridging clip **14** may also be manufactured of any suitable material. For example, the bridging clip **14** may be manufactured of extruded or cast aluminum or cast or forged steel. The teeth **13** of the embed **12** and the teeth **15** of the bridging clip **14** are matched to engage and interlock, thereby allowing adjustments to be made to locate the bridging clip **14** both in and out and laterally from the plane of the frame, the face of the slap, the column or shear wall.

[0087] For attaching a curtainwall unit to a building frame, the adjustable embed **12** (with end closure arms **20** and end seals **22** if provided) may be placed in concrete forms prior to pouring of the concrete with a designated face to be placed against the formwork. After pouring, the inside of the embed **12** is accessed by removing the peel strip **18** (or other sealing means) at the designated outboard positioned face after the formwork has been removed. The bridging clip **14** may then be inserted and positioned within the embed **12**. After positioning, the locking strip **16** is inserted into the known dimensioned space above the bridging clip **14**. In some embodiments, an end portion **30** may be coupled to the bridging clip **14** to customize the position of the curtainwall with respect to the adjustable attachment system **10**.

[0088] FIG. **27** illustrates an adjustable attachment system used for attaching a pipe **42** to a base **44**. The adjustable

attachment system **10** comprises an embed **12**, a bridging clip (or anchor plate) **14**, and a locking strip (or wedge block) **16**. The embed **12** is positioned in a recess in an outward facing surface of base. The outward facing surface may be any surface of the base. Thus, for example, the outward facing surface may be a top surface, a bottom surface, or a side surface. The bridging clip **14** is inserted into the embed **12** to a desired in/out position. As with the embodiments described above, teeth are provided along at least one of an upper and lower inner surface of the embed. Corresponding teeth are provided along at least one of an upper and lower surface of the bridging clip. Once the bridging clip **14** is in the desired in/out position, the teeth on the bridging clip **14** are engaged with the teeth of the embed **12**. The position of the bridging clip **14** in the embed **12** may be adjusted laterally. When the desired position is achieved, the locking strip **16** is inserted between the bridging clip **14** and the embed **16** to fix the bridging clip **14** in place. An attachment piece **40** is provided configured for attachment to a pipe **42**. The attachment piece **40** is coupled to the bridging clip **14**. In alternative configurations, other configurations of attachment piece **40** may be provided for attachment to other units.

[0089] FIGS. **32-38** illustrate an adjustable attachment system **60** according to another embodiment. The adjustable attachment system **60** of the present embodiment may include an embed **62**. The embed **62** may be in the shape of a box having a front face **66**, a rear face **68**, and at least two side faces **70**. The embed **62** may also have a top face **72** and a bottom face **73**. The embed **62** may include lips **67** and may have an opening **69** on its front face **66** and may include an opening **63** on its top face **72**. The opening **63** on the top face may be covered by a lid **64**. A bridging clip **74** may also be included with slotted holes **76** for inward and outward adjustment. The opening **69** on the front face **66** of the embed **62** may be adapted to receive the bridging clip **74**. The embed **62** may also include anchors **80** extending away from the embed **62** to restrain the embed **62** against movement when embedded in a base material. The anchors **80** may extend through an outer wall of the embed **62** into the interior volume of the embed **62**. The anchors **80** may be adapted for insertion into the slotted holes **76** of the bridging clip **74** and may be further adapted to receive a nut **82** and washer **84** for securing the bridging clip **76**.

[0090] The opening **63**, best shown in FIGS. **37** and **38**, on the top face of the embed may be sized to allow access to the inside of the embed **62**. Depending on the nature and size of the embed, the opening **63** may be relatively large and may allow for hand tightening of elements within the box or the opening **63** may be relatively small allowing only for insertion of a slender tool. The opening **63** may reflect a large portion of the top face **72** of the embed **62** or even the entire top face, or the opening **63** may only be a small opening relative to the size of the top face **72** or may be any size in between.

[0091] Referring to FIG. **32**, the lid **64** may be configured to cover the opening **63**. The lid **64** may extend beyond the outer perimeter of the opening **63** and further may be recessed into the top face **72** of the embed **62**. In this recessed condition, the lid **64** may be flush with the outer surface of the top face **72**. Further in this recessed condition, the lid **64** may be positioned to rest on a recessed shelf **71**. The recessed shelf **71**, best shown in FIGS. **37** and **38**, may be defined on one edge by the outer perimeter of the opening **63** and on another edge by a perimeter lip **75**. The lid **64** may be sized to fit within the perimeter lip **75**. Alternatively, the lid **64** may be placed against the outer surface of the top face **72** and not recessed.

[0092] The lid **64** may be removably, pivotably, slidably, or hingedly attached to the embed **62** making the embed accessible from the top face **72**. The lid **64** of the embed **62** may be removably fastened in a closed position with four screws **65** as show in FIG. **32**. Alternatively, the lid **64** may be fastened with three or two or any number of fasteners. The fasteners may be any fastener known in the art including screws, bolts, clips, rivets, or the like. Alternatively or additionally, the lid **64** may be welded closed. In one embodiment, the lid **64** may be pivotably secured to the embed **62** with a single fastener. The fastener may be a limited release fastener having limited movement such that, when loosened, the fastener may be withdrawn from the embed **62** to a stopping point allowing the lid **64** to be lifted and rotated about the axis of the fastener, but not completely removed from the embed **62**. In yet another embodiment, the lid **64** may slide into position along a track provided on two sides of the embed **62**. The lid **64** may also have edges configured to engage the track and the embed **62** and the lid **64** may have an interlocking clip type engagement when the lid **64** is fully slid along the embed track. In still another embodiment, the lid **64** may have a hinge along any of its four sides allowing the lid **64** to be opened without separating it from the embed **62**. In this embodiment, the free end opposite the hinge may be fastened with any of the above mentioned fastening devices or any known latching device.

[0093] Together with the several attachment options discussed above, the lid **64** may include a sealing element. This sealing element may include a gasket placed on or permanently positioned between the lid **64** and the embed **62**. The seal may also include a strip seal positioned on the perimeter of the lid **64** or in the seam between the lid **64** and the embed **62**. In addition or alternatively, the lid **64** may be taped and the seam between the embed **62** and the lid **64** may be partially or completely covered. In the case of a welded lid **64**, the full perimeter may be partially welded or alternatively may be seal welded.

[0094] The surface of the lid **64** may also be adapted for several exposure conditions. For example, where the embed **62** is used in a floor slab of a building and is placed flush with the top surface of a floor slab, the lid **64** may be adapted to accommodate several building conditions. The lid **64** may include a recessed channel for wiring or conduit to pass through the embed **62**. The lid **64** may include a recessed channel for receiving the bottom edge of sheetrock panels. The lid may also be adapted to receive carpet tack strips.

[0095] FIGS. **33** and **34** show an additional view of the embed **62** wherein the bridging clip **74** is in a retracted position. In FIG. **34**, similar to that shown in FIG. **7**, a peel strip **78** may be included to close the opening off to the entrance of debris. The peel strip **78** may be a piece of adhesive backed material placed across the opening **69**, or it may include an insert that is forcibly fit into the opening **69**. In the case of an insert, a portion of the peel strip **78** may overlap the surface of the embed lips **67** to aid the installer in removing the peel strip **78**. In FIG. **33**, a peel strip **78** is not shown.

[0096] FIGS. **33** and **34** also show horizontally extending lips **67** on the front face **66** of the embed **62**. These lips **67** may function to assist in fastening the embed **62** to formwork or other surfaces prior to placement of a base material. As best shown in FIG. **33**, holes **86** may be provided in the lips **67** for receiving screws to fasten the embed **62**. Holes **86** may also be provided in alternative faces of the embed **62** for attaching to

form work or other support surfaces. In another embodiment, the embed **62** may include a clip configured to slip over the top edge of a piece of formwork so as to position the top of the embed **62** flush with the top of the formwork. In yet another embodiment, the embed **62** may include clips or loops for attaching to reinforcing in a base material prior to placing the base material. In still another embodiment, the embed **62** may have extended metal tabs for fastening to form work or reinforcing.

[0097] FIGS. **35** and **36** show the embed **62** in an upright position and an upside down position respectively. As shown in both figures, the embed **62** may include anchors **80**. The anchors **80** may function to engage the embed **62** with a base. For example, where the embed **62** is placed in a concrete slab and thus, concrete is poured around the embed **62** and allowed to cure, the anchors **80** may extend away from the embed **62** into the concrete slab thereby securing the embed **62** in the slab. The anchors **80** may be any material, including, but not limited to reinforcing bar, threaded rods, plate material, bent plate material, or any material adapted to engage a base material. The anchors **80** may be affixed to the embed **62** as shown or may be otherwise separate from the embed **62**.

[0098] Where the anchors **80** are separate from the embed **62**, the anchors **80** may be placed to cause the embed **80** to engage the base. That is, the anchors **80** may be positioned adjacent to or hooked around a given portion of the embed **62** and may extend into the base. As such, the lap length of the anchor **80** with the embed **62** or the hook of the anchor **80** around a portion of the embed **62** may activate the engagement properties of the base and cause the embed **62** to be anchored in the base. For example, in a concrete base, the frictional characteristics of the concrete including the aggregate interlock may provide for transfer of force from the embed **62** to the anchor **80** through an appropriate lap length with the embed **80** or hook around the embed **80**. The frictional characteristics of the concrete may then allow for appropriate distribution of force from the anchor **80** to a slab, for example, as the anchor **80** extends away from the embed **62**.

[0099] In some embodiments, the anchors **80** may be affixed to the embed **62**. Referring to FIG. **36**, two bottom anchors **80** are shown extending out the bottom of the embed **62** and two back anchors **80** are shown extending angularly downward out of the back of the embed **62**. The anchors **80** may extend from any side of the embed **62** at any angle relative to the surface of the embed **62**. In one embodiment, the anchors may extend from the bottom face and/or rear face and/or at least one side face of the embed, but may be omitted from at least one side face and the top face. As such, the embed may be situated flush with an upper surface of a base and an edge of a base while still being anchored in the base.

[0100] Where the anchors **80** are affixed to the embed, the anchors **80** may be rigidly attached to the embed **62** or may be free to rotate or pivot relative to the surface of the embed **62**. The anchors **80** may also be adjustable in a direction parallel to their longitudinal axis. In one embodiment, the anchors **80** may extend through the wall of the embed **62** into the internal volume of the embed **62**. The portion of the anchor **80** within the embed **62** may then be used to secure a bridging clip **74**. The anchors **80** shown in FIGS. **35** and **36** are generally straight. However, the anchors **80** may be formed in any shape. For example, they may be straight as they exit the embed **62**, but then be bent to extend at an angle. The anchors **80** may terminate inside the embed **62** with a bolt head, a nut, a welded connection, a cotter pin connection, or any other securing mechanism.

[0101] In the case of anchors **80** separate from the embed **62** and thus not extending through the wall of the embed **62** as shown, a connection mechanism may be provided on the inside of the embed for securing the bridging clip. The connection mechanism may be a threaded rod welded to the inside of the embed **62**, a bolt anchored through the embed, or a clamp or any other mechanism disclosed herein or known in the art for attaching a relatively flat piece of material such as a bridging clip.

[0102] The anchors **80**, in addition to engaging with a base material, may be used to adjust the height of the embed **62** within a base or concrete floor slab prior to pouring of the concrete. In this embodiment, the anchors **80** may be threaded rods and adjusting nuts may be provided along the length of the anchor **80**. These adjusting nuts may include a single nut inside the embed **62** and/or a single nut on the outside of the embed **62**. Twisting the nuts and/or the anchor **80** may allow the anchor **80** to be adjusted inward and outward through the wall of the embed **62**. Alternatively, the embed **62** may included a threaded sleeve through which the anchor **80** penetrates the wall of the embed **62**. The anchor **80** may then be adjusted inward or outward by turning the anchor **80**. Where the anchor **80** rests on the bottom surface of formwork or on any supporting surface, the inward and outward movement of the anchor **80** may allow for vertical adjustment of the embed **62**. Those skilled in the art will understand and appreciate that various adjustments of the anchors **80** shown could be used to level and tilt the embed **62** by adjusting the anchors **80** inward and outward.

[0103] Referring still to FIGS. **35** and **36**, two reinforcing ribs **88** are shown. The ribs **88** generally may extend from the front of the embed **62** to the back of the embed **62** along a line connecting a bottom anchor **80** to a corresponding back anchor **80**. The ribs **88** may taper from relatively thin near the front of the embed **62** to relatively thick near the back of the embed **62**.

[0104] In other embodiments, the ribs **88** may form protrusions extending away from the embed **62** for engagement with anchors **80**, the anchors **80** being in the form of lapped or hooked bars. In other embodiments, the ribs **88** may be a series of crossing ribs on the lower surface of the embed **62** for causing an interlocking engagement with a base material. In other embodiments, the ribs **88** may be relatively tall in a direction perpendicular to the surface of the embed **62** and relatively narrow in a direction parallel to the surface of the embed **62**. As such, the ribs **88** may have a tab-like or ear-like shape. In some embodiments, these tab-like ribs **88** may have a relatively short or relatively long length and may include one or more openings passing laterally through them for receiving or passing through of anchors **80**. The openings may or may not align with additional openings in other ribs **88**. The anchors **80** may be inserted through one or several openings and may, in turn, extend into the base material. The anchors **80** may extend relatively straight through the openings or may be bent, hooked, or otherwise formed to engage the ribs **88** and the base material. In other embodiments, the ribs **88** may include a coupling that is directly attachable to an anchor **80**.

[0105] In some embodiments, the ribs **88** may act to transfer force directly from the securing point of the bridging clip to the anchors **80** or the base material. In other embodiments,

the ribs **88** may act to transfer force from the embed **62** to the anchors **80** or the base material. In certain examples, the ribs **88** may be integral with the embed **62** or may be added on via clips, snap connections, fasteners, or other methods known in the art. For example, in the case of a plastic embed **62**, the ribs **88** may be a stronger metal material and may be screwed to the embed **62**.

[0106] FIGS. **37** and **38** each illustrate an adjustable attachment system **60** according to certain embodiments. In FIGS. **37** and **38** a lid **64** is not shown. As shown, a bridging clip **74** may be inserted through the front opening **69** of the embed **62**. FIG. **37** shows the bridging clip **74** extending slightly outward from the embed **62** and FIG. **35** shows the bridging clip **74** in a retracted position.

[0107] As can be seen from FIGS. **37** and **38**, the bridging clip **74** may include a generally planar insertion portion **92** and an end portion **94**. The end portion **94** may be any shape necessary for attachment of a curtain wall system including those discussed with respect to FIGS. **9-19**. In the present embodiment, the insertion portion **92** may include at least two horizontal straight slots **76** configured for inward and outward adjustment of the bridging clip **74**. The slots **76** may be spaced apart a distance approximately equal to the spacing of the anchors **80**. Where the anchors **80** extend into the internal volume of the embed **62**, the anchors **80** may engage the slotted holes **76** and provide for slidable adjustment of the bridging clip **74**.

[0108] The slots **76** may be a standard slot width for receiving a threaded rod or other anchor **80**, but may also be oversized in width to provide lateral adjustment of the bridging clip **74** in addition to inward and outward adjustment. Those skilled in the art will understand and appreciate that the oversized slots **76** may also allow for the bridging clip **74** to be rotated slightly. Alternatively, the slots **76** may be in the shape of opposing arcs to allow for rotational adjustment of the bridging clip **74**. The rotational adjustment may be in the range of 0 to 5 degrees.

[0109] The bridging clips **74** shown in FIGS. **37** and **38** also include teeth **96** on an upper surface. Plate washers **84** are shown with teeth **96** on a lower surface. The teeth **96** of the washers **84** and the bridging clip **74** are adapted to interlock and engage one another. Also shown are nuts **82** threaded onto the top end of the anchors **80** for fastening the washers **84** against the surface of the bridging clip **74**. The bridging clip **74** may also or alternatively include teeth **96** on a bottom surface and corresponding teeth could be provided on the bottom internal surface of the embed **62**.

[0110] Vertical adjustment of the bridging clip **74** may be provided by additional shimming washers placed below the bridging clip **74** and above the bottom surface of the embed **62**. These shimming washers may be flat plate washers or alternatively may include upward facing teeth **96** for engaging teeth **96** provided on the bottom surface of the bridging clip **74**. Alternatively, where teeth **96** have been provided on the bottom internal surface of the embed **62** and teeth **96** have been provided on the bottom of the bridging clip **74**, the washers may include teeth **96** on both the top and bottom surface for engaging both the bridging clip **74** and the embed **62**. The shimming washers may be any shape or size. Preferably, the shimming washers may be similar in size to the bridging clip **74** and include slots for receiving the upward extending anchors **80**.

[0111] In use, the slots **76** in the bridging clip **74** may allow it to slide freely along the anchors **80**, when the nut **82** and washer **84** are not tightened or are not in place. Once the bridging clip **74** is positioned, the washers **84** may be placed on top of the bridging clip **74** allowing the teeth **96** of the washer **84** to engage the teeth **96** of the bridging clip **74**. A nut **82** may then be placed on the anchor **80** over the washer **84** to fasten the assembly together. Inward and outward movement of the bridging clip **74** is resisted by the teeth **96** of the washer **84**. The washer **84** is prevented from moving due to its bearing condition against the surface of the anchor **80**. As mentioned above, the anchors **80** extending into the base prevent movement of the embed **62** and the bridging clip **74**. Where shimming washers are used to adjust the bridging clip **74** upward, these washers may be placed prior to placement of the bridging clip **74**.

[0112] Another embodiment of an adjustable attachment system **160** is shown in FIGS. **39-42**. In this embodiment, as shown in FIG. **39**, the system **160** may include an embed **162**. The embed **162** may be in the shape of a box defining a front face **166**, a rear face **168**, and at least two side faces **170**. The embed **162** may also have a top face **172** and a bottom face **173**. The embed **162** may include lips **167** and may be substantially open on the top face **172** and a the front face **166**. The embed **162** may also include a lid **164** for covering the top face and a portion of the front face. A bridging clip **174** may also be included with slotted holes **176** for inward and outward adjustment. The embed **162** may also include anchors **180** extending away from the embed **162** to restrain the embed **162** against movement when embedded in a base material.

[0113] The lid **164** may be generally flat and may contain flanges comprising bent edges. The flanges may correspond to the front face **166**, rear face **168**, and side faces **170** of the embed **162** and as such may be referred to herein as a front flange **167**, rear flange **169** (not shown), and/or side flange **171**. The lid **164** may be sized so that each of the flanges **167**, **169**, **171** may be positioned just to the inside edge of its respective embed face. Any combination of flanges **167**, **169**, **171** may be included. For example, where the lid **164** is hinged to the rear face **168** of the embed **162**, the rear flange **169** may be omitted. The flanges **167**, **169**, **171** may extend the full depth of the box so as to position the lid **164** flush with the top face **172** of the embed **162**. However, the front flange **167** of the lid **164** may be adapted to accommodate the bridging clip **174**. That is, the front flange **167** may extend along the front face **166** of the embed **162** a distance approximately equal to the depth of the embed **162** less the thickness of the bridging clip **174**. In other embodiments, the front flange **167** may extend a shorter distance along the front face **166** to allow for some adjustment of the bridging clip **174** within the depth of the embed **162** without interfering with the tip of the front flange **167**.

[0114] As shown in FIG. **40**, the embed **162** may be positioned in a base flush with an upper surface and an outer surface of the base and the lid **164** may nest inside the embed **162**.

[0115] A top view of the embed **162** is shown in FIG. **41** and depicts the inside of the embed as accessible from the top and the front due to the open top and front faces **172**, **166**.

[0116] As shown in FIG. **42**, a side view of an embed **162** is shown with an anchor **180** extending vertically down from the bottom face **173** of the embed **162**. Also shown is a horizontally extending rib **188**, which further extends as an additional anchor **180** beyond the rear face **168** of the embed **162** in the

form of a bent plate. Additional features of the embed **162** may include any or all of those features described with respect to embed **62**.

[0117] The several embodiments of an embed described may be made of any material including, but not limited to, metal, plastic, or composite materials. The exterior and/or interior of the box may be milled, anodized, painted, or otherwise coated and/or protected. The coating may be any coating, including, but not limited to latex paint, bituminous based paint, epoxy based paint, galvanization, or any other coating known in the art.

[0118] The embed may also be any shape and is not limited to a rectangular box as shown in the figures. For example, the embed may be skewed in plan view to form a parallelogram shape to allow specific curtain wall support points to be provided along the edge of a base material and still avoid base material interruptions, such as pipe penetrations, electrical conduit penetrations, floor recesses and the like. The embed may taper as it extends into the base material or alternatively may expand as it extends into the base material. Those skilled in the art will understand and appreciate that several shapes may be provided.

[0119] The interior volume of the embed may be stuffed or otherwise filled with a material to increase its insulation, sound transmission, or fire resistive properties. The fill may be included for other reasons as well, such as to protect against damage to the lid. This may appropriate in cases where the lid is thin or is otherwise prone to damage due to weight or force on the surface of the lid. As such, the fill material may be compressible or non-compressible and may be more permanent or less permanent depending on the need to access the internal space of the embed over time. The fill material may be a form of batt, polystyrene, spray-in, or other insulation. Additionally, the fill may be an epoxy, a granular material, a concrete material, or any other material adaptable for placement within the embed.

[0120] The embodiments shown and described with respect to FIGS. **32-42** are advantageous because the embed can be placed flush with outer and upper surfaces of a base material. This may eliminate the need for base material above the embed. Thus, the overall thickness of the base material can be decreased relative to alternative embeds that require base cover on the top and bottom of the embed. In concrete applications, this allows the presently described embed to be used in concrete floors formed with metal form decking or composite decking. In this condition, the uniform concrete thickness above the flutes of the decking may be minimized relative to that of a concrete floor formed on a flat supporting surface. By allowing the embed to be placed flush with the top of the slab, the embed may be provided with sufficient clearance from the flutes of the metal deck without requiring a thicker slab.

[0121] The presently described embodiment is also advantageous because of the direct load path from the bridging clip to the anchors. This direct load path minimizes the forces the embed needs to resist, which in turn minimizes the material strength and thickness needed for the embed and may minimize the cost.

[0122] The presently described embodiment is also advantageous because of the internal access it provides to the embed. This internal access allows the embed to be cleared of any debris. It also provides easier access to the bridging clip attachment allowing the bridging clip to be more precisely positioned.

[0123] The adjustable attachment system may be used for attaching any suitable unit to any suitable base. For example, the base may be a wood, drywall, brick, concrete, steel, or other. The base may comprise a frame structure, a wall, a ceiling, a floor, or any other structural component. The embed of the attachment system may be provided in the base in any suitable manner. For example, the embed may be placed in concrete, the embed may be built into a brick wall, the embed may be anchored into a drywall sheet, or the embed may be fastened to a wood piece. Alternatively, the embed may be screwed, welded or otherwise fastened to metal structure. Regarding any suitable unit, the adjustable attachment system may be used to attach plumbing, electrical conduit, ceilings, mechanical material and equipment, technology material equipment or other elements requiring attachment.

[0124] The length of the embed and the bridging clip may be varied to vary the load capacity of the adjustable attachment system. More specifically, the longer the embed and the bridging clip, the higher the load capacity of the adjustable attachment system. Further, in order to increase the load capacity of the adjustable attachment system rebar may be slid through the embed.

[0125] Although the present invention has been described with reference to preferred embodiments, persons skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

1. An embed for embedding in a base, the embed comprising a box defining a top face and at least one side face, the top face configured to be placed flush with an upper surface of the base, and the at least one side face configured to be placed flush with an edge of the base.

2. The embed of claim **1**, wherein the top face comprises a substantially open top face configured to provide access to the inside of the embed.

3. The embed of claim **2**, further comprising a lid configured to cover the open top face.

4. The embed of claim **1**, wherein the top face includes a recessed shelf and a perimeter lip and the lid is recessed into the top face.

5. The embed of claim **4**, wherein the lid is removably attached to the embed.

6. The embed of claim **4**, wherein the lid is pivotably attached to the embed.

7. The embed of claim **3**, wherein the side face comprises a substantially open side face.

8. The embed of claim **7**, wherein the open side face is configured to receive a bridging clip.

9. The embed of claim **8**, further comprising at least one anchor extending from the embed.

10. The embed of claim **9**, wherein the at least one anchor is a threaded rod anchor.

11. The embed of claim **10**, wherein the embed is adapted for threaded engagement with the at least one anchor, the at least one anchor adjustably extending into the internal volume of the embed.

12. An adjustable attachment system comprising:

an embed for positioning in a base; and

a bridging clip configured for insertion in the embed and adapted for coupling to a unit.

13. The adjustable attachment system of claim **12**, wherein the embed is in the shape of a box.

14. The adjustable attachment system of claim **13**, wherein the base has an upper surface and an outer surface and the embed is adapted to be positioned flush with the upper and outer surfaces.

15. The adjustable attachment system of claim **14**, further comprising at least one anchor extending from the embed.

16. The adjustable attachment system of claim **15**, wherein the embed includes a removably attachable lid.

17. The adjustable attachment system of claim **16**, wherein the at least one anchor extends in a direction away from the outer and upper surface of the base.

18. The adjustable attachment system of claim **17**, wherein the bridging clip includes slotted holes.

19. The adjustable attachment system of claim **18**, wherein the at least one anchor is a threaded rod anchor.

20. The adjustable attachment system of claim **19**, wherein the embed is adapted for threaded engagement with the at least one anchor, the at least one anchor adjustably extending into the internal volume of the embed.

21. The adjustable attachment system of claim **20**, wherein the bridging clip further comprises teeth on an upper surface.

22. The adjustable attachment system of claim **21**, further comprising at least one washer with teeth on a bottom surface adapted to engage the teeth of the bridging clip.

23. The adjustable attachment system of claim **22**, further comprising a peel strip.

24. The adjustable attachment system of claim **22**, further comprising a lid.

25. The adjustable attachment system of claim **24**, further comprising at least one fastener for removably attaching the lid to the embed.

26. An adjustable attachment system kit comprising:
an embed box with a removably attachable lid;
a bridging clip;
at least one nut; and
at least one washer.

27. The kit of claim **26**, wherein the embed box includes at least one threaded rod anchor extending into the internal volume of the embed.

28. The kit of claim **27**, wherein the embed is adapted for threaded engagement with the at least one threaded rod anchor.

29. The kit of claim **28**, wherein the bridging clip includes slotted holes for receiving the at least one threaded rod anchor.

30. The kit of claim **29**, wherein the bridging clip includes teeth on an upper surface and the at least one washer includes teeth on a lower surface adapted to engage the teeth of the bridging clip.

31. The kit of claim **30**, wherein the at least one nut is adapted for threaded engagement with the anchor.

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