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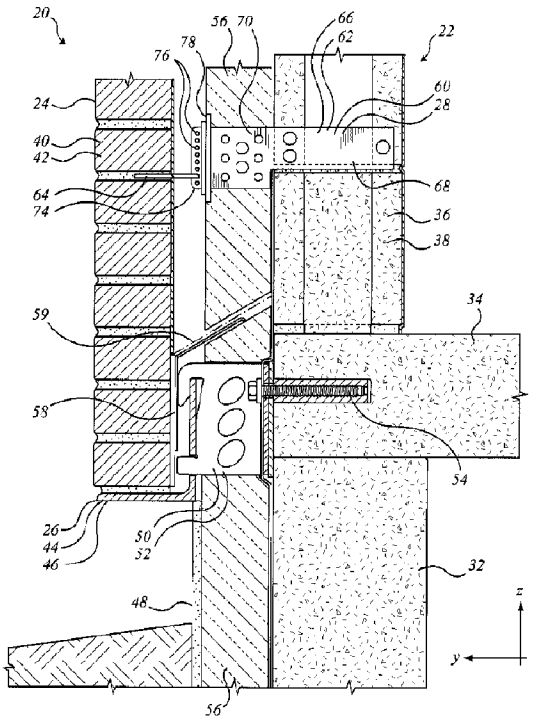

(57) Abrégé/Abstract:
A support assembly is provided for supporting external veneer. It has a mounting bracket and a shelf angle. The mounting bracket is fixedly mounted to a load bearing wall support structure, and may hang downwardly from the support structure. The shelf angle is a right-angle having a horizontal leg upon which to mount the external veneer and a vertical leg that engages the mounting bracket. The mounting bracket may be a channel in which the legs define a seat. The seat has an accommodation for the shelf angle. The back of the shelf angle may have apertures to admit toes of the mounting bracket. The toes do not extend below the horizontal leg of the shelf angle, and do not protrude downwardly of it.

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Abstract

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SUPPORT BRACKET ASSEMBLY AND METHOD

Field of Invention

This specification relates to structural materials for use in the construction of buildings, and, in one particular context, to support structure external veneer components.

Background of the Invention

In former times, brick walls were load bearing structures. In contemporary building structures bricks, or other masonry elements, or other visible finished surface elements, are rarely load-bearing and tend more often to be employed as surface cladding on the exterior face of load-bearing structure.

When mounting face brick or stone veneer on the face of a wall structure, it is common to support the first row of bricks or stone, or veneer on a steel support. The steel support may be termed a shelf angle, and may extend outward from the wall structure, and may run along, or have a major dimension extending in, a direction that is generally horizontal and cross-wise to the wall. The steel support is mounted to the on the wall before brick-laying commences. The steel support may be welded to a steel anchoring system embedded in the wall. Alternatively, the steel support may be carried in spaced apart brackets that have themselves been mounted to the load bearing wall structure.

Summary of Invention

In an aspect of the invention there is an external facing support assembly. It has a first member and a second member. The second member is engageable with the first member for support thereby. The first member has a mounting fitting by which to secure the assembly to load-bearing wall structure. The first member has a seat located distant from the mounting fitting. The seat has a protrusion, a shear load receiving interface, and a moment couple reaction interface. The second member has an external facing carrier and a seat engagement. The carrier is connected to the seat engagement. The seat engagement has an accommodation sized to admit the protrusion; a shear load transmission interface that, in use, engages the shear load receiving interface; and a moment couple transmission interface that, in use, engages the moment couple reaction interface.

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In a feature of that aspect of the invention, the protrusion has an upwardly facing shoulder, and the upwardly facing shoulder defines the shear load receiving interface. In another feature, the carrier is located lower than the protrusion. In another feature, the carrier has an upwardly facing interface above which to locate the external facing, and, as installed in use, the shear load receiving interface is located higher than the upwardly facing interface of the carrier. In still another feature, the second member is a shelf angle having a flange and a web. The flange defines an upwardly facing external veneer load receiving interface. The web has the accommodation for the protrusion formed therein. In an additional feature, the web is an upstanding web; and the upstanding web has a greater vertical extent than the seat. In a still further additional feature, the web includes an aperture formed therein at a medial height location thereof, the aperture permitting introduction of the protruding toe therethrough, and the aperture defining the accommodation. In another feature, on assembly, the flange is located one of: (a) flush with a lowermost portion of the protruding toe; and (b) downwardly proud of the protruding toe. In a still further feature, the flange and the web meet at a vertex, the vertex having an internal radius, and the accommodation is formed as an aperture in the web upwardly clear of the radius. In another feature, the seat engagement extends rearwardly and upwardly of the carrier.

In another feature, the first member is a channel member having a back and two spaced apart legs extending away from the back. The back of the channel has the mounting fitting. Each of the legs of the channel has one of the seats. In another feature, the assembly includes a plurality of the first members, and the second member has a plurality of the accommodations corresponding to the plurality of the first members. In a further feature, the assembly includes a plurality of the first members, and the second member has a plurality of the accommodations corresponding to the plurality of the first members.

In another feature, the protrusion has an upwardly facing shoulder defining the shear load transmission interface. The seat includes an upwardly extending slot and an over-hanging finger. The second member seat engagement includes a web having an upwardly extending extremity that, on assembly, seats in the slot. The over-hanging finger defines one portion of the moment-couple reaction interface. In a further feature, the slot is oversized to admit at least partial angular rotation of the web of the second member on installation. The slot has a relieved first wall portion angled on a first angle relative to vertical. The overhanging finger has a downwardly distal tip, the downwardly distal tip is relieved to accommodate insertion of the web on assembly; the downwardly distal tip having a chamfer on a second angle relative to vertical. The second angle is greater than the first angle.

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In another aspect of the invention there is an external facing support assembly. It includes at least a first member and a second member. The first member has a first portion having a fitting by which to secure the first member to a wall. The first member has a second portion standing outwardly away from the first portion. The second portion includes a seat located distantly from the first portion. The seat has a protruding toe, a rebate located upwardly of the protruding toe, and an overhanging retainer. The second member is a veneer support. The veneer support has a foot upon which to mount at least one veneer member. The veneer support has a back to which the foot is joined. The back has a first accommodation in which to admit the protruding toe.

In a feature of that aspect, the foot of the second member defines a shelf for the at least one veneer member. The first member has first and second protruding toes. The bench has the first accommodation and a second accommodation. The first and second accommodations admit the first and second protruding toes, respectively. In another feature, the first member is a channel member having a back and a pair of first and second legs extending away from the back. The first portion of the first member includes the back of the channel member. The first leg of the channel member defines one the second portion of the first member. The second leg of the channel defines another the second portion of the first member. Each of the first and second legs has one the protruding toe. The back of the second member has the first accommodation and a second accommodation. The first and second accommodations are spaced apart to receive the respective protruding toes of the first and second legs of the channel member. In another feature, the second member is a shelf angle, the first portion of the second member is an horizontal leg of the shelf angle, and the second portion is a back of the shelf angle.

In a further aspect of the invention, there is a wall support assembly. It has a bench member, a first mounting member and a second mounting member. The first mounting member is a U-shaped bracket having a back and first and second legs extending from the back. The back has a mounting fitting by which to secure the back to supporting structure. The bench has a first portion, the first portion being an horizontally extending flange, the flange defining a seat for wall members. The bench has a second portion, the second portion defining a web running along the flange. The first and second legs of the bracket each have a seat into which to introduce at least a first portion of the web. The first and second legs of the bracket each have a protruding toe adjacent to its respective seat. The web has at least one lodgement into which to engage the respective protruding toes when the first portion of the web is located in the seat.

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Brief Description of the Illustrations

The foregoing aspects and features of the invention may be explained and understood with the aid of the accompanying illustrations, in which:

Figure **1a** is a side view in section of a general arrangement of an assembly of wall elements according to an aspect of the invention;

Figure **1b** is an enlarged detail of an arrangement similar to the general arrangement of Figure **1a**;

Figure **1c** is a top view of the elements of the enlarged detail of Figure **1b**;

Figure **2a** is an isometric view of a structural element of the assembly of Figure **1a**;

Figure **2b** is a side view of the structural element of Figure **2a**;

Figure **2c** is a front view of structural element of Figure **2a**;

Figure **3a** is an isometric view of structural elements of the assembly of Figure **1a** shown without associated wall members from in front, to one side, and above;

Figure **3b** is an isometric view of the structural elements of Figure **3a** viewed from behind, to the other side, and above;

Figure **3c** is an end view of elements of Figure **3a**;

Figure **3d** is a front view of the assembly of Figure **3a**;

Figure **3e** is a rear view of the assembly of Figure **3a**;

Figure **4a** is a front view of a structural element of the assembly of Figure **1a**;

Figure **4b** is an enlarged detail of the structural element of Figure **4a**.

Figure **5a** is an isometric view of an alternate embodiment of support bracket to that of Figure **2a**;

Figure **5b** is a side view of the support bracket of Figure **5a**;

Figure **6a** is a side view of an alternate assembly to that of Figure **1a**;

Figure **6b** is a side view of an alternate assembly to that of Figure **6a**;

Figure **6c** is a side view of another alternate assembly to that of Figure **6a**; and

Figure **6d** is a side view of a further alternate assembly to that of Figure **6a**.

Detailed Description

The description that follows, and the embodiments described therein, are provided by way of illustration of an example, or examples, of particular embodiments of the principles of

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the present invention. These examples are provided for the purposes of explanation, and not of limitation, of those principles and of the invention. In the description, like parts are marked throughout the specification and the drawings with the same respective reference numerals. The drawings may be taken as being to scale, or generally proportionate, unless indicated otherwise.

Referring to the general arrangement of Figure **1a**, there is a partial cross-section of a wall assembly, indicated generally as **20**. For the purposes of this description it may be helpful to consider a Cartesian co-ordinate frame of reference. The vertical, or up-and-down, direction may be designated as the **z**-axis, or **z**-direction. The direction perpendicular to the plane of the page may be considered as the longitudinal direction or **x**-direction, or **x**-axis, and may be taken as being the cross-wise direction of the wall. The left-to-right direction in the plane of the page, i.e., perpendicular to the wall, may be considered the sideways, or **y**-direction, or **y**-axis.

In this description, reference is made to load-bearing structure, and load-bearing wall structure. The description pertains to mounting bracket assemblies that support external facing veneer components, such as face brick, spaced away from the supporting structure. The mounting brackets are anchored to load-bearing structure. Whether that load bearing structure is a structural wall or a concrete floor slab carried by framework, by a poured wall, by a block wall, or other load bearing members, in the context of this description whether it is a wall, a floor, or a ceiling, within the meaning of this specification it is a load-bearing wall structure to which the veneer supporting members may be mounted.

Wall assembly **20** may include load-bearing structure, indicated generally as **22**, and externally visible facing elements, indicated generally as **24**. The externally visible facing elements are mated to, or linked to, or stabilised by, load bearing structure **22**. The linking, or positioning of the facing elements with the load-bearing structural elements may be achieved by the use of interface elements such as supports, or support assemblies, **26**, and tying members **28**. Support assemblies **26** and tying members **28** may be taken as being made of mild steel unless otherwise noted. Combinations of load bearing frame or wall assemblies, such as **22**, facing elements **24**, support assemblies **26** and tying assemblies **28** may be assembled as indicated in Figure **1a**.

Load-bearing structure **22** may have several different forms. First, it may include a foundation, which may be a poured concrete foundation **32**. There may be a floor structure,

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such as a poured concrete floor slab **34**. Floor slab **34** may carry a wall structure **36** which may have the form of laid blocks **38**, or which may in other embodiments include a framed structure, such as may be a wood or steel framed structure.

Visible facing elements **24** may include brickwork **40**, or stonework, be it rough stone or finished stone, or other cladding. The anchor system described may be used for supporting masonry veneer, thin granite veneer, large stone panels or pre-cast concrete in place of the bricks. In the example shown, facing elements **24** are shown as bricks **42** laid in successive courses. As suggested by Figure **1a**, support assembly **26** may include a base or bench or first member **44** that may have the form of a "shelf angle", or angle iron **46**. Angle iron **46** runs along the wall structure in the horizontal direction and provides the bed upon which the lowest course of bricks finds its support, hence angle iron **46** may be termed a brick support. Angle iron **46** may rest with the back or the angle iron seated above a non-load bearing abutment or stop or skirt such as plate **48**. First member **44** may be mounted to a second member **50**, which may have the form of a support bracket **52**. Second member **50** it itself fixedly mounted to the load bearing wall structure. The vertical load of the facing, e.g., bricks **42** is carried by the bench or "shelf" of first member **44**, and passed into such number of second members **50** as may support first member **44**.

There may typically be at least first and second such second support members **50** spaced laterally apart. For example, there may be several such supports on, for example, 24" centers, indicated as spacing $\mathbf{L_1}$, which may correspond to the spacing, or double the spacing of wall studs in standard framing (see Figure **3e**). Second members **50** may then carry the shear load from first member **44** into the load bearing wall structure. The depth of second members **50** in the **y**-direction (i.e., normal to the wall) may typically be less than the vertical height of second members **50**, such that the webs of second members **50** may be considered low aspect ratio beams in which the bending moment is small, or negligible.

Second members **50** are secured to load bearing wall **22**. The securement may be by suitable means. For example mechanical securements in the nature of threaded fasteners **54**. In the case of securement to a poured concrete wall or floor slab (as shown) the fasteners may be concrete anchors. Fasteners **54** may be concrete anchor fittings, as shown in Figure **1a**, or embedded threaded rods, studs, or bolts, as in Figure **1b**.

Second members **50** have a depth (in the **y**-direction) that may correspond to, or may be greater than, the thickness of insulation panels **56** such as may be mounted to the front (or outside) face of the structural load-bearing wall assembly **22**. There may also be a drainage

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shield, or flashing, **58** such as may encourage moisture to drain outwardly of and away from structural wall assembly **26**. A vapour barrier membrane **59** may be captured behind insulation panels **56** upwardly of the floor slab, may traverse insulation **56** at the level of flashing **58**, and may lay overtop of flashing **58** with its lowermost margin draining over angle iron **46**, such that any moisture draining over vapour barrier **59** is drained away. That is, a continuous metal flashing **58** is supported on or above shelf angle **46**. It may connect to a continuous flexible flashing which extends over the brick supports and that may connect to a vapour barrier membrane on the outer face of the wall. Sheets of rigid insulation are mounted over top of the membrane on the outer face of the wall. The anchor system allows cavity insulation to be continuous behind the brick support. The rigid insulation may be of a thickness that allows an air space between the insulation and the external veneer brick facing mounted on shelf angle **46**. The anchor brackets **52** may be made in a variety of sizes each corresponding to a desired thickness of the rigid insulation and air space. In this arrangement, a standard size of brick support shelf angle **46** may be used without regard to the spacing between the brick facing and the face of the wall desired for insulation.

In some embodiments, tying members **28** may be located upwardly of support assembly **26**. Tying members **28** may have the form of brick tie assembly **60**, in which there is an anchor **62** and a brick tie **64**. As may be noted, anchor **62** has a body **66** such as may have the form of a stamped steel plate. The distal portion of body **66** may be termed a tail **68**. Tail **68** may have a length in the **y**-direction (i.e., into the wall) corresponding to the through thickness of cinder blocks **38**, and such as may be located between adjacent blocks of a block wall, and embedded in the mortar therebetween. To that end, tail **68** may have perforations such as may permit mortar to flow therethrough. Body **66** may also have a proximal portion **70** of a depth in the **y**-direction corresponding to the thickness of insulation panel **56**. Proximal portion **70** may be perforated to reduce thermal conduction in the **y**-direction. Proximal portion **70** may have a step, or abutment, or indexing or locating feature, such as a shoulder, by which the correct depth position in the **y**-direction is obtained relative to the cinder block and the insulation. Body **66** may also have an outermost end portion **74** having an array of tie location apertures, or seats or positions **76**. A faceplate **78** seats on the outside face of the insulation, and may be used on installation where the positioning of anchor **62** is set prior to installation of tail **68** in a poured concrete form. Brick tie **64** is then located in one or another of the seat positions **76**. When the successive courses of bricks **42** are laid, the outermost ends of brick tie **64** are embedded in the mortar between courses, as suggested in Figure **1a**. Tying members as described are used where the air or insulation space between the load bearing structure and the external veneer exceeds one inch, and in all

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cases where the wall height exceeds 30 ft. Tying members such as those described may be placed on up to 24 inch spacing vertically, and up to 32 inch spacing horizontally.

Considering the enlarged detail of the embodiment of Figure **1b**, support bracket **52** may have the form of a channel **80** (as viewed from above, as in Figure **1c**) having a first member in the nature of a rear plate or back **82**, and a second member in the nature of a web or leg **84**. Channel **80** may also have a third member in the nature of a second web or leg **86**. In the embodiment shown, legs **84** and **86** stand outwardly of back **82**. That is, as installed back **82** may lie in an **x-z** plane abutting the load bearing structure, be it framing, metal girders, poured concrete wall or poured concrete slab, and so on. Legs **84** and **86** stand outwardly away from that **x-y** plane. In general, it may be convenient that legs **84** and **86** stand in **y-z** planes perpendicular to the plane of back **82**, standing spaced apart and parallel, but this is not necessarily so. For example, legs **84**, **86** could be splayed to form a V or winged shape as opposed to a square-sided U. In the particular embodiment illustrated, legs **84**, **86** are a pair of side plates that extend from respective sides of the rear plate, back **82**, in a direction away from the wall to form the sides of the U-shaped channel. The side plates are generally rectangular in shape and lie in respective vertical planes.

Back **82** may have a mounting, a seat, or an attachment fitting **90** such as shown in Figure **2c** by which mechanical fastener **54** may secure bracket **52** to the load bearing structure. In general, in all of the embodiments herein a shim plate, such as may be substantially similar in size to the anchor bracket, may be mounted between each anchoring bracket and the outer face of the wall (i.e., load-bearing wall assembly **52**), as may be suitable, for evenly engaging the concrete surface and for spacing each anchor bracket **52** from the wall as desired to accommodate irregularities in the outer face of the wall. Fitting **90** may be a slot **92** that permits height adjustment of bracket **52**. Slot **92** may be oriented at a non-parallel angle or direction that is skewed relative to the vertical axis. Slot **92** may be an elongate aperture in back **82** that extends along an inclined axis **83** angularly offset from vertical. Figure **2c** shows a left-hand configuration. The inclined axis may be offset 22.5 degrees from vertical. In a right hand configuration the fastener slot may be offset 22.5 degrees from vertical axis in the opposite direction. The upright plate of back **82** can thus be fastened to the wall at numerous locations relative to the wall corresponding to different positions of the bolt within the slot. As installed, fastener **54** may be in tension, and the lowermost edge of back **82** may be in compression, i.e., pressed against the load-bearing structure, such that there is a moment reaction and a moment arm, $\mathbf{z}_{54}$. Slot **92** may be located closer to the upper margin of bracket **52** than to the lower margin, such that moment

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arm z_{54} of the reaction of bracket **52**, defined as the distance from the centerline of fastener **54** to the lower margin, is typically greater than half the height of bracket **52**, indicated a z_{52}, (Figures **1b** and **2c**). In the default, the upper datum of z_{54} may be taken as the mid-height location of fitting **90**, namely half way up in the middle of slot **92**. Slots **92** of successive brackets **52** may be alternately left handed and right handed. That is, in use, a plurality of anchor brackets may be spaced horizontally across a wall using a chalk line and a measuring tape. The anchoring brackets are mounted in an alternating arrangement of left-hand and right-hand configurations. The brackets are mounted along the wall such that each anchoring bracket having a left-hand orientation is beside an anchor bracket having a right-hand orientation. On installation, the vertical shear load may tend to cause the brackets to wedge and lock in position on the fasteners.

The side plates defined by legs **84**, **86** are arranged to receive and to carry the brick support defined by bracket **46**. Looking at leg **84** as being representative also of leg **86**, and considering the profile shown in Figures **1b** and **2b**, the distal portion of leg **84** (i.e., the portion standing away most distantly from back **82**) has a fitting, or accommodation, or seat **94** that is matingly co-operable with first member **44**, and that provides a shear load transfer interface in which a vertical gravity load from member **44** is transferred into web **84** (or **86** as may be). The profile of each seat **94** in the respective side plates of legs **84**, **86** may have the appearance of a recessed channel in the forward or foremost, or distal edge or margin thereof.

Seat **94** includes a vertical reaction interface, indicated at **96**, and a moment restraint, indicated at **98**. Moment restraint **98** includes an upper reaction member **100** and a lower reaction member **102**. Leg **84** (or **86**) may have an overhanging member, or finger **104** that, in use, over-reaches, and depends in front of, the uppermost margin of first member **44**. The space between finger **104** and the upper leading edge of the body of leg **84** (or **86**) more generally defines a receiving slot **107** as, or at, the upper portion of seat **94**. Slot **107** extends upward, and has a rearward edge (i.e., at edge or wall **114**) at a top end of the recessed, generally channel-shaped profile of seat **94**. The inside face of the downward or distal tip of finger **104** may have the form of an abutment, or stop, or restraint that faces wholly, substantially, or predominantly in the **–y** direction, defining upper reaction member **100**.

Vertical reaction interface **96** may be defined as the upper face of the toe, edge, or side of an extending portion or member or dog or toe **108**, such as may be or define a protruding extension or protrusion in the **y**-direction of the lower margin of leg **84**. That is, in the embodiment illustrated the recessed channel shape of seat **94** includes a shoulder at a

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bottom end. That shoulder defines vertical reaction interface **96**, and it carries the shelf angle, such that the brick supporting flange extends laterally outward from the wall.

Lower reaction member **102** extends upwardly and away from the root of toe **108**, and has the form of a wall or edge that faces wholly, substantially or predominantly in the **+y** direction. A fatigue detail, or stress relief detail, in the form of a finite radius relief **110** is provided at the root of the intersection of vertical reaction interface **96** and lower reaction member **102**. The upper and lower stops (i.e., **100** and **102**) constrain the translational degree of freedom of corresponding upper and lower regions of angle iron **46**, and thus define a moment-couple reaction inhibiting motion in the rotational degree of freedom about the **x**-axis of angle iron **46** in the counter-clockwise direction.

Upwardly of an inflection point **112**, wall **114** of seat **94**, (being the back or rearward margin of slot **107**) is relieved in the **–y** direction such that seat **94** may include, and slot **107** may be, a slanted slot or accommodation such as to permit entry of the upper leg of angle iron **46** into the accommodation on installation. The angle of inclination α_{107} may be in the range of 10 – 20 degrees in some embodiments. The lowermost extremity of the inside tip of finger **104** may also be trimmed, or tapered, or chamfered as at **115**. The angle or size of the chamfer or relief at **115** , designated as α_{115}, is steeper, i.e., smaller, than the size of angle α_{107} of the chamfer or relief of wall **114**. That is, whereas wall **114** may be angled at 10 – 20 degrees, from vertical, the relief at **115** may be more than 20 degrees, and may be about 24 or 25 degrees. Lower reaction member **102** may extend in a vertical plane, $\mathbf{P}_{102}$. Upper reaction member **100** may extend in a vertical plane $\mathbf{P}_{100}$. Planes $\mathbf{P}_{102}$ and $\mathbf{P}_{100}$ may be parallel and spaced apart, with upper reaction member **100** being more distant from back **82** than is lower reaction member **102**. They may be spaced apart by a distance corresponding to the through thickness of the upstanding leg of angle iron **46**.

The overall height of seat **94** may be taken from the vertical shear transfer receiving interface of shoulder **96** to the uppermost extremity of slot **107**, and is indicated as $\mathbf{h}_{94}$ in Figure **1b**. In this embodiment, shelf angle **46** is mounted at a height that corresponds generally to the height of the attachment interface of back **82** to the load-bearing support wall structure. This may be expressed several ways. First, it may be expressed in the relative squareness of the mounting bracket when seen in side view, as in Figures **1b** and **2b**. In this embodiment the most distant extremity of toe **108** is the same distance from back **82** as is the most distant extremity of finger **104**. That distance, $\mathbf{y}_{108}$, may be comparable to the overall height of member **50**, indicated as $\mathbf{z}_{52}$. It may be that the ratio $\mathbf{z}_{52}/\ \mathbf{y}_{108}$ may lie in the range: $2/3 < \mathbf{z}_{52}/\ \mathbf{y}_{108} < 3/2$. As another measure of squareness, the lateral projection of fastener **54**

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falls between the upper and lower boundaries of seat **94**. Expressed differently again, the projection of the **y**-direction of mounting fitting **90**, namely slot **92**, falls within the projection of seat **94** in the **y**-direction. This may be expressed equivalently as the projection of seat **94** in the **y**-direction including the footprint of the mounting fitting. Either of those conditions also implies that the **y**-direction projection of shelf angle **46** also falls upon the mounting fitting footprint. As another expression of the squareness, it may be said that seat **94** lies opposite to mounting fitting **92**, or generally substantially or predominantly in line with mounting fitting **92**, as opposed to being offset downwardly therefrom as in the apparatus shown of Figures **6a** – **6d**, discussed below.

The brick support defined by angle iron **46** may include a mounting flange which engages anchor bracket **50**, and a supporting flange arranged to carry bricks. The mounting flange and the supporting flange may typically be mounted at right angles to form an L-shaped angle iron, typically made of steel. As in Figure **3a**, angle iron **46** has a first or horizontal leg **116** and a second or vertical leg **118**. Horizontal leg **116** extends forwardly (in the **+y** direction) away from vertical leg **118**, and hence on installation also forwardly and away from bracket **52**. Horizontal leg **116** runs along the wall structure in the **x**-direction. Typically the running length of the angle iron is much greater than the horizontal leg length. For example, in one embodiment the running length may be 72 inches, while the leg of the angle may be 6 inches or less. In various embodiments the **x**:**y** aspect ratio of lengths may be in the range of 4:1 to 16:1. Bracket **52** may be cut to length as may suit. As installed, the length of leg **118** proud of the end of toe **108** in the **y**-direction may have a length corresponding to the depth in the **y**-direction of the facing members to be supported. In the case of face brick, that length corresponds to the depth of the face brick. In some embodiments it may be somewhat less than the depth of the face brick to permit the iron to be less noticeably visible, as in Figure **1a**, or to be hidden, as in the embodiment of Figures **6a** – **6d**.

In the embodiment of Figure **1a**, vertical leg **118** has an accommodation, slot, aperture, socket, or relief, or reliefs **120**, **122** spaced upwardly from the junction of members **116** and **118**. The lower margin of reliefs **120**, **122** may be located at or above the run-off of the rolled radius between members **116** and **118**, i.e., in the tangent portion of the vertical leg, rather than in the radius. Reliefs **120**, **122** are sized to receive the dogs, or toes **108** of web members **84** or **86**. They are over-sized in the **x**-direction to permit lateral adjustment of bracket **52**, as, for example, according to the fastener position along inclined slots **92**. For half inch thick legs, the slot may be 2.5 inches wide, giving, potentially, one inch play to

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either side of center. The height of the slot may be slightly oversize to permit rotating installation of bracket **52**. The vertical through thickness of each toe **108** may be 1" or more.

In the engagement of toe or dog **108** in accommodation or relief **120** or **122**, as may be, it may be that the lowermost margin of leg **84** (or **86**) does not extend lower than (i.e., downwardly proud of) the bottom of horizontal leg **116**, such that no additional vertical clearance allowance is required for toe **108**, meaning that the toe is concealed behind the external veneer and the bottom edge of the lowest course of bricks may be lower than otherwise. Expressed differently, in terms of a seating arrangement of structural members, second member **50** may be considered to be the receiving member, and first member **44** may be considered to be the received member. In the arrangement of Figures **1a**, **1b**, and **3a** to **3e**, the received member is flush with, or extends downwardly proud of, the lowermost portion or extremity of the receiving member and may tend to conceal the receiving member from view. The engagement of the receiving and received members is a mechanical interlocking relationship that is biased into securement by gravity acting on the load. That is, while the angle iron may be adjustable and engageable while unloaded, the loading of bricks or other surface elements may tend to increase the moment couple on the angle iron, such as may tend to tighten the hold of the moment couple reaction members of the receiving member.

The receiving slot **107** slidably receives an edge portion of the mounting flange of leg **118** therein such that the brick support remains secured to the anchoring bracket **46** when a weight of bricks is stacked on the supporting flange of leg **116**. The rearward edge **114** of receiving slot **107** extends upward at a slight rearward incline for accommodating the edge portion of the mounting flange of leg **118** as it is inserted therein. A wedge shaped shim may then be inserted between the distal tip of leg **118** and the rearward edge **114** such as to lock the assembly in tight engagement.

The received member, such as the shelf angle identified as angle iron **46**, is itself a receiving member, or accommodation, for the externally visible facing elements, and as the facing elements are received, rearward structure such as bracket **52** is obscured from view. The received member need not be an angle iron, and whether or not it is an angle iron, is need not have a 90 degree angle. In more general terms, the received member has a first portion that defines a seat or bench, or accommodation, or support, or platform or under-girding, or shelf, for the externally visible facing members, hence the term "shelf angle". It is a form of sill. The received member also has a second portion that engages the receiving member such that vertical load from the received member is transmitted or carried into the receiving member and thence into the load-bearing supporting structure. In that sense the

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second portion can be thought of as an engagement fitting, or key, or inter-locking feature, or indexing feature, that mates with the receiving member. It happens that an L-shaped angle iron may be a convenient form having these properties.

In the embodiment shown in Figure **1a**, inasmuch as each leg **84**, **86** may pass through the wall insulation panels **56**, each leg may also have an array of apertures as at **124**, such as may reduce the section for heat transfer in the **y**-direction. In some embodiments apertures **124** may be non-circular, and may have an oval, oblong, or elliptical form. The form of aperture may have a long axis and a short axis. The long axis may be inclined at an angle to the perpendicular. In one embodiment the angle of inclination may be about 45 degrees. The interstitial strips **126** between adjacent apertures may tend to be correspondingly inclined on a generally diagonal angle. On the diagonal angle, the diagonal may be oriented from outwardly and downwardly to upwardly and inwardly, i.e., the mean slope dz/dy in Figure **1b** is negative. As such, a vertical load imposed at interface **96** may tend to place members **126** in tension, or to impose a tensile load component in them.

In the alternate embodiment of Figures **5a** and **5b** there is a first member of a support assembly, identified as bracket **128**. Bracket **128** has a back **130**, and first and second legs **131**, **132**, the legs and the back being joined together to for a U-shaped channel as indicated. In this instance the seat for the shelf angle may be defined by a slot **134** and the uppermost end **135** of an upwardly extending finger **136**. In this example, the shelf angle (not shown, but understood to be the same as, or similar to, shelf angle **162**, below) may seat in an inverted orientation, with the back web extending downward into the slot, and the root of the horizontal flange being supported on ends **135** of fingers**136**. The ends of fingers **136** are vertically shy of the upper edge **133** of the proximal portion of legs **131**, **132** such that, on installation, the upwardly facing surface of the horizontal flange of the inverted shelf angle may lie flush with edges **133**. Ends **135** may define the shear load receiving interface. Given the downward vertical loading orientation of the accommodations defined by slots **134**, slots **134** may be straight-sided, since they do not have to allow for angular rotation upon entry. Slots **134** may nonetheless define a moment-couple reaction interface such as may tend to react the eccentric moment due to loading on horizontal flange. Bracket **128** may have an array of reliefs or apertures, as indicated at **138**. Apertures **138** may be non-circular, and may have a major axis and a minor axis, as do the elliptical apertures shown in Figures **5a** and **5b**. As before, the major axis of the ellipse may be angled upwardly and inwardly toward back **130**. Apertures **138** may correspond in number, size, spacing, angle, and arrangement to apertures **124** in Figures **1b** and **2b**. Back **130** may have a mounting fitting,

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such as slot **129**, which may be taken as being the same as slot **92** noted above. As above, bracket **128** has a general squareness when taking the ratio of **z**-direction height to **y**-direction depth, falling in the same range as member **50** discussed above. Likewise, the seat defined by slot **134** has the same **y**-direction relationship of projection relative to slot **129**, the slot being opposed or generally in line with the mounting fitting. Whether upright, as in Figures **1a** and **1b**, or inverted, as in the embodiment of Figures **5a** and **5b**, the shelf angle and bracket assembly may employ apertures to reduce thermal conductivity through the bracket in the **y**-direction.

Support assemblies **26** need not be located only at the lowermost course of facing elements. As seen in Figures **6a**, **6b**, **6c**, and **6d**, such assemblies may be located at intermediate height locations, where there are bricks both above and below the support bench defined by the horizontal leg of the shelf angle. Such intermediate height locations may occur at horizontal control joints, which may typically be employed in non-residential structures having wall heights in excess of 30 ft. A shelf angle may then be used for each successive storey. Whatever the case may be, the height of the structure to which the support assembly may be mounted may not necessarily be the height of the structure at which the shelf angle is to be located. As suggested by the illustrations in Figures **6a** – **6d**, there may be circumstances when the shelf angle is to be located some distance below the level of the securement to load-bearing structure.

Considering Figure **6a**, structural load-bearing wall assembly **140** may have steel framing **142** and a floor slab **144**. A hard-point, or rail, **146** is located at the end of floor slab **144**. A mounting fitting **148** is secured to rail **146**. An external facing veneer assembly is identified as **150**. Veneer assembly **150** has a horizontal expansion joint **152**. Veneer assembly **150** is connected to wall assembly **140** by a vertical load transfer assembly **160** that, as before, includes a first member **162** and a second member **164**. First member **162** may be the received member, and may be a shelf angle. The shelf angle may have a first portion identified as horizontal leg **166** and a second portion identified as upright leg **168**. The shelf angle, and in particular horizontal leg **166**, may be located at the position of horizontal expansion joint **152**, such that it bears the vertical load of that portion of wall assembly **150** extending upwardly thereof.

Second member **164** may be the receiving member with which it co-operates, and may be a channel-shaped bracket **170**. As before, the receiving member **164** is rigidly secured to the load bearing wall structure, namely wall assembly **150**. On installation, the back of bracket **170** lies in facing abutment against the load bearing wall structure in the

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same manner, or substantially the same manner, as member **50** described above, and where the wall is vertical, bracket **170** is correspondingly vertical. The load output interface of vertical load transfer assembly **160**, namely the connection to the load bearing wall, is located at a first height, identified as $\mathbf{H_{164}}$. The load input interface of assembly **160**, at which the vertical load of the external veneer or cladding is received at leg **166**, is identified as a second height, $\mathbf{H_{166}}$. The first height is substantially higher than the second height. That is, $\mathbf{H_{162}}$ lies at a level that is below the height of the bottom margin of the floor slab, and at a height that is more than two brick courses (i.e., more than 6") below $\mathbf{H_{164}}$. Side web or leg **172** of channel or bracket **170** is much deeper in the z-direction (see $\mathbf{H_{172}}$) than is the depth of the accommodation for the shelf angle, i.e., first member **162**, identified as $\mathbf{H_{168}}$.

In the embodiment of Figure **6a**, second member **164** may have substantially the same mounting arrangement and adjustability as back **82** of bracket **46**. The receiving seat or accommodation may differ, though. That is, there may be a vertical load reaction member, in the nature of a protruding toe **174** having an upper shoulder or side, or face, upon which shelf angle **162** rests. A relief or slot, or rebate, or accommodation **176** may extend upwardly therefrom, the slot being bounded by a first wall or vertex, or abutment **178** that defines the first moment couple reaction interface. At the upwardly distant end of accommodation **176** there is an overhanging, downwardly extending finger **180**, the overhang being spaced away forwardly by a gap defining a slot **182** sized to fit the upper margin of the angle iron leg. The inner face or side of finger **180** defines the second moment couple resisting interface **184**.

In the embodiment of Figure **6b**, insulation **182** is located in the space between load-bearing wall assembly **140** and veneer assembly **150**. Bracket **184** is may be understood to be the same as bracket **164**, except insofar as, in the manner of the embodiment of Figure **1a**, web **186** of bracket **184** is perforated as at **188** to reduce the conduction heat transfer path width across the bracket.

In the embodiment of Figure **6c**, bracket **190** is substantially the same as bracket **46**, except of greater vertical extent in the manner of bracket **164**; or, equivalently, bracket **190** is substantially the same as bracket **184** except in respect of having a receiving seat **192** that corresponds to the receiving seat of bracket **46**. In this embodiment, first member **194** may be taken as being the same as first member **44** in having apertures or reliefs **120**, **122** in the upstanding leg that engage with the protruding toes **108** of the various spaced bracket. It may be that such an embodiment may be desirable where the shelf angle forms a header or sill over a window or door opening or window or door installation, as at **196**.

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The embodiment of Figure **6d** is substantially the same as the embodiment of Figure **5a**, except insofar as it shows a vertical load transfer assembly **200** in which the receiving load transfer member, or bracket, **202** is of greater length than in Figure **5a**, such as may be suitable where the expansion joint (or window header or door header) is more distant from the floor plate to which the assembly is anchored. The embodiment of Figure **5d** may also be modified to correspond to the embodiments of Figures **5b** and **5c**, as may be.

In each of Figures **6a** – **6d**, if one defines a load center at the vertical load input interface of the seat, notionally $\mathbf{C}_{174}$ and another load center at the connection point, or centroid, of the fastening connection or connections to the load-bearing wall structure, notionally $\mathbf{C}_{164}$, the line of action constructed between those centers extends upwardly and toward the load-bearing structure. That line of action is predominantly upwardly oriented, i.e., the rise is greater than the run, as suggested by the ratio of $\mathbf{164}_{\mathbf{Rise}}/\mathbf{174}_{\mathbf{Run}}$. This may also be expressed in terms of the hanging, non-square nature of the mounting brackets of Figures **6a** – **6d**. In these embodiments the **y**-direction projection of the seat does not fall on the footprint of the mounting fitting, but rather falls well below it. The seat is not in line with the mounting fitting. On the contrary, the seat is downwardly displaced from the centerline of the mounting fitting at $\mathbf{C}_{164}$ by several pitches of the magnitude of the seat height, $\mathbf{H}_{168}$. This downward offset of seat **168** (or, from the other perspective, upward offset of fitting **148**) is more than one pitch of the seat height, and may be up to 6 or 8 pitches, or may lie in the range of 2 to 8 pitches of the seat height.

In each of the embodiments of Figures **6a** – **6d** it may be that the receiving member, such as **170**, may be a bracket having a channel-shaped cross-section when viewed from above, that cross section being substantially similar to, or the same as, that of member **50** such as illustrated in Figure **1c** or **2a**. However, in an alternate embodiment, the receiving member, corresponding to item **170**, may have a single web standing outwardly away from the supporting load-bearing wall structure. The web may be aligned on the center-line of the fastening mount at item **148**. In some embodiments the receiving member may be an angle bracket having a flange that locates in facing abutment against the wall structure, and a web that stands perpendicular to the wall structure.

In each case the general description of installation and use is substantially the same. That is, a brick support in the form of a standard size shelf angle is mounted across the wall on the anchoring brackets. The anchoring brackets are first bolted to the wall by securing the bolts loosely by hand. The brick support is then mounted on the anchoring brackets by inserting a edge portion of the mounting flange **118** upward into the receiving slot **92** of each

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anchoring bracket **52** (or as may be) at an incline and then by pivoting the supporting flange inward until the mounting flange engages the rearward edge of seat **94**. The rearward edge at **102** prevents the brick support from being further pivoted within the recessed channel under the increasing moment couple as the weight of the bricks is applied to the brick support. The bolts are then tightened snugly and the wedge shaped shims may be inserted to suit.

Until the nuts on the respective bolts are tightened, the relative height of each anchoring bracket is adjustable by sliding the anchoring bracket laterally along the brick support as the anchoring bracket is moved upward or downward relative to the bolt extending from the wall. This lateral movement of the anchoring bracket relative to the brick support with the adjustment in height is due to the inclination of the fastener slot from the vertical.

Once the nuts are tightened on the bolts the brick support is secured to the load-bearing wall structure, and bricks may be supported thereon. The inclination of the fastener slot from the vertical acts to inhibit vertical displacement of the anchoring bracket along the mounting bolt through the resistance of the lateral movement of the anchoring bracket along the brick support. Having anchoring brackets of opposing orientation mounted adjacent to each other further restricts the entire brick anchor system from shifting positions relative to the wall once the bolts are tightened.

The relative location of the anchoring brackets remains adjustable as the brick support is mounted thereon for accommodating irregularities in the wall or misalignment between adjacent anchoring brackets. Once the brick support is securely fastened to the wall further vertical displacement of the anchoring brackets is inhibited by the resistance of lateral movement of the anchoring brackets relative to the brick support due to the arrangement of the fastener slot.

A shim plate which is substantially similar in size to the anchoring bracket, mounts between each anchoring bracket and the outer face of the wall for evenly engaging the concrete surface and for spacing each anchoring bracket from the wall as desired to accommodate for irregularities in the outer face of the wall.

Various embodiments of the invention have been described in detail. Since changes in and or additions to the above-described best mode may be made without departing from the nature, spirit or scope of the invention, the invention is not to be limited to those details but only by the appended claims.

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Claims

I claim:

1. A mounting assembly for mounting masonry to supporting structure with the masonry spaced away from the supporting structure, said mounting assembly comprising:

a shelf angle; a first mounting member; and a second mounting member;

said first and second mounting members being spaced laterally apart from each other;

said shelf angle having a vertical leg and a horizontal leg, said vertical leg and said horizontal leg meeting at a right angle; said shelf angle having a length running laterally to span said first and second mounting members;

said horizontal leg defining a shelf for the masonry;

said horizontal leg extending forwardly of said vertical leg;

said first and second mounting members extending rearwardly of said vertical leg;

each of said first and second mounting members having a respective web that stands away from the supporting structure, whereby the shelf angle is spaced forwardly away from the supporting structure;

each of said first and second mounting members having an upper region and a lower region;

said shelf angle extending forwardly away from said respective lower regions of said first and second mounting members;

said upper regions of said first and second mounting members each having a respective support attachment fitting;

said first mounting member having a lower margin;

as installed, said vertical leg and said horizontal leg of said shelf angle being located lower than the supporting structure to which it is attached; and

as installed, said lower margin of said first mounting member being concealed behind said shelf angle.

2. The mounting assembly of claim 1 wherein said lowermost margin of said first mounting member is flush with said shelf angle.

3. The mounting assembly of claim 1 wherein:

said web of said first mounting member has a seat formed therein;

said shelf angle has at least one accommodation formed therein;

said web of said first mounting member has a protrusion that engages said at least one accommodation; and said shelf angle nests in said seat.

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4. The mounting assembly of claim 1 wherein:

said web is a first web;

each of said first and second mounting members has a back, a respective said first web and a second web spaced from said first web, said first and second webs being joined to, and extending away from, said back;

said attachment fitting is formed in said back;

said attachment fitting accommodates a mechanical fastener by which said mounting assembly is secured to the supporting structure;

as installed, said back and said first and second webs depend from the supporting structure to a height lower than the supporting structure to which said attachment fitting is mounted;

said vertical leg of said shelf angle is mounted to said first and second webs of said first and second mounting members respectively; and

said respective webs of said first and second mounting members extend upwardly to a greater height than does said vertical leg of said shelf angle ; and, as installed, said shelf angle is located lower than the supporting structure.

5. The mounting assembly of any one of claims 1 to 4 wherein said vertical legs of said shelf angles have apertures formed therein; said first and second mounting members have respective first and second protruding toes; and, on installation of said shelf angle said protruding toes extend through respective ones of said apertures.

6. The mounting assembly of claim 5 wherein said shelf angle has an internal radius extending between said vertical leg and said horizontal leg, and said apertures are formed clear of said internal radius.

7. The mounting assembly of any one of claims 1 to 6 wherein said seats include a retainer that extends over said vertical legs of said shelf angles; said vertical legs of said shelf angles have apertures formed therein; said first and second mounting members each have respective first and second protruding toes; and, on installation of said shelf angle said protruding toes extend through respective ones of said apertures.

8. A mounting assembly for mounting masonry to supporting structure with the masonry spaced away from the supporting structure, said mounting assembly comprising:

a shelf angle; a first mounting member; and a second mounting member;

said first and second mounting members being spaced laterally apart from each other;

each of said first and second mounting members having a back and first and second

legs joined to and extending forwardly from said back away from the supporting structure;

said shelf angle having a vertical leg and a horizontal leg, said vertical leg and said horizontal leg meeting at a right angle;

said shelf angle having a length running laterally to span, and be mounted to, said first and second mounting members;

said horizontal leg defining a shelf for the masonry;

said horizontal leg extending forwardly of said vertical leg;

said first and second mounting members extending rearwardly of said vertical leg, whereby the shelf angle is spaced forwardly away from the supporting structure;

each of said first and second mounting members having an upper region and a lower region;

said shelf angle extending forwardly away from said respective lower regions of said first and second mounting members;

said upper regions of said first and second mounting members each having a respective support attachment fitting formed in said respective backs;

said respective attachments fittings being located at a height that is upward of said vertical leg of said shelf angle; and as installed, said shelf angle being located downwardly lower than the support structure.

9. The mounting assembly of claim 8 wherein said attachment fitting is adjustable, and a layer of insulation is mounted between said vertical leg of said shelf angle and the support structure.

10. The mounting assembly of claim 8 wherein said shelf angle is removable from said first and second mounting members prior to masonry being installed thereon.

11. The mounting assembly of claim 8 wherein, as installed on the supporting structure, said first and second mounting members depend from the supporting structure, said shelf angle is located at a height that is lower than the supporting structure, and at least one of:

(a) said first mounting member has an input load transfer interface and an output load transfer interface; there is a Rise/Run between said input load transfer interface and said output load transfer interface, and said Rise is greater than said Run;

(b) said first mounting member has an overall height that is greater than two courses of face brick; and

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(c) said vertical leg of said shelf angle has a seat height, and said first mounting member has a height that is in the range of 2:1 to 8:1 times said seat height.

12. The mounting assembly of claim 8 and the supporting structure, wherein:

the supporting structure includes one of (a) a floor slab, and (b) a beam, the masonry being spaced away therefrom on installation;

each of said first and second mounting members extends forwardly away from the one of (a) the floor slab; and (b) the beam;

said respective upper regions of said first and second mounting members each have their respective said support attachment fittings secured to the one of (a) the floor slab; and (b) the beam;

said respective support attachment fittings are higher than said vertical leg of said shelf angle;

said respective lower regions of said first and second mounting members extend downwardly lower than the one of (a) the floor slab; and (b) the beam;

said lower regions of said first and second mounting members have respective seats in which said shelf angle is mounted; and

said horizontal leg of said shelf angle is lower than, and spaced forwardly away from, the one of (a) the floor slab; and (b) the beam.

13. The mounting assembly of claim 8 wherein:

said shelf angle has an inner radius running between said vertical leg and said horizontal leg;

said first and second mounting members are channels;

as installed, said respective backs of said first and second mounting members extend in a vertical plane, and said legs of said first and second mounting members have said respective seats formed therein;

said respective seats of said legs of said channels have respective forwardly protruding toes;

said vertical leg of said shelf angle has apertures formed therein corresponding to said protruding toes;

said apertures are located upwardly clear of said inner radius of said right angle;

said respective seats include a first moment reaction restraint that extends over said horizontal leg of said shelf angle;

said first moment reaction restraint engages said shelf angle upwardly clear of said inner radius;

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said respective seats include a second moment reaction restraint that extends vertically, said second moment reaction restraint is located rearwardly of said vertical leg of said shelf angle;

said aperture is located in said vertical leg upwardly clear of said inner radius; and, as installed, said protruding toe extends through said aperture over said horizontal leg of said shelf angle.

14. The mounting assembly of claim 8 and the supporting structure wherein:

said supporting structure includes a structural member that is one of (a) a floor slab; and (b) a beam;

said first and second mounting members are mounted to said structural member by said respective fittings of said respective upper regions thereof;

said respective lower portions of said first and second mounting members have respective seats to which said shelf angle is removably mounted; and

said lower portions of said shelf angle support brackets extend downwardly of said structural member, said respective seats being located lower than said structural member of said supporting structure.

15. The mounting assembly of claim 14 and the supporting structure wherein said structural member has an overall depth; said first and second mounting members have an overall height; and said overall height is greater than that overall depth.

16. The mounting assembly of claim 14 and the supporting structure, wherein:

said first and second mounting members are channels;

each said back extends in a vertical plane; and said legs of said first and second mounting members have said respective seats formed therein;

said respective seats of said legs of said first and second mounting members have respective forwardly protruding toes;

said shelf angle has an inner radius running between said vertical leg and said horizontal leg of said shelf angle;

said vertical leg of said shelf angle has apertures formed therein corresponding to said protruding toes;

said respective seats include a first moment reaction restraint that extends over said horizontal leg of said shelf angle;

said first moment reaction restraint engages said shelf angle upwardly clear of said inner radius;

said respective seats include a second moment reaction restraint that extends

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vertically, said second moment reaction restraint is located rearwardly of said vertical leg of said shelf angle;

said apertures are located in said vertical leg of said shelf angle upwardly clear of said inner radius; and, as installed; and

said protruding toe extends through said aperture over said horizontal leg of said shelf angle.

17. The mounting assembly of any one of claims 8 to 16 wherein said shelf angle defines a lintel of one of (a) a door; and (b) a window located downwardly of the structural member.

18. The mounting assembly of any one of claims 8 to 17 wherein said legs of said first and second mounting members have respective arrays of spaced-apart non-circular apertures formed therein.

19. The mounting assembly of any one of claims 8 to 18 wherein said assembly includes a shim mounted between any said first and second mounting member and the supporting structure.

20. A mounting assembly for mounting masonry to supporting structure with the masonry spaced away from the supporting structure, said mounting assembly comprising:

a shelf angle; a first mounting member; and a second mounting member;

said first and second mounting members being spaced laterally apart from each other;

said shelf angle having a length running laterally to span said first and second mounting members; on installation, said shelf angle being mounted to said first and second mounting members;

said shelf angle having a vertical leg and a horizontal leg, said vertical leg and said horizontal leg meeting at a right angle;

said horizontal leg defining a shelf for the masonry;

said horizontal leg extending forwardly of said vertical leg;

said first and second mounting members extending rearwardly of said vertical leg;

each of said first and second mounting members having a respective web that stands away from the supporting structure, said shelf angle being spaced forwardly away from the supporting structure;

each of said first and second mounting members having an upper region and a lower region;

said shelf angle extending forwardly away from said respective lower regions of said first and second mounting members;

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said respective upper regions of said first and second mounting members each having a support attachment fitting for securement to the supporting structure;

said respective support attachment fittings being higher than said vertical leg of said shelf angle; and

as installed, said lower regions of said first and second mounting members extending downwardly lower than said supporting structure to which said respective upper regions of said mounting members are secured by said attachment fittings.

21. The mounting assembly of claim 20 for mounting masonry to supporting structure with the masonry spaced away from the supporting structure, wherein:

said first mounting member is a first channel section having a back and a pair of first and second legs extending away from said back, said first leg of said first channel section defining said web of said first mounting member, said second leg of said first channel section defining a second web of said first mounting member, and said back of said first channel section having said support attachment fitting of said first mounting member defined therein;

said second mounting member is a second channel section having a back and a pair of first and second legs extending away from said back, said first leg of said second channel section defining said web of said second mounting member, said second leg of said first channel section defining a second web of said second mounting member, and said back of said second channel section having said support attachment fitting of said second mounting member defined therein;

each of said first and second legs of said first channel section and of said second channel section having a respective seat to which said shelf angle is removably mounted;

said upper regions of said first and second mounting members each having one of said support attachment fittings formed in said respective backs;

each said seat includes a respective protruding member;

said vertical leg of said shelf angle has first and second apertures of a first pair of apertures formed therein;

said protruding members of said first and second legs of said first channel section extend through said first and second apertures of said first pair of apertures in said vertical leg of said shelf angle respectively;

said vertical leg of said shelf angle has first and second apertures of a second pair of

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apertures formed therein; and

said protruding members of said first and second legs of said second channel section extend through said first and second apertures of said second pair of apertures in said vertical leg of said shelf angle respectively.

22. The mounting assembly of claim 21 wherein each said respective seat has a retainer that locates forwardly of said vertical leg of said shelf angle upwardly of the respective said aperture.

23. The mounting assembly of any one of claims 20 to 22, the supporting structure including one of (a) a floor slab, and (b) a beam, the masonry being spaced away therefrom on installation, and wherein:

each of said first and second mounting members extends forwardly away from the one of (a) the floor slab; and (b) the beam;

said respective upper regions of said first and second mounting members each have their respective said support attachment fittings secured to the one of (a) the floor slab; and (b) the beam;

said respective lower regions of said first and second mounting members extend downwardly lower than the one of (a) the floor slab; and (b) the beam; and

said horizontal leg of said shelf angle is lower than, and spaced forwardly away from, the one of (a) the floor slab; and (b) the beam.

24. The mounting assembly of any one of claims 20 to 23 wherein said shelf angle defines a lintel of one of (a) a door; and (b) a window located downwardly of the structural member.

25. The mounting assembly of any one of claims 20 to 23 wherein said legs of said channels have respective arrays of spaced-apart non-circular apertures formed therein.

26. The mounting assembly of any one of claims 20 to 25 wherein said assembly includes a shim mounted between any said first and second mounting member and the supporting structure.

27. The mounting assembly of any one of claims 20 to 26 wherein said shelf angle has an internal radius extending between said vertical leg and said horizontal leg, and said apertures are formed clear of said internal radius.

28. A mounting assembly for mounting masonry and a supporting structure wherein:

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said supporting structure includes one of (a) a floor slab, and (b) a beam;
said masonry is spaced away from said supporting structure;
said mounting assembly includes
a shelf angle; a first mounting member; and a second mounting member;
said first and second mounting members being spaced laterally apart from each other;
said shelf angle having a vertical leg and a horizontal leg that are joined together at a right angle;
said shelf angle having a length running laterally to span, and to permit mounting to, said first and second mounting members;
said horizontal leg defining a shelf for the masonry;
said horizontal leg extending forwardly of said vertical leg;
said first and second mounting members extending rearwardly of said vertical leg;
each of said first and second mounting members extending forwardly away from the one of (a) the floor slab; and (b) the beam;
each of said first and second mounting members having an upper region and a lower region; said respective upper regions of said first and second mounting members each having a support attachment fitting for securement to the one of (a) the floor slab; and (b) the beam;
said respective support attachment fittings being higher than said vertical leg of said shelf angle;
said respective lower regions of said first and second mounting members extending downwardly lower than the one of (a) the floor slab; and (b) the beam;
said lower regions of said first and second mounting members have respective seats in which said shelf angle is mounted;
when installed in said seats, said shelf angle extends forwardly away from said respective lower regions of said first and second mounting members; and
said horizontal leg of said shelf angle being lower than, and spaced forwardly away from, the one of (a) the floor slab; and (b) the beam.

29. The mounting assembly and supporting structure of claim 28, the one of (a) the floor slab; and (b) the beam, having an overall depth, wherein said first and second mounting members have an overall height, and said overall height is greater than that overall depth.

30. The mounting assembly and supporting structure of any one of claims 28 and 29 wherein said right angle has an inner radius running between said vertical leg and said horizontal leg.

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31. The mounting assembly and supporting structure of any one of claims 28 to 30 wherein said first and second mounting members are channels; each said channel having a back and a pair of first and second webs extending forwardly away from said back; and each said back extends in a vertical plane, and said webs have said respective seats formed therein.

32. The mounting assembly and supporting structure of claim 31 wherein said respective seats of said webs of said channels have respective forwardly protruding toes; said vertical leg of said shelf angle has apertures formed therein corresponding to said protruding toes; and said apertures are located upwardly clear of said inner radius of said right angle.

33. The mounting assembly and supporting structure of claim 32 wherein said apertures are wider than high.

34. The mounting assembly and supporting structure of claim 32 wherein:

said right angle of said shelf angle includes an inner radius that extends between said vertical leg and said horizontal leg;

said respective seats include a first moment reaction restraint that extends over said horizontal leg of said shelf angle;

said first moment reaction restraint engages said shelf angle upwardly clear of said inner radius;

said respective seats include a second moment reaction restraint that extends vertically, said second moment reaction restraint is located rearwardly of said vertical leg of said shelf angle;

said aperture is located in said vertical leg upwardly clear of said inner radius; and, as installed, said protruding toe extends through said aperture over said horizontal leg of said shelf angle.

35. The mounting assembly and supporting structure of any one of claims 28 to 31 wherein said shelf angle defines a lintel of one of (a) a door; and (b) a window located downwardly of the structural member.

36. The mounting assembly and supporting structure of any one of claims 31 to 34 wherein said legs of said channels have respective arrays of spaced-apart non-circular apertures formed therein.

37. The mounting assembly of any one of claims 28 to 36 wherein said assembly includes a shim mounted between any said first and second mounting member and the supporting structure.

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38. An assembly of a shelf angle, first and second shelf angle support brackets, and a supporting structure wherein:

said supporting structure includes a structural member that is one of (a) a floor slab; and (b) a beam;

said shelf angle has a first leg defining a shelf upon which to mount masonry;

said shelf angle has a second leg defining a back that mounts to said first and second shelf angle support brackets;

said back mating with said shelf;

said first and second shelf angle support brackets each have an upper portion and a lower portion;

said respective upper portions of said first and second shelf angle support brackets have respective fittings by which said first and second shelf angle support brackets are mounted to said structural member;

said respective lower portions of said shelf angle support brackets have respective seats to which said shelf angle is removably mounted;

said lower portions of said shelf angle support brackets extend downwardly of said structural member; and as installed, said seats of said shelf angle support brackets being located lower than said structural member.

39. The assembly of claim 38 wherein said structural member has an overall depth; said first and second shelf angle support brackets have an overall height; and said overall height is greater than that overall depth.

40. The assembly of claim 39 wherein said first leg of said shelf angle is located lower than said structural member.

41. The assembly of any one of claims 38 to 40 wherein said first and second shelf angle support brackets are channels; each said channel has a back and a pair of first and second webs extending forwardly away from said back; each said back extends in a vertical plane; and said webs have said respective seats formed therein.

42. The assembly of claim 41 wherein said first leg of said shelf angle is a horizontal leg, said second leg of said shelf angle is a vertical leg, said vertical leg is joined to said horizontal leg at a right angle; said right angle has an inner radius running between said vertical leg and said horizontal leg; said respective seats of said webs of said channels have respective forwardly protruding toes; said vertical leg has apertures formed therein

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corresponding to said protruding toes; and said apertures are located upwardly clear of said inner radius of said right angle.

43. The assembly of any one of claims 38 to 41 wherein said first leg of said shelf angle is a horizontal leg, said second leg of said shelf angle is a vertical leg, said vertical leg being joined to said horizontal leg at a right angle; and said right angle has an inner radius running between said vertical leg and said horizontal leg.

44. The assembly of claim 43 wherein:

said respective seats include a first moment reaction restraint that extends over said horizontal leg of said shelf angle; said first moment reaction restraint engages said shelf angle upwardly clear of said inner radius;

said respective seats include a second moment reaction restraint that extends vertically, said second moment reaction restraint is located rearwardly of said vertical leg of said shelf angle;

said aperture is located in said vertical leg upwardly clear of said inner radius; and, as installed, said protruding toe extends through said aperture over said horizontal leg of said shelf angle.

45. The assembly of any one of claims 38 to 44 wherein said shelf angle defines a lintel of one of (a) a door; and (b) a window located downwardly of the structural member.

46. An external masonry facing support assembly mountable to supporting structure, said assembly comprising:

a shelf angle, a first support bracket and a second support bracket;

as installed, said first and second support brackets being spaced apart from each other and being mounted to the supporting structure, said shelf angle being mounted to span said first and second support brackets;

said shelf angle having a horizontal leg and a vertical leg, said horizontal leg and said vertical leg being joined at a right angle;

said first and second support brackets each including a respective channel having a back, a first leg, and a second leg;

said back extends in a vertical plane and said first and second legs extend forwardly away therefrom;

said first and second legs having respective seats in which said shelf angle is engaged, said seats being distant from said respective backs;

said respective backs of said first and second support brackets having a wall

mounting fitting;

when said shelf angle is mounted in said respective seats, said vertical leg of said shelf angle terminates upwardly at a first height;

said wall mounting fitting is located above said first height;

as installed said first height being lower than said supporting structure; and

on assembly, said horizontal leg of said shelf angle is located one of: (a) flush with a lowermost portion of said first mounting bracket; and (b) downwardly proud of said first mounting bracket.

47. The external masonry facing support assembly of claim 46 wherein said right angle of said shelf angle includes an internal radius extending between said vertical leg and said horizontal leg; said respective seats include a moment reaction restraint; and said moment reaction restraint engages said shelf angle upwardly clear of said internal radius.

48. The external masonry facing support assembly of claim 46 wherein said respective seats include a moment reaction restraint that extends over said horizontal leg of said shelf angle, and engages a front face of said vertical leg of said shelf angle.

49. The external masonry facing support assembly of claim 46 wherein said seat includes a moment reaction restraint that extends vertically, and said moment reaction restraint is located rearwardly of said vertical leg of said shelf angle.

50. The external masonry facing support assembly of claim 46 wherein:

said right angle of said shelf angle includes an internal radius that extends between said vertical leg and said horizontal leg;

said respective seats include a first moment reaction restraint that extends over said horizontal leg of said shelf angle;

said first moment reaction restraint engages said shelf angle upwardly clear of said internal radius; and

said respective seats include a second moment reaction restraint that extends vertically, said second moment reaction restraint is located rearwardly of said vertical leg of said shelf angle.

51. The external masonry facing support assembly of claim 46 wherein said respective seats have a vertical shear load input interface, said fitting has a vertical shear load output interface, there is a Run and a Rise between said vertical shear load input and output interfaces, and said Rise is greater than said Run.

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52. The external masonry facing support assembly of claim 51 wherein said vertical leg of said shelf angle has a height; and said first support bracket has a vertical height that is greater than two courses of face brick; and in a range of 2 to 8 pitches of seat height of said vertical leg of said shelf angle.

53. The external masonry facing support assembly of claim 46 wherein:

said first leg of said first mounting bracket has a forward margin distant from said back thereof, and said forward margin has a protruding toe; and

said vertical leg of said shelf angle has an aperture formed therein to receive said protruding toe.

54. The external masonry facing support assembly of claim 53 wherein:

said right angle of said shelf angle includes an internal radius that extends between said vertical leg and said horizontal leg;

said respective seats include a first moment reaction restraint that extends over said horizontal leg of said shelf angle;

said first moment reaction restraint engages said shelf angle upwardly clear of said internal radius;

said respective seats include a second moment reaction restraint that extends vertically, said second moment reaction restraint is located rearwardly of said vertical leg of said shelf angle;

said aperture is located in said vertical leg upwardly clear of said internal radius; and, as installed, said protruding toe extends through said aperture over said horizontal leg of said shelf angle.

55. The external masonry facing support assembly of any one of claims 46 to 54 wherein said legs of said channels have respective arrays of spaced-apart non-circular apertures formed therein.

56. The external masonry facing support assembly of any one of claims 46 to 54 wherein said assembly includes a shim mounted between said back of any said channel and the supporting structure.

57. An external masonry facing support assembly and a supporting structure, said assembly comprising:

a shelf angle, a first support bracket and a second support bracket;

as installed, said first and second support brackets being spaced apart from each other

and being mounted to the supporting structure, said shelf angle being mounted to span said first and second support brackets;

said shelf angle having a horizontal leg and a vertical leg, said horizontal leg and said vertical leg being joined at a right angle;

said first and second support brackets including a respective channel having a back, a first leg, and a second leg;

said back extends in a vertical plane and said first and second legs extending forwardly away therefrom

said first and second legs having respective seats in which said shelf angle is engaged, said seats being distant from said respective backs; said respective backs of said first and second support brackets having a wall mounting fitting;

when said shelf angle is mounted in said respective seats, said vertical leg of said shelf angle terminates upwardly at a first height;

said wall mounting fitting is located above said first height;

as installed said first height being lower than said supporting structure; and

said first leg of said first support bracket has a forward margin distant from said back thereof, and said forward margin has a protruding toe; and

said vertical leg of said shelf angle has an aperture formed therein to receive said protruding toe.

58. The external masonry facing support assembly of claim 57 wherein said right angle of said shelf angle includes an internal radius extending between said vertical leg and said horizontal leg; said respective seats include a moment reaction restraint; and said moment reaction restraint engages said shelf angle upwardly clear of said internal radius.

59. The external masonry facing support assembly of claim 57 wherein said respective seats include a moment reaction restraint that extends over said horizontal leg of said shelf angle, and engages a front face of said vertical leg of said shelf angle.

60. The external masonry facing support assembly of claim 57 wherein said seat includes a moment reaction restraint that extends vertically, and said moment reaction restraint is located rearwardly of said vertical leg of said shelf angle.

61. The external masonry facing support assembly of claim 57 wherein:

said right angle of said shelf angle includes an internal radius that extends between said vertical leg and said horizontal leg;

said respective seats include a first moment reaction restraint that extends over said

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horizontal leg of said shelf angle;

said first moment reaction restraint engages said shelf angle upwardly clear of said internal radius; and

said respective seats include a second moment reaction restraint that extends vertically, said second moment reaction restraint is located rearwardly of said vertical leg of said shelf angle.

62. The external masonry facing support assembly of claim 57 wherein said respective seats have a vertical shear load input interface, said fitting has a vertical shear load output interface, there is a Run and a Rise between said vertical shear load input and output interfaces, and said Rise is greater than said Run.

63. The external masonry facing support assembly of claim 62 wherein said vertical leg of said shelf angle has a height; and said first mounting member has a vertical height that is greater than two courses of face brick; and in a range of 2 to 8 pitches of seat height of said vertical leg of said shelf angle.

64. The external facing support assembly of claim 57 wherein:

said right angle of said shelf angle includes an internal radius that extends between said vertical leg and said horizontal leg;

said respective seats include a first moment reaction restraint that extends over said horizontal leg of said shelf angle; said first moment reaction restraint engages said shelf angle upwardly clear of said internal radius;

said respective seats include a second moment reaction restraint that extends vertically, said second moment reaction restraint is located rearwardly of said vertical leg of said shelf angle;

said aperture is located in said vertical leg upwardly clear of said internal radius; and, as installed, said protruding toe extends through said aperture over said horizontal leg of said shelf angle.

65. The external masonry facing support assembly of any one of claims 57 to 64 wherein said legs of said channels have respective arrays of spaced-apart non-circular apertures formed therein.

66. The external masonry facing support assembly of any one of claim 57 to 65 wherein said assembly includes a shim mounted between said back of any said channel and the supporting structure.

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67. The external masonry facing support assembly of any one of claims 57 to 66 wherein said shelf angle defines a lintel of one of (a) a door; and (b) a window located downwardly of the structural member.

68. The external masonry facing support assembly of any one of claims 57 to 67 wherein said mounting brackets each have a back and a pair of legs, and said legs of said channels have respective arrays of spaced-apart non-circular apertures formed therein.

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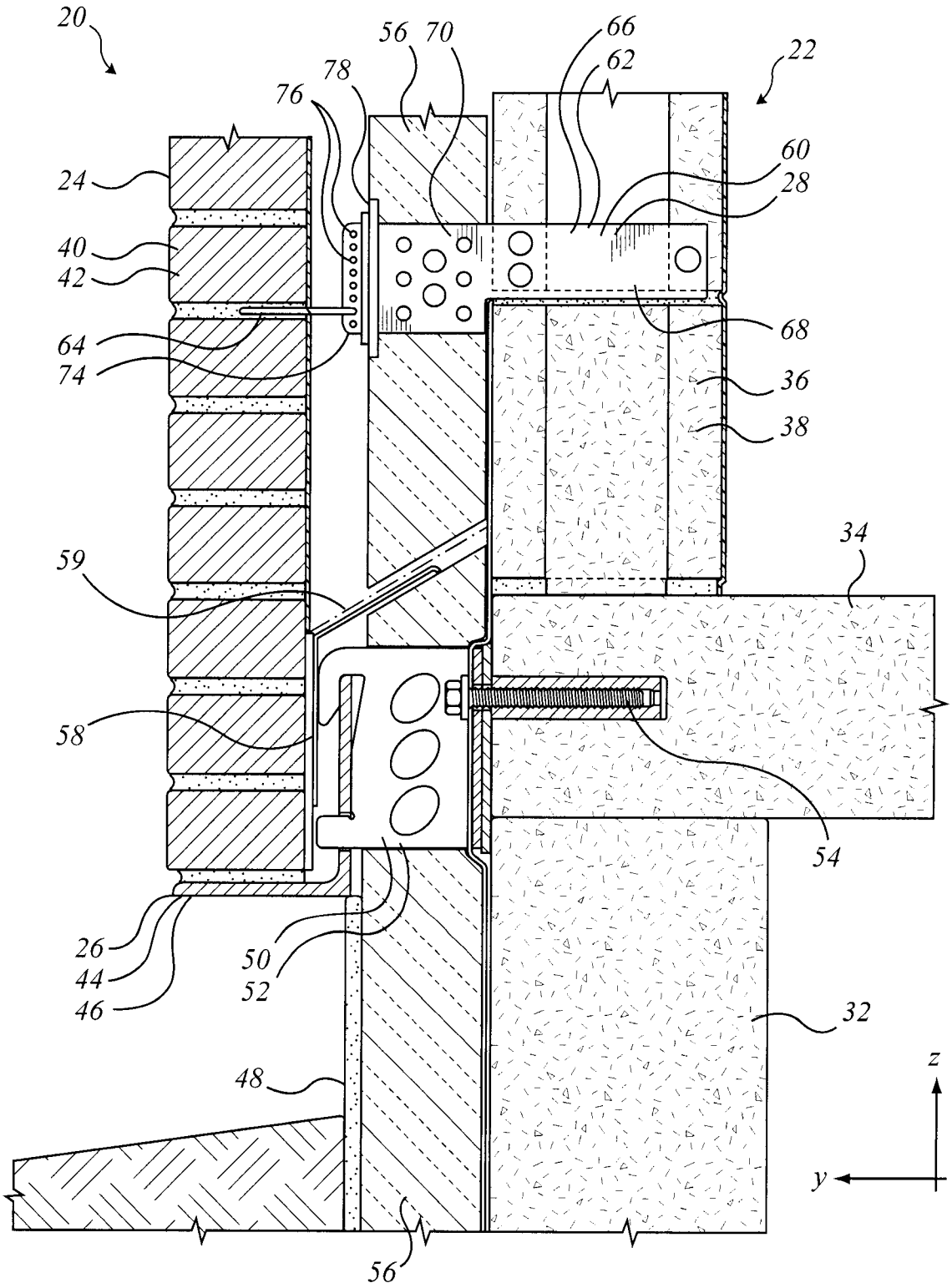
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42
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52
32
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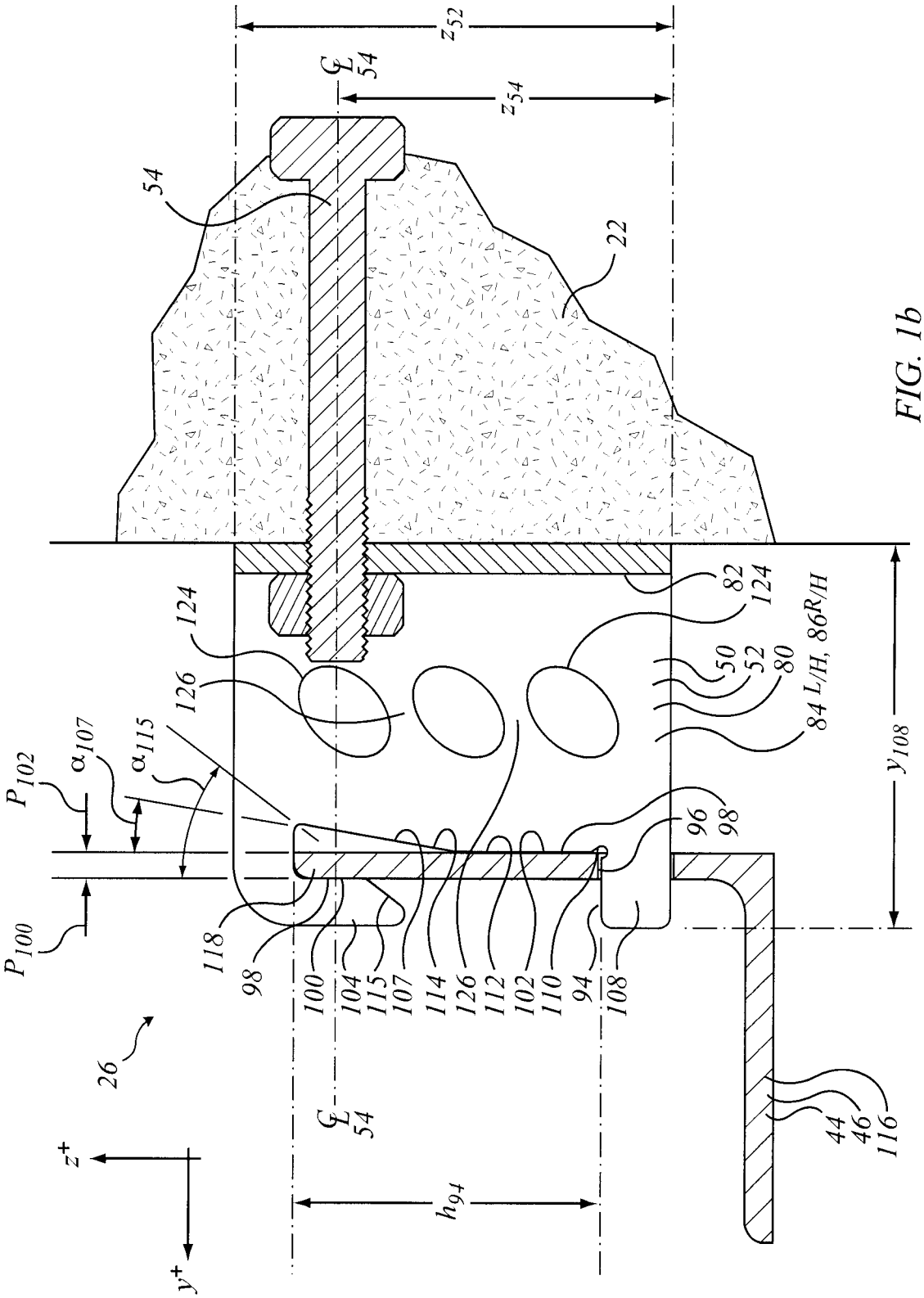
z
y
56

FIG. 1a


z_{52}
z_{54}
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84 L/H, 86R/H
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P_{102}
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α_{115}
P_{100}
96
98
118
98
100
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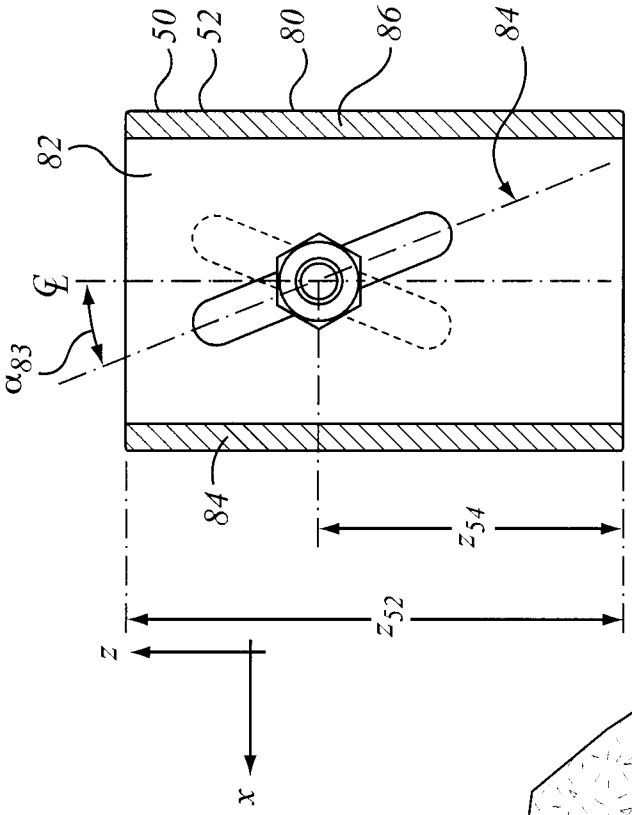
z^+
y^+
h_{94}
44
46
116

FIG. 1b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82
℄
α_{83}
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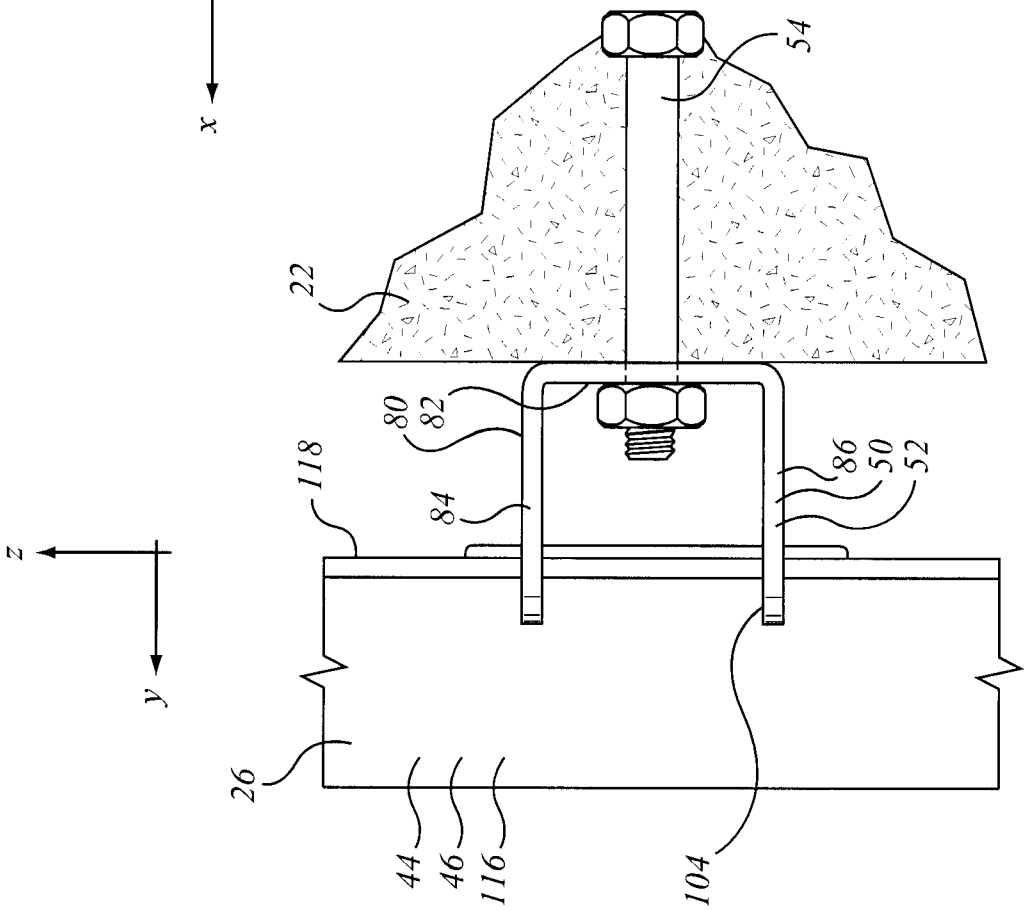
z_{54}
z_{52}
z
x

FIG. 2c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z
y
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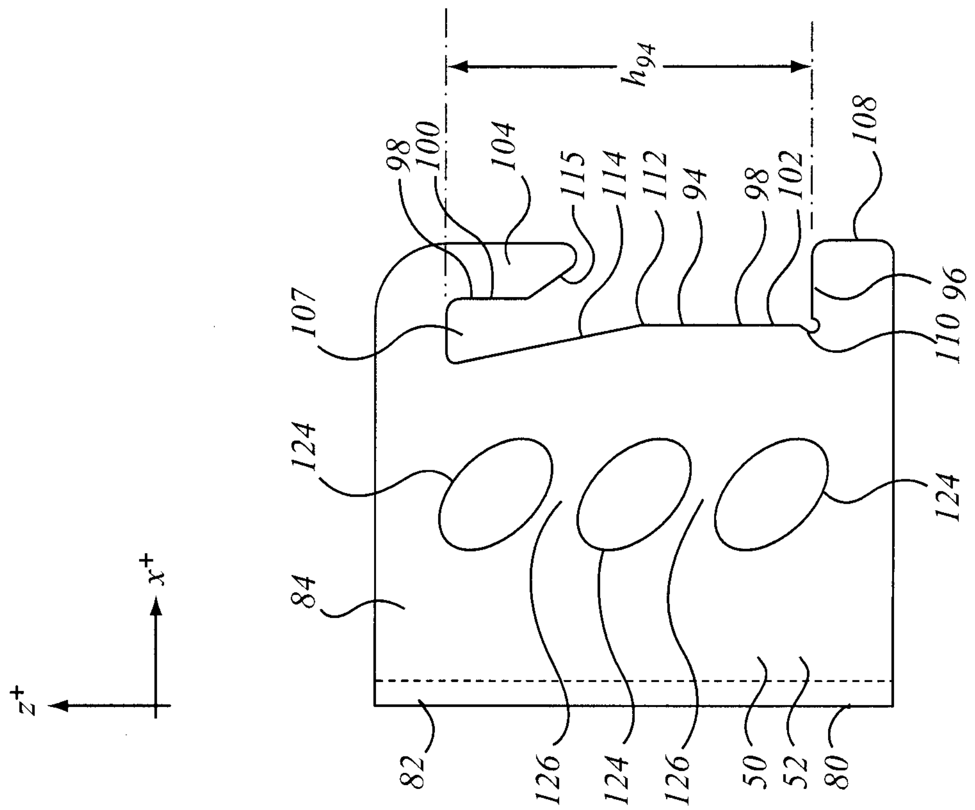
104

FIG. 1c



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115
114
112
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102
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124
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84
x+
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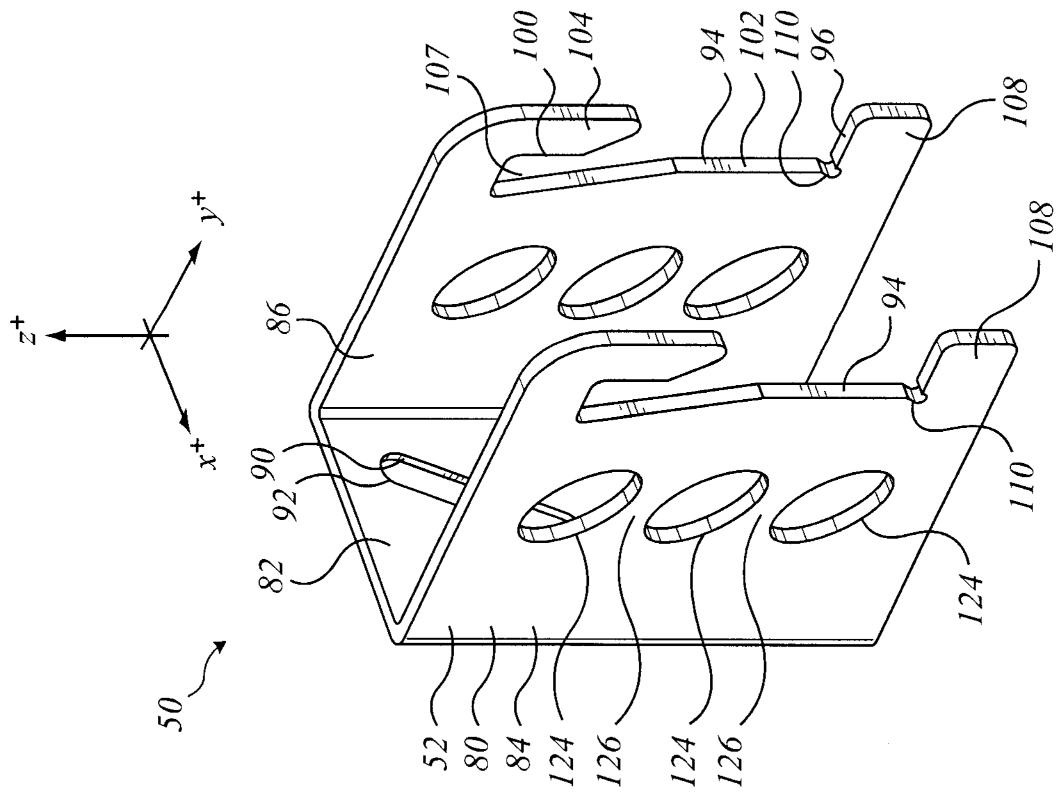
82
126
124
126
50
52
80

FIG. 2b



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102
110
96
108
y+
z+
x+
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110
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80
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124
126
124
126

FIG. 2a

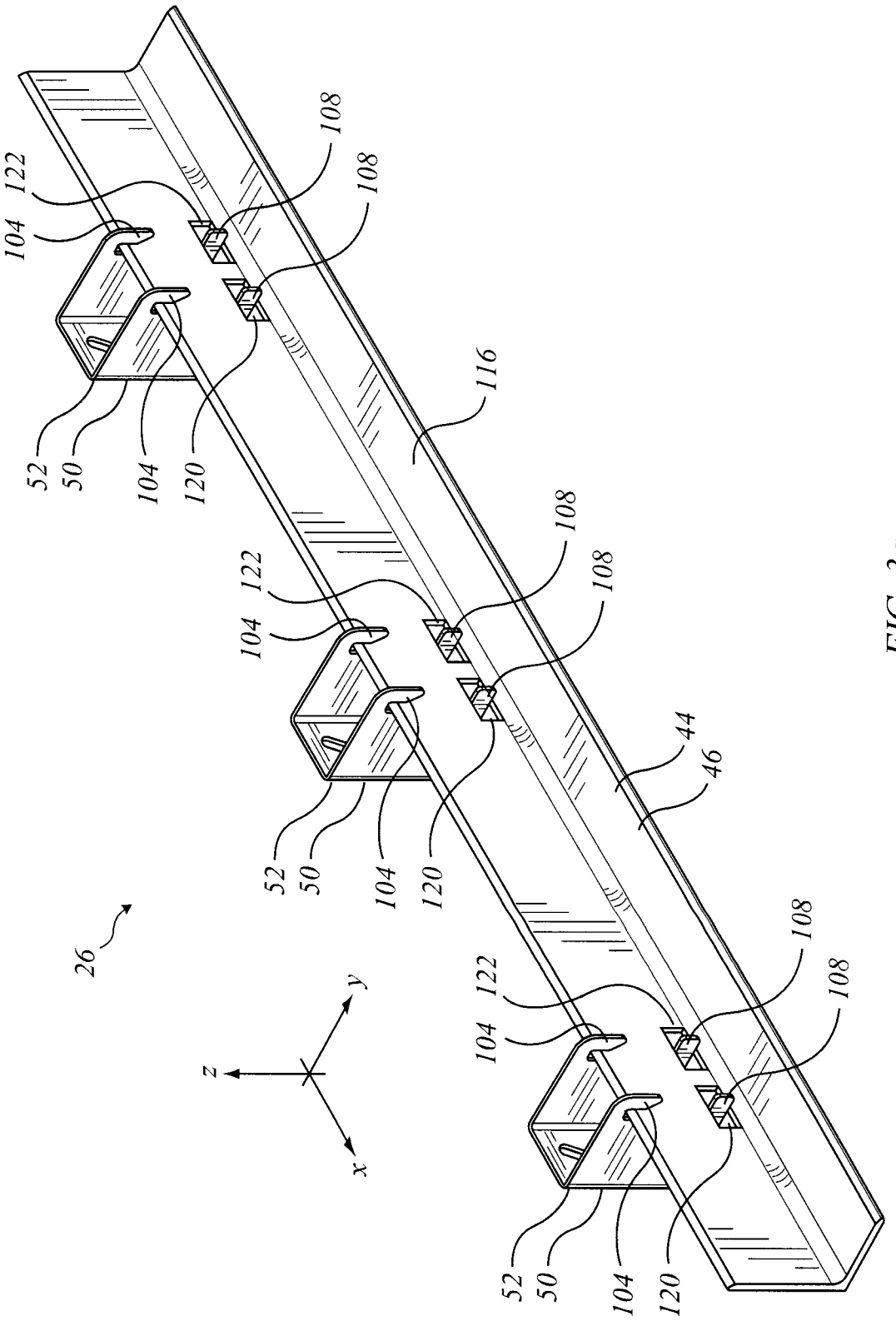

FIG. 3a

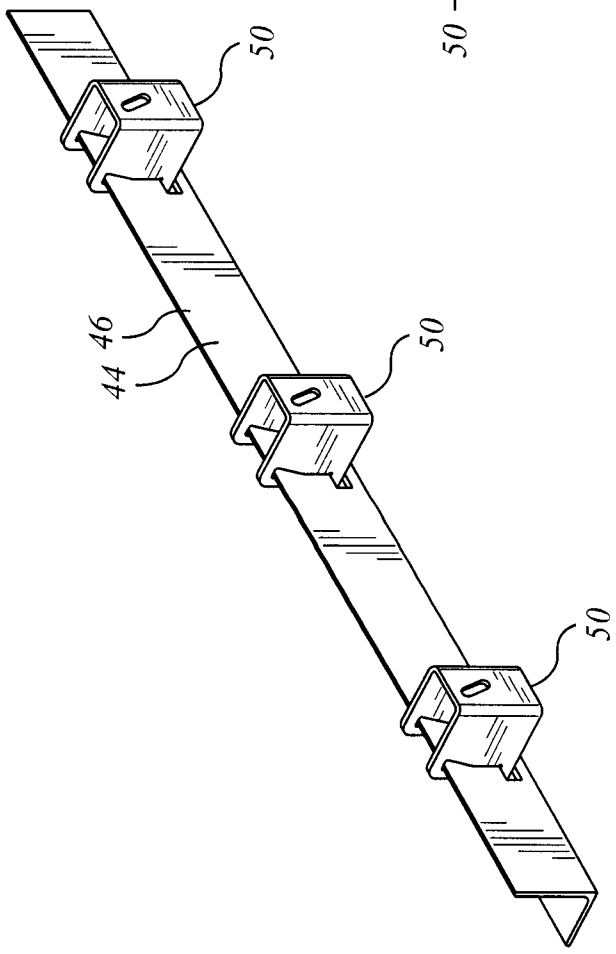

FIG. 3b

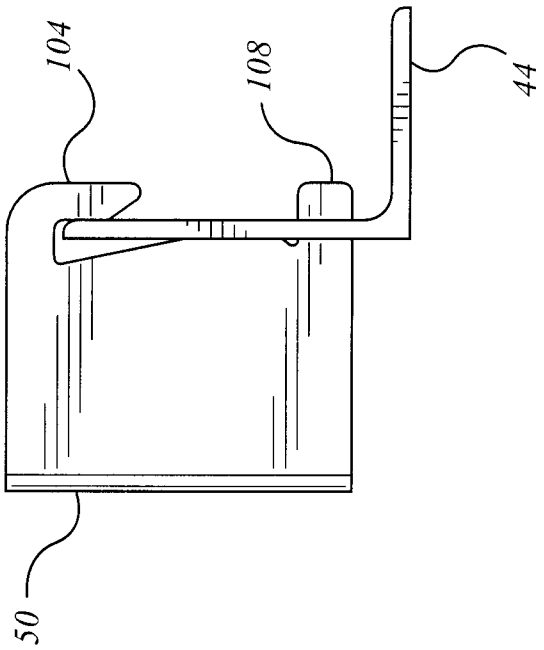

FIG. 3c

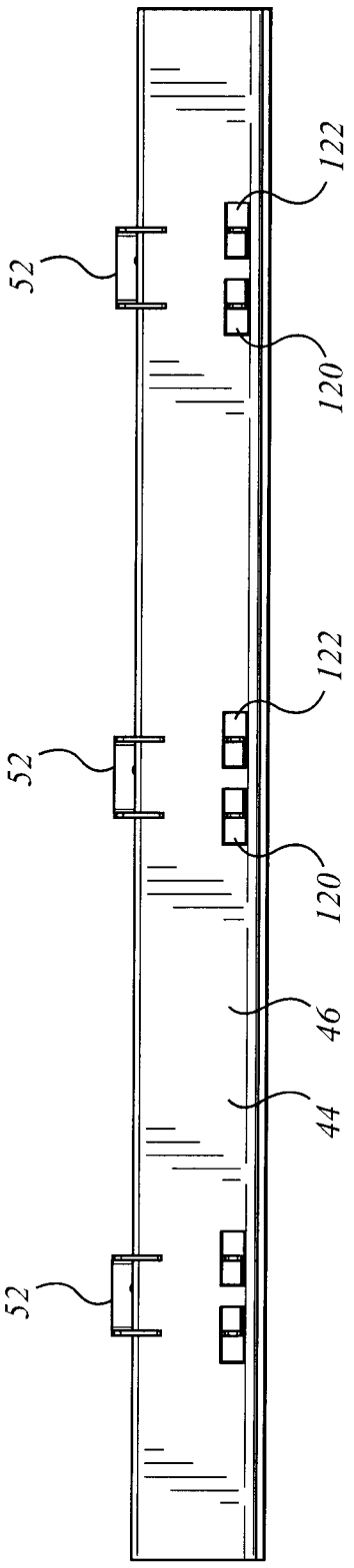
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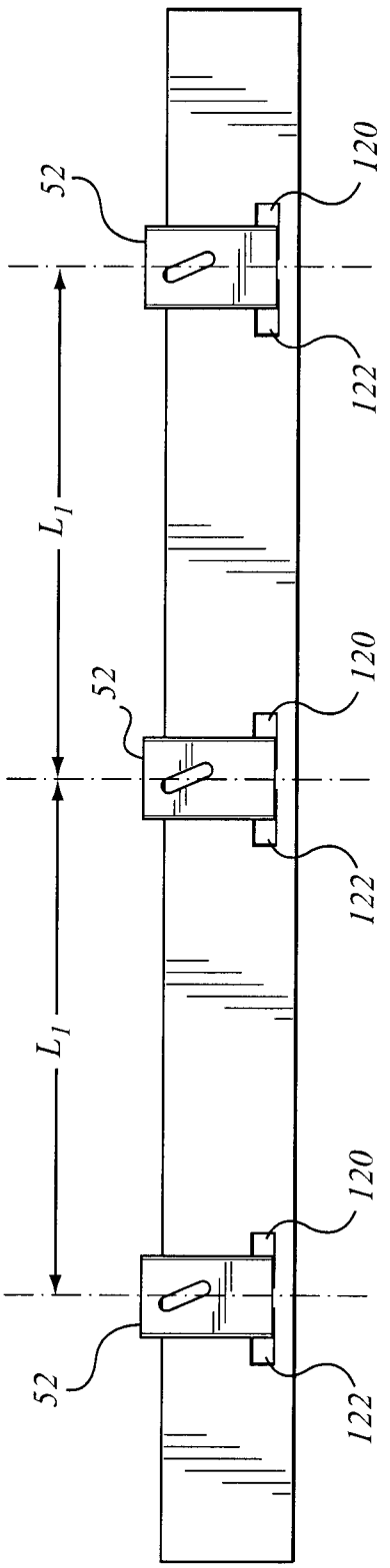
FIG. 3d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120
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L_1
52
120
122
L_1
120
52
122

FIG. 3e

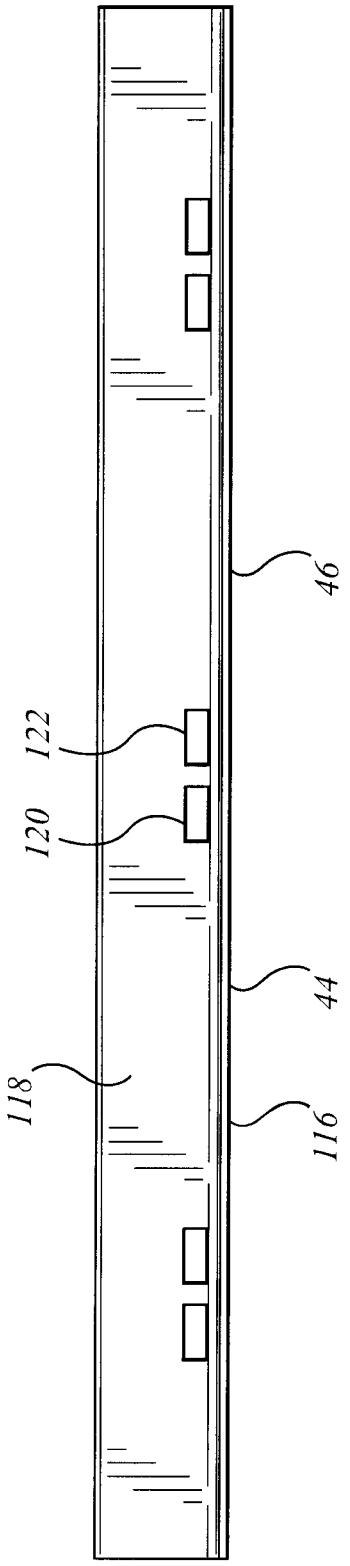

FIG. 4a

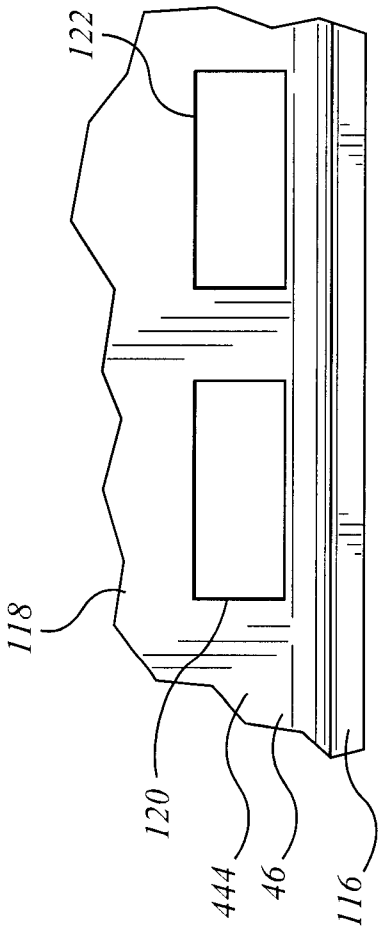

FIG. 4b

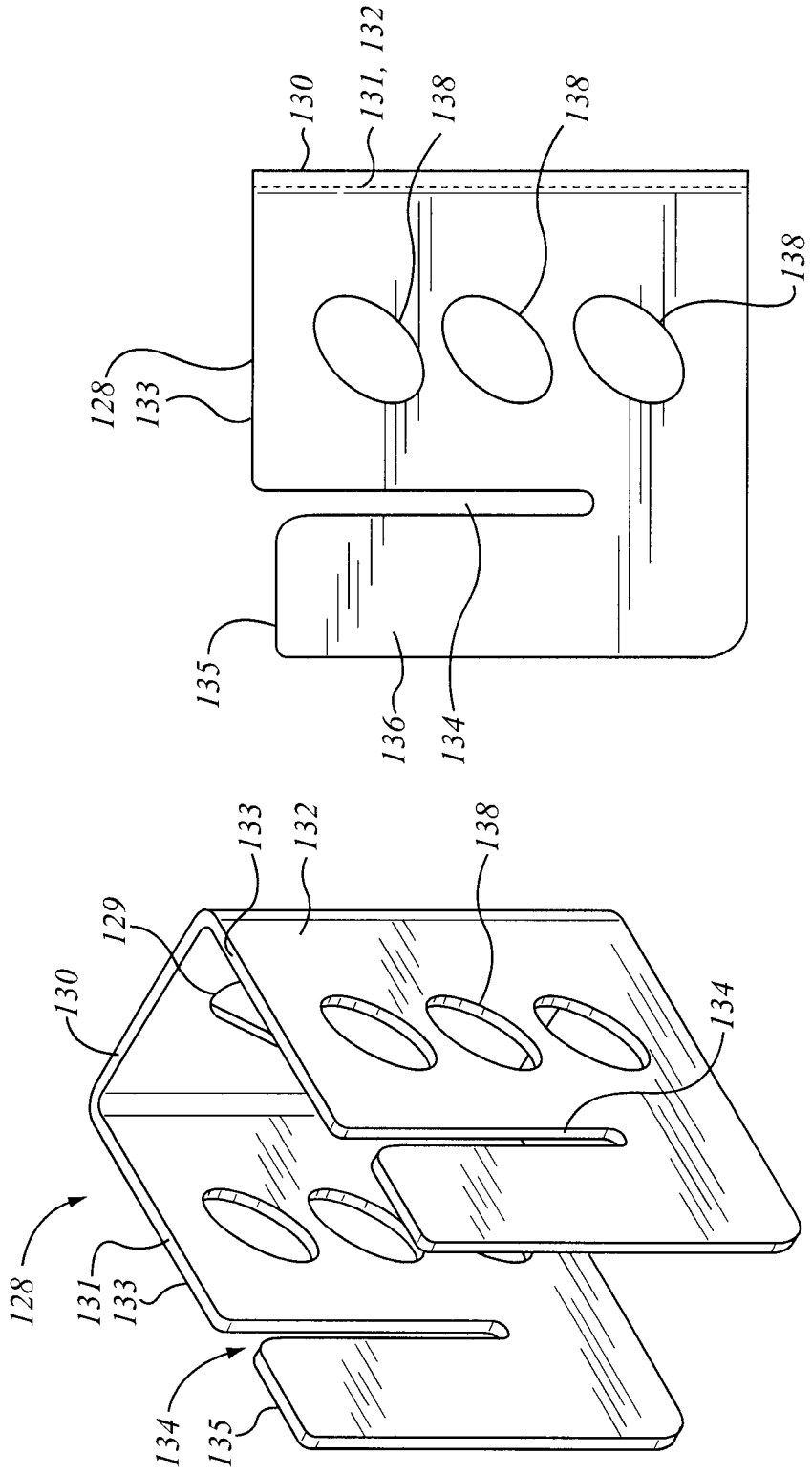
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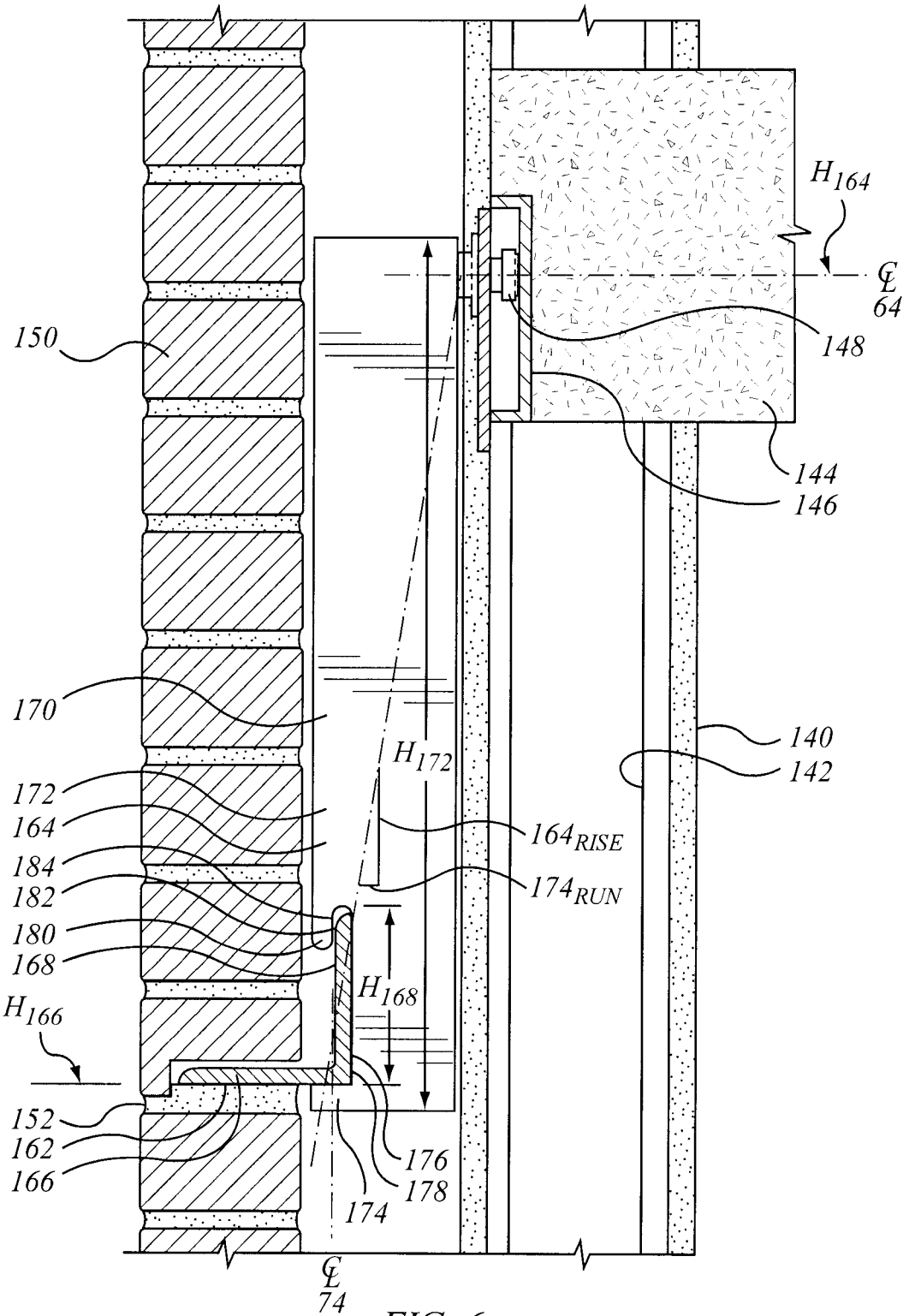
FIG. 5b

FIG. 5a


H_{164}
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164_{RISE}
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FIG. 6a

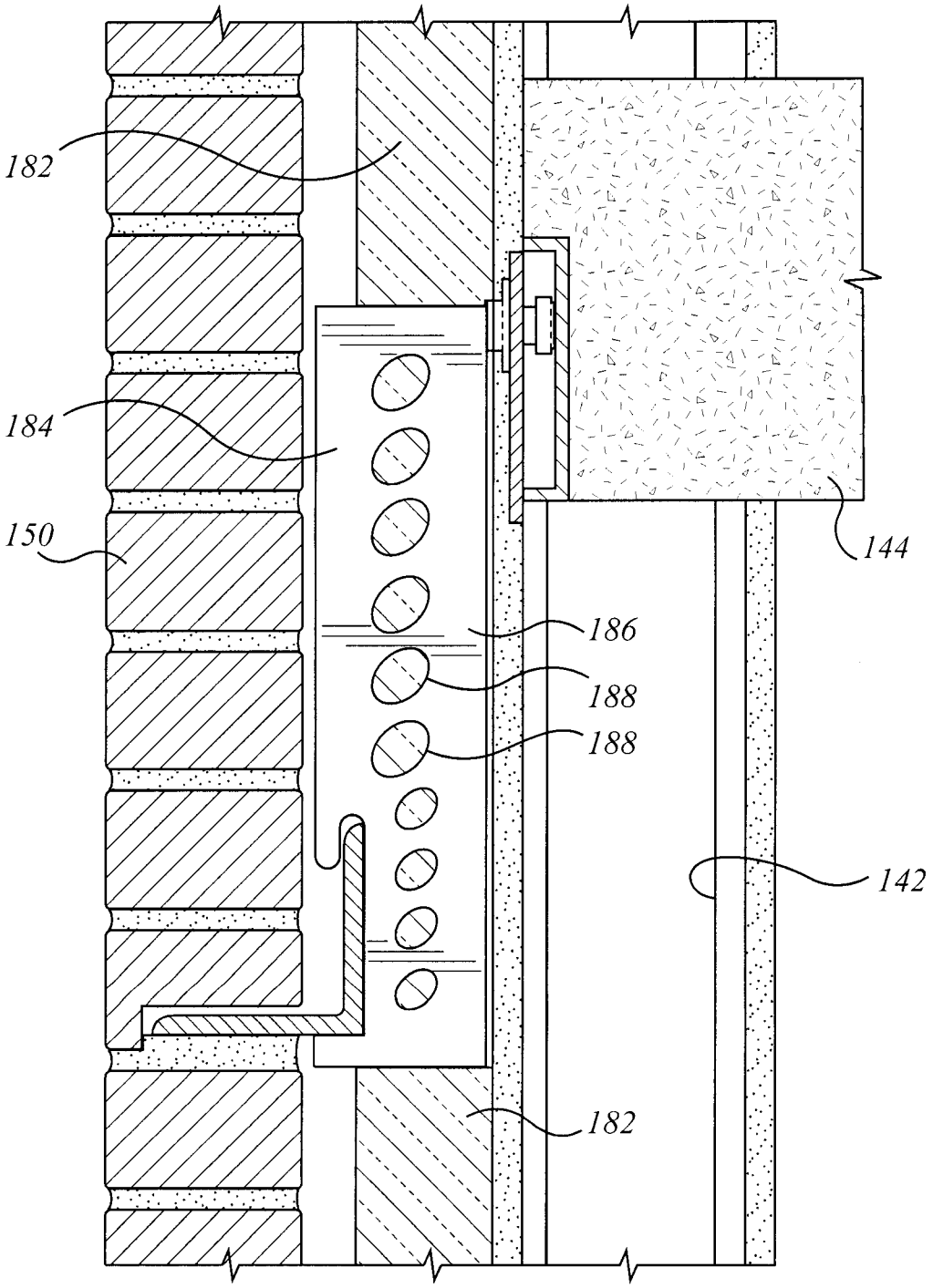


FIG. 6b

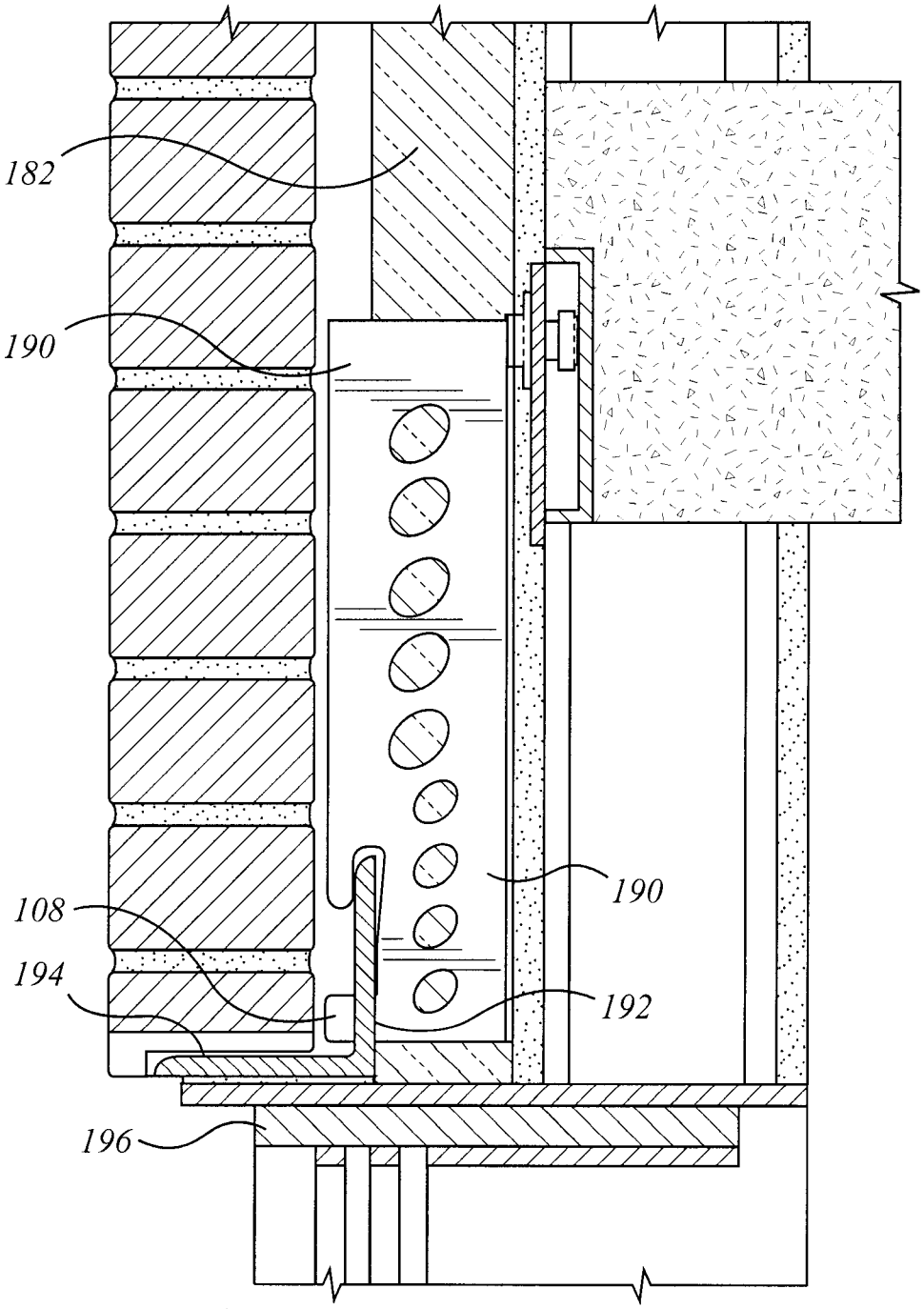


FIG. 6c

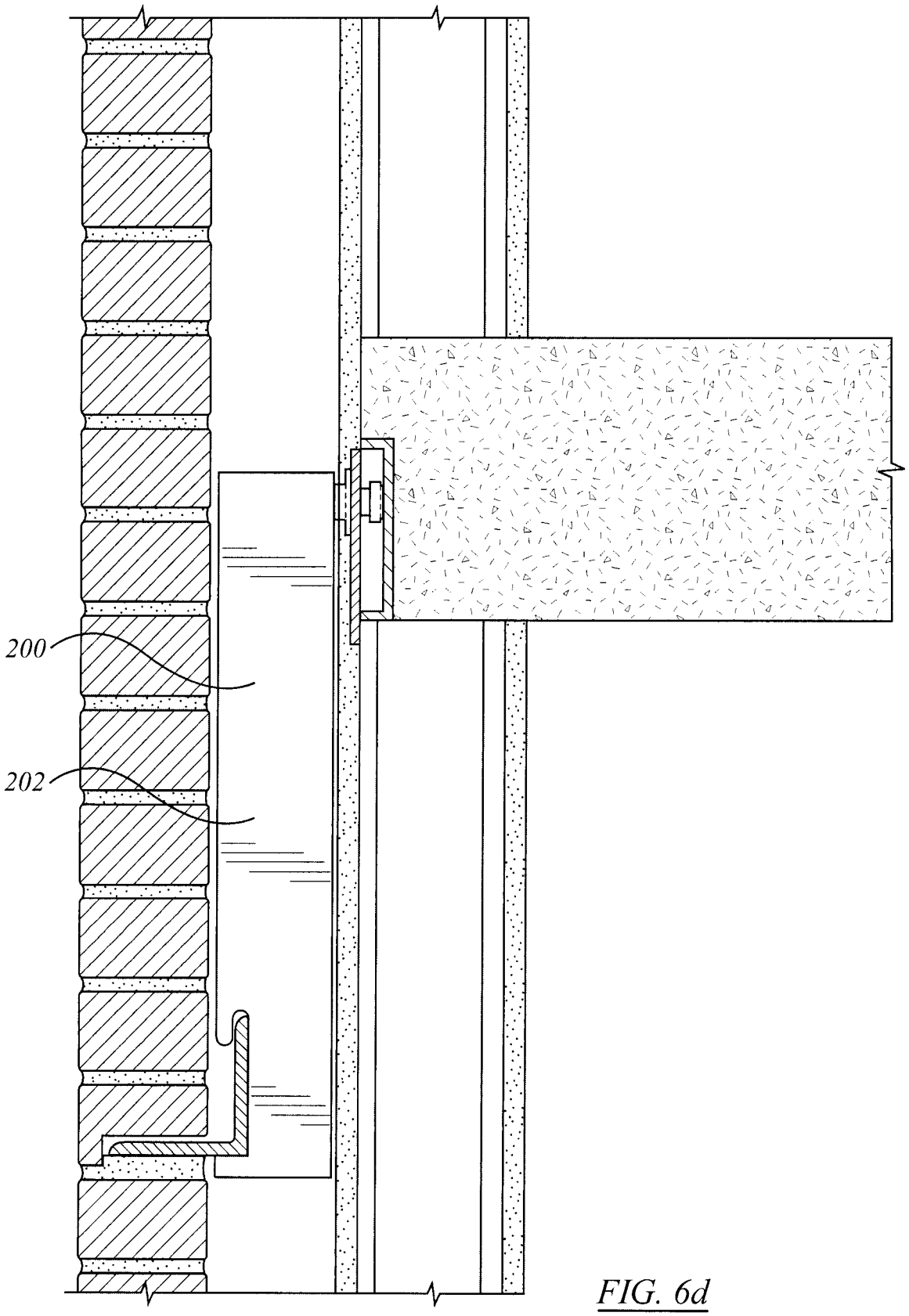
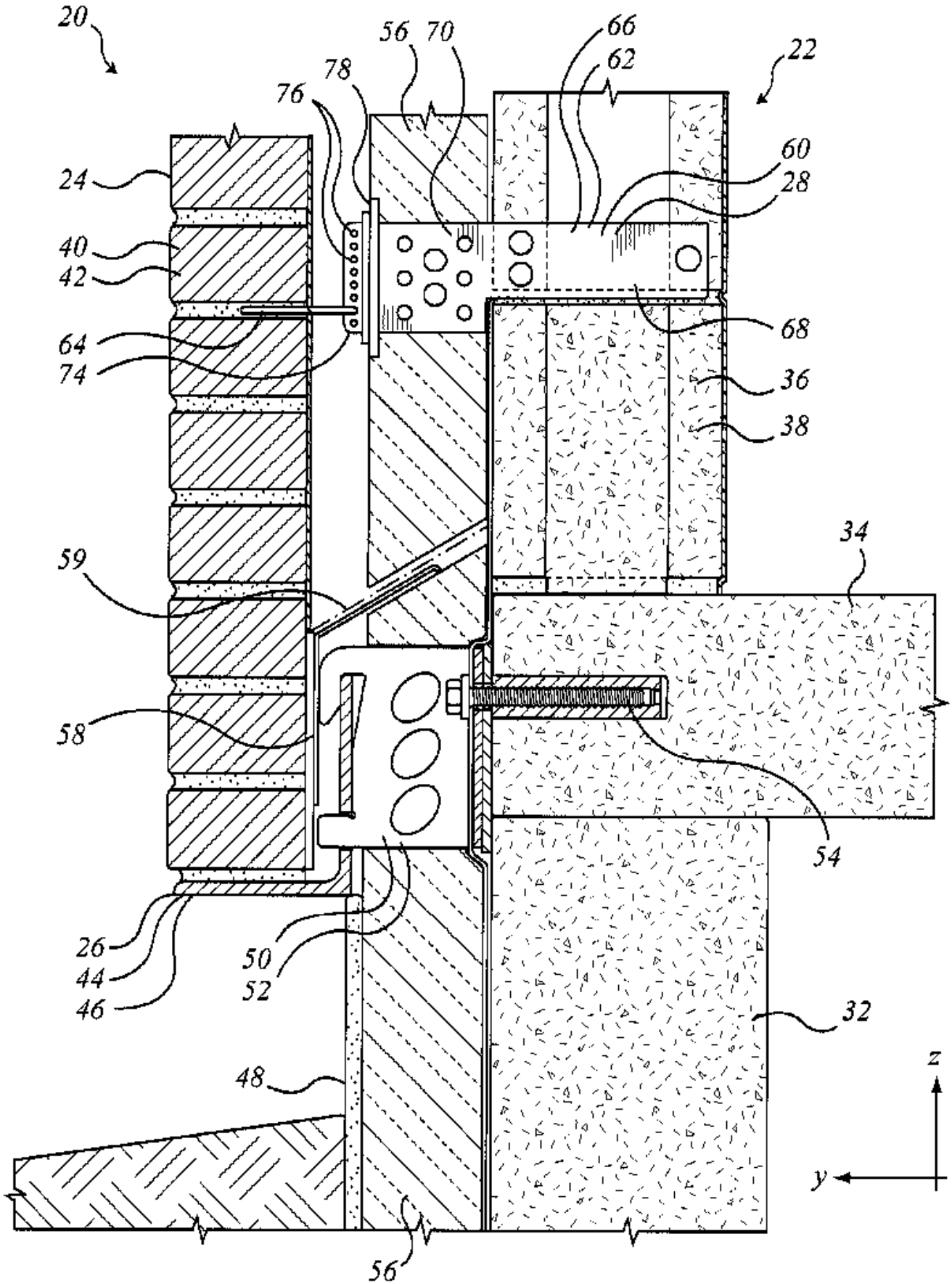


FIG. 6d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