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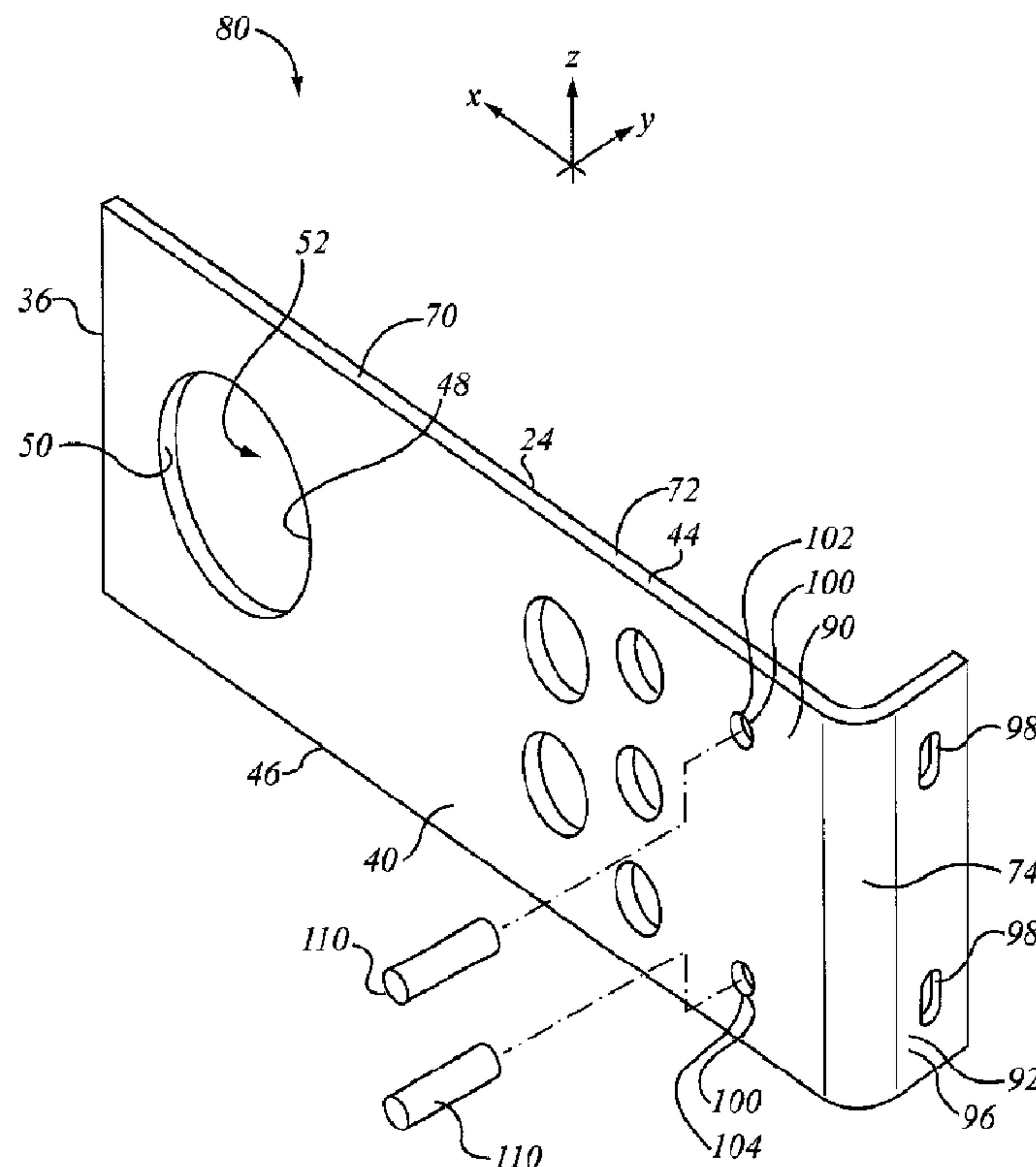
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(54) Titre : APPAREIL ET PROCEDE POUR ATTACHE MURALE

(54) **Title: WALL TIE APPARATUS AND METHOD**



(57) Abrégé/Abstract:

A tie system is provided for use with a wall form for a cementitious backup wall and for use with a wall tie to connect between the cementitious backup wall and a veneer. The tie system includes a backup wall connector and a form connector. The form connector is connectable to the form and secures the backup wall connector in position as the wall form is filled. The connector may have heat transfer reducing perforations. The connector may have an outwardly positioned flange to which external wall members may be attached. The connector may have multiple gap-setting features.

ABSTRACT

A tie system is provided for use with a wall form for a cementitious backup wall and for use with a wall tie to connect between the cementitious backup wall and a veneer. The tie system includes a backup wall connector and a form connector. The form connector is connectable to the form and secures the backup wall connector in position as the wall form is filled. The connector may have heat transfer reducing perforations. The connector may have an outwardly positioned flange to which external wall members may be attached. The connector may have multiple gap-setting features.

WALL TIE APPARATUS AND METHOD

FIELD OF THE INVENTION

[0001] The invention herein relates to a tie system and method for connecting a veneer, or fronting, to a back-up structure.

BACKGROUND OF THE INVENTION

5 [0002] The various embodiments of apparatus and methods discussed herein relate to a tie system and method for connecting a veneer, or fronting, to a back-up wall. One embodiment may relate to a tie system and method for connecting a veneer made from bricks, or siding, or other external presentation material to a backup wall, or structural
10 anchor, as may typically be made from a masonry or cementitious material that is formed using a form made from a penetrable material. The penetrable material of the form may be such a foam material.

[0003] Certain types of building incorporate a backup wall that is made from a cementitious material and a veneer as may be made of bricks or the like. The cementitious
15 backup wall is sometimes poured on-site into a form that may be made from slabs of foam material.

[0004] Connectors are typically used to secure the veneer to the backup wall. However, these connectors sometimes move out of position during the pouring of the cementitious material that makes up the backup wall, thereby potentially impacting their ability to function
20 as desired. For example, the connector may not be properly positioned to secure the veneer in place once the cementitious material cures.

SUMMARY OF THE INVENTION

[0005] In an aspect of the invention there is a tie apparatus. It has a first portion, a second portion and a third portion. The first portion defines an anchor fitting for permanent
25 engagement of wall structure. The second portion defines a web intermediate the first portion and the third portion. The third portion defining a veneer connection interface. The third portion includes an array of indexing fittings, the indexing fittings also providing accommodations for form engagement tie retainers.

[0006] In a feature of that aspect of the invention the second portion has a lengthwise extent between the first portion and the third portion corresponding to an insulation thickness. In another feature there is a combination of the tie retaining apparatus and a wall form member. The wall form member is formed of thermal insulation material. The wall form member is penetrable by the tie retaining apparatus. The wall form member has a through thickness. On installation the second portion extends through the through-thickness of the thermal insulation member. In use, the indexing fittings locate outwardly proud of the thermal insulation material. In another feature the third portion includes a flange formed thereon most distantly from the first portion. In a further feature, the first portion and the second portion are substantially co-planar, and the flange of the third portion is oriented out-of-plane relative to the first portion and the second portion. In a still further feature, the array of indexing fittings includes at least a first set of indexing members offset from the flange and a second set of indexing members offset from the flange, the first set of indexing members being more offset from the flange than is the second set of indexing members.

[0007] In another feature, the second portion is predominantly perforate. In another feature, the second portion is more predominantly perforate than is the first portion. In a further feature, the second portion is perforate, and the second portion is more predominantly perforate than is the first portion. In another feature, the third portion includes a flange formed thereon most distantly from the first portion. In still another feature, the first portion and the second portion are substantially co-planar, and the flange of the third portion is oriented out-of-plane relative to the first portion and the second portion. In another feature, the array of indexing fittings includes at least a first set of indexing members offset from the flange and a second set of indexing members offset from the flange, the first set of indexing members being more offset from the flange than is the second set of indexing members.

[0008] In another aspect of the invention there is a tie system for use with a penetrable form for a cementitious backup wall and for use with a wall tie to connect between the cementitious backup wall and a veneer. The tie system has (a) a form connector connectable to a form; (b) a backup wall connector shaped to extend through an aperture in the form and having an inwardly oriented forward-facing form-connector-engagement surface and a rearward-facing form-connector-engagement surface that are positioned to directly engage the form connector to substantially prevent forward and rearward relative movement between

the backup wall connector and the form connector; (c) the backup wall connector having an outwardly oriented seat defining an accommodation for the form connector; (d) the accommodation in the form connector also defining a brick-tie engagement fitting; and (e) the form connector being removable from the seat.

5 **[0009]** In a feature of that aspect there is also a forward-facing wall-tie-engagement surface and a rearward-facing wall-tie-engagement surface. They are positioned to engage a wall tie to substantially prevent forward and rearward relative movement between the wall tie and the backup wall connector. In another feature the forward-facing form-connector-engagement surface is the same as the forward-facing wall-tie-engagement surface, and
10 wherein the rearward-facing form-connector-engagement surface is the same as the rearward-facing wall-tie-engagement surface. In another feature, the backup wall connector has a connector aperture defined by a connector aperture wall, and the connector aperture wall has the forward-facing and rearward-facing wall-tie-engagement surfaces.

15 **[0010]** In another aspect of the invention there is a tie system for use with a penetrable form for a cementitious backup wall and for use with a wall tie to connect between the cementitious backup wall and a veneer. The tie system has at least one form dog connectable to a form; and a backup wall connector shaped to extend through an aperture in the form, the backup wall having at least one dog engagement seat that, in use, engages the at least one dog co-operably to discourage forward and rearward relative movement between the backup
20 wall connector and the at least one dog. The backup wall connector has a plurality of outwardly oriented seats defining respective accommodations for the at least one dog. The plurality of outwardly oriented seats include at least a first seat and a second seat. The first seat defines a first form connector embedment depth, and the second seat defines a second form connector embedment depth. At least one of the accommodations in the backup wall
25 connector also defines a respective brick-tie engagement fitting. Each of the dogs is removable from engagement with its respective seat.

30 **[0011]** In a feature of that aspect of the invention, the backup wall connector has a first portion, a second portion and a third portion. The first portion defines an anchor fitting for permanent engagement of wall structure. The second portion defines a web intermediate the first portion and the third portion. The third portion defines a veneer connection interface.

The second portion has a lengthwise extent between the first portion and the third portion corresponding to an insulation thickness of said form. In a further feature, there is a combination of the tie apparatus, and the form. The form is made of a thermal insulation material. The form is penetrable by the backup wall connector. The form has a through-
5 thickness. On installation the second portion extends through the through-thickness of the form, and, in use, at least some of the seats are located outwardly proud of the form. In another feature, the backup wall connector has a flange formed thereon most distantly outward from the form. In another feature, the third portion of said backup wall connector has a flange formed thereon. The flange includes the veneer connection interface. The first
10 portion and the second portion are substantially co-planar. The flange is oriented out-of-plane relative to the first portion and the second portion. In a still further feature, the seats include at least a first set of accommodations offset from the flange and a second set of accommodations offset from the flange. The first set of accommodations is, or are, more offset from the flange than is, or are, the second set of accommodations. In a further feature,
15 the second portion is predominantly perforate. In a still further feature, the second portion is more predominantly perforate than is the first portion.

[0012] In one embodiment, the method of installation comprises filling the wall form with cementitious material and removing the form connector from the wall form and the form connector engagement member prior to attaching the wall tie to backup wall connector. In
20 another embodiment, the method further comprises constructing the wall form from foam. In another embodiment, the method further comprises filling the wall form with cementitious material and permitting the cementitious material to cure prior to removing the form connector from the wall form. In another embodiment, the method further comprises filling the wall form with cementitious material prior to attaching the wall tie to the second portion.
25 In another embodiment, the method further comprises selecting a backup wall connector wherein the first portion has at least one form-connector-engagement surface.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] For a better understanding of the present invention and to show clearly how it may be carried into effect, reference will now be made, by way of example only, to the accompanying drawings, in which:

5 [0014] Figure 1 is a perspective view of the components that make up a tie system in accordance with a first embodiment of the present invention;

[0015] Figure 2 is a side view of an initial tie assembly made from the components shown in Figure 1, wherein the initial tie assembly is installed in a form for a cementitious backup wall;

10 [0016] Figure 3 is a perspective view of the initial tie assembly shown in Figure 2, shown with the form shown in Figure 2 and a cementitious backup wall made therein;

[0017] Figure 4 is a plan view of a final tie assembly made from the components shown in Figure 1, wherein the final tie assembly connects between the cementitious backup wall shown in Figure 3 and a veneer;

15 [0018] Figure 5 is a perspective view of the final tie assembly, cementitious backup wall and veneer shown in Figure 4; and,

[0019] Figure 6 is a side view of an alternative backup wall connector to that shown in Figure 1.

20 [0020] Figure 7 is a perspective view of an alternative embodiment of tie assembly to that of Figure 1;

[0021] Figure 8 shows a plan view of the tie assembly of Figure 7;

[0022] Figure 9 shows a profile view of the tie assembly of Figure 7;

[0023] Figure 10 is a plan view of an alternate tie to that of Figure 7;

[0024] Figure 11 is a profile view of the tie assembly of Figure 10.

25 **DETAILED DESCRIPTION OF THE INVENTION**

[0025] 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 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.

[0026] The scope of the invention herein is defined by the claims. Though the claims are supported by the description, they are not limited to any particular example or embodiment, and any claim may encompass processes or apparatus other than the specific examples described below. Other than as indicated in the claims themselves, the claims are not limited to apparatuses or processes having all of the features of any one apparatus or process described below, or to features common to multiple or all of the apparatus described below. It is possible that an apparatus or process described below is not an embodiment of any claimed invention. The text and illustrative drawing figures herein are intended to correspond to the subject-matter shown and described in co-pending USSN 14/052,478 filed October 11, 2013.

[0027] The terminology used in this specification is thought to be consistent with the customary and ordinary meanings of those terms as they would be understood by a person of ordinary skill in the art in North America. Following from the decision of the Court of Appeal for the Federal Circuit in *Phillips v. AWH Corp.*, the Applicant expressly excludes all interpretations that are inconsistent with this specification, and, in particular, expressly excludes any interpretation of the claims or the language used in this specification such as may be made in the USPTO, or in any other Patent Office, other than those interpretations for which express support can be demonstrated in this specification or in objective evidence of record in accordance with *In re Lee*, (for example, earlier publications by persons not employed by the USPTO or any other Patent Office), demonstrating how the terms are used and understood by persons of ordinary skill in the art, or by way of expert evidence of a person or persons of experience in the art.

[0028] A frame of reference may be helpful in understanding the description. In the case of a wall structure, such as may be described herein, a Cartesian co-ordinate system may be applied on the assumption that walls have height and width and through thickness and are

generally planar height-wise and width-wise, with the through-thickness of the wall being generally more than an order of magnitude smaller than width or height. Not all walls are planar – walls can be curved or arched. However, in this description whether curved or planar, the wall will be assumed to have a width-wise extent following its surface, and a height-wise extent following its surface, and a thickness normal to both height and width. In general, in an insulated wall structure it may be assumed that there is an inside and an outside. The outside may be taken as the side upon which an external facing or veneer may be mounted. In the embodiments described, the z-axis or z-direction may be taken as being the height or height-wise direction of the eventual assembly as assembled and installed in a building. In such installation the z-direction would most normally be a vertical axis. The y-direction may be taken as the horizontal direction running along the wall width-wise. In the description, the major faces of the wall, be it inner or outer, may tend to be planar surfaces extending height-wise and width-wise in an z-y plane. The x-direction may be taken as the through-thickness direction of the wall panels and of their insulation member components. This co-ordinate system assumes that the wall or wall module, or components thereof, is or are, viewed as finally installed. The terminology is nonetheless somewhat arbitrary and is understood whether the unit is installed or not. The commonly used engineering terms “proud”, “flush” and “shy” may be used herein to denote items that, respectively, protrude beyond an adjacent element, are level with an adjacent element, or do not extend as far as an adjacent element, the terms corresponding conceptually to the conditions of “greater than”, “equal to” and “less than”.

[0029] Reference is made herein to insulated members. For the purposes of this discussion a variety of commercially available materials could be used. Unless stated otherwise, it may be taken that the insulation members are made of expanded rigid foam, such as EPS (expanded polystyrene), although other foams could be used, and, subject to the needs of manufacturing processes, a less rigid material might also be employed in some instances.

[0030] Reference is made herein to ties and tie plates such as may be installed in masonry walls, whether in poured concrete or in cinder block, or other block walls. For the purposes of this description it may be understood that such ties and plates are most typically made of steel, generally mild steel, which may have been treated to resist corrosion.

[0031] Figure 1 shows an embodiment of tie system, indicated generally as 10. Tie system 10 exemplified in Figure 1 is used to make a final tie assembly 11, exemplified in Figure 4, for connecting between a backup wall 12 and a wall of veneer 14 in certain types of structures. The backup wall 12 may be made from a cementitious material 16 that is poured in situ into a form 18 made from slabs of a penetrable material 20 such as a polymeric foam material. It will be appreciated that cementitious material 16 may be any fluid cementitious material 16 known in the building industry to fill a wall form 18. It will also be appreciated that form 18 may be made from any material known in the building industry to construct a wall form 18. The veneer 14 may be made from rows of bricks 22 such as may be face brick, facing stone or the like, which may also be referred to as external facing members or veneer elements 22. It will be appreciated that veneer 14 may be any veneer or facing element known in the building industry that is secured to a support by a wall tie. It is assumed that the external facing element is external, in the sense of being exposed to outdoor climate in terms of temperature, wind, sun, and precipitation, however this need not necessarily be so.

[0032] Referring to Figure 1, the system 10 includes a backup wall connector 24 for connecting to backup wall 12 (Figure 4), a form connector 26 for connecting to form 18 (Figure 4), one or more fasteners 28 for attaching form connector 26 to form 18 (Figure 4), and a wall tie 30 (Figure 4).

[0033] Referring to Figure 2, backup wall connector 24 extends through (such as by being pushed inwardly through, slide downwardly through or otherwise inserted) form 18 into the space shown at 32 that will receive the cementitious material 16 (see Figure 3) that will make up backup wall 12 (i.e. the cavity defined by wall form 18). Backup wall connector 24 may typically has a shape that facilitates penetration of form 18. Along a direction of insertion normal to the form in the x-direction, as in the manner of inserting a blade or knife through, for example, a billet of EPS or XPS. For example, backup wall connector 24 may be a generally planar plate (i.e. sides 40 and 42 may be planar) having a length, a width and a thickness, such that the leading edge face (i.e., that penetrates form 18 at forward end 36) may be defined by the width and thickness of the plate. It will be appreciated that backup wall connector 24 may alternately have sides 40 and 42 that are not planar. For example, the section may be L-shaped, or S-shaped, or wavy in corrugations running in the x-direction. In such cases the section may be constant and may be inserted

linearly by translation in the x-direction normal to the form through a slot of corresponding profile. Alternatively, e.g., they may be S-shaped, corrugated or have a portion that extends laterally outwardly (e.g. bent laterally), backup wall connector **24** may be positioned by sliding backup wall connector **24** downwardly into a slot provided in a wall form.

5 **[0034]** The plate may be made from corrosion resistant steel, or from some other suitable material having a suitable thickness. In this embodiment backup wall connector **24** does not have any flanges or the like extending outwardly from first and second sides **40**, **42**. That is, to the extent that connector **24** may be substantially planar, as are sides **40**, **42**, the portions of wall connector **24** that are to be inserted through form **18** do not have out-of-plane features
10 such as might tend complicate insertion in the through thickness direction (i.e., the x-direction normal to the wall surface) As the backup wall connector **24** is inserted through the form **18** (e.g., by hammering it on its rearward end **38**), it creates a form aperture **34** (see Figure 4), which may generally have the cross-section of a slit corresponding to the inward end face of wall connector **24** that has been driven, much like a blade, through the form
15 material. The form material may then tend to form a close fit, perhaps an interference or compression fit about the connector **24**. The backup wall connector **24** and the thus formed aperture **34** may tend mutually to seal, in the sense of forming an engagement through which material such as poured concrete may tend not readily to flow. This relationship is shown in at **35** in Figure 4, and may at least substantially prevent leakage of cementitious material **16**
20 out of the aperture **34** in the form **18** prior to the curing of the cementitious material **16**. A preformed aperture may be provided in the wall form.

[0035] A sectional view of backup wall **12** and form **18** are shown in Figure 3 to facilitate illustration of the structure of backup wall connector **24**. Form **18** may be a stay-in-place form. That is, in a conventional poured concrete wall, the forms are removed after
25 curing, and construction proceeds accordingly. Form **18** may be, or may include, a slab or billet of thermal insulation, such as may be made of expanded polystyrene (EPS) or extruded polystyrene board (XPS), or other suitable material. The slab defines a portion of the wall of the form for the poured and cured material, and then, after having performed its one-time forming function, remains in place to form a portion of the thermal insulation of the wall.
30 The external facing of the wall is then applied outwardly of the insulation.

[0036] Referring to back up wall connector **24** exemplified in Figure 4, back up wall connector **24** has a forward end **36** (which has the leading edge that cuts through thermal insulation form **18**), a rearward end **38**, a first side **40**, a second side **42**, an upper margin or edge identified as top **44** (Figure 2) and a lower edge or margin identified as bottom **46** (Figure 2). Backup wall connector **24** has additional surfaces to abut against the cured cementitious material to assist in retaining backup wall connector **24** in position in the cured cementitious material.

[0037] Referring to Figure 2, such additional surfaces are provided by providing at least one aperture. As seen in Figure 2, proximate forward end **36**, backup wall connector **24** has a first backup-wall-engagement surface **48** and a second backup-wall-engagement surface **50**, both of which are positioned in space **32** so that they are buried in cementitious material **16** of back up wall **12**. The first backup-wall-engagement surface **48** is forward-facing in use, and engages cementitious material **16** (Figure 3) thereby tending to prevent movement of backup wall connector **24** in the forward direction (i.e., into the cementitious material **16**). Second surface backup-wall-engagement **50** is rearward-facing and engages cementitious material **16** and may tend to prevent movement of backup wall connector **24** in the rearward direction (i.e., out of the cementitious material **16**).

[0038] It is not necessary for forward-facing surface **48** to face directly forwardly. Thus, it is not necessary for forward-facing surface **48** to be vertical or to have any portion that is vertical. Forward-facing surface **48** may have any shape that faces forwardly at least somewhat. It may be curved, linear, or a combination of both. Similarly, it is not necessary for rearward-facing surface **50** to face directly rearwardly and therefore it is not necessary for rearward-facing surface **50** to be vertical. That is, the angle of insertion may not be perfectly normal, but may be somewhat oblique either vertically or horizontally. Rearward-facing surface **50** may have any shape that faces rearwardly at least somewhat, and may be curved, linear or a combination of both. Forward facing surface **48** and rearward facing surface **50** may amount to indexing fittings such as may tend, on installation, to inhibit motion in the degree-of-freedom of the direction of insertion. They may be termed two fittings, one inhibiting inward motion in compression, the other inhibiting outward motion in the retraction direction, or they may be referred to as a single fitting performing both functions. They can be considered as a single "anchor" fitting, or as abutment fittings, or as out-of

plane-fittings or fitting faces, (i.e., the anchoring face extends transversely to the direction of insertion and retraction although the face may be located between the plane of face 40 and face 42, the point being that, once installed, one way or the other cured wall material forms an x-direction obstruction.

5 [0039] In the embodiment of Figure 2, the forward-facing and rearward-facing surfaces 48 and 50 are halves of the wall or perimeter of a backup wall connection aperture 52 formed through the thickness of the connector 24 from the first side 40 to the second side 42 (Figure 3) proximate the forward end 36 of the backup wall connector 24. In the embodiment shown in Figure 2, the backup wall connection aperture 52 is closed and is generally circular.

10 [0040] In the embodiment of Figure 6, forward-facing and rearward-facing surfaces 48 and 50 are halves of a backup wall connection aperture 54 that is U-shaped and is an open-ended slot. The aperture 54 passes through the thickness of the connector 24 from the first side 40 to the second side (not shown in Figure 6), proximate the forward end 36.

15 [0041] The backup wall connector 24 may have a plurality of forward-facing surfaces 48 instead of one. The backup wall connector 24 may have a plurality of rearward-facing surfaces 50 instead of one. For example, the backup wall connector may have a plurality of apertures and the apertures may be positioned on any portion of backup wall connector 24 that will be positioned in cementitious material 16 when that material 16 is cured.

20 [0042] In a further alternate embodiment, It will be appreciated that backup wall connector 24 may alternately have sides 40 and 42 that are not planar, e.g., they may be S-shaped, corrugated or have a portion that extends laterally outwardly (e.g. bent laterally with respect to the longitudinal axis of backup wall connector 24, i.e. the axis defined by a line passing through forward end 36 and rearward end 38).

25 [0043] Referring to Figure 1, backup wall connector 24 has a connecting aperture 56 extending therethrough between the first side 40 and the second side 42 (not shown in Figure 1) proximate rearward end 38. Connecting aperture 56 may be sized snugly to receive form connector 26 (Figures 2 and 3) therethrough when initially connecting the back up wall connector 24 to the form 18. Referring to Figure 2, connecting aperture 56 has a forward-facing form connector engagement surface 58 and a rearward-facing form connector engagement surface 60. The forward-facing and rearward-facing form connector

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engagement surfaces **58** and **60** preferably cooperate with form connector **26** to at least substantially prevent the forward and rearward relative movement between backup wall connector **24** and the form connector **26**, (and therefore between the backup wall connector **24** and the form **18**), when the cementitious material **16** is poured into the space **32**. It will be appreciated that, in an alternate embodiment, the form connector **26** may be secured to backup wall connector **24** by other means.

[0044] The connecting aperture **56** is preferably sized to concurrently or subsequently (i.e., after form connector **26** is removed) receive the wall tie **30** (Figures **4** and **5**) therethrough. The wall tie **30** is used to connect the backup wall connector **24** to the veneer **14**. In this way, the forward-facing and rearward-facing form connector engagement surfaces **58** and **60** may also be referred to as forward-facing and rearward-facing wall tie engagement surfaces **58** and **60** (see Figure **4**). It will be appreciated that, in an alternate embodiment, the wall tie **30** may be secured to backup wall connector **24** by other means and may be of any construction known in the building industry. Sectional views of backup wall **12** and form **18** are shown in Figures **4** and **5** to aid in seeing the structure of backup wall connector **24**.

[0045] Rather than a single connector aperture **56**, as in Figure **1**, for receiving both form connector **26** and wall tie **30**, it is alternatively possible to provide a backup wall connector that is not shown in the Figures that includes a separate connector aperture for receiving the form connector **26**, and a separate connector aperture for receiving the wall tie **30**. In such an alternative, the forward-facing and rearward-facing form connector engagement surfaces of the connector aperture for the form connector may be separate from the forward-facing and rearward-facing wall tie engagement surfaces of the connector aperture for the wall tie. In such an embodiment, form connector **26** may be left in position once the cementitious material cures to a sufficient degree with retain backup connector **24** in position. The connector aperture **56** is shown in Figure **1** as being a closed aperture. It is alternatively possible for the backup wall connector **24** to have a connector aperture as shown at **62** in Figure **6**. The connector aperture **62** is open at one end, which facilitates positioning the form connector **26** (Figure **2**) therein and which also facilitates positioning the wall tie **30** (Figure **4**) therein.

[0046] Referring to Figure 2, form connector 26 connects, or retains backup wall connector 24 to, or relative to, form 18 and thereby fixes the position of backup wall connector 24 so that it may tend not to be moved inadvertently, or more than a desired amount, during the pouring and curing of cementitious material 16. Form connector 26 may have any suitable shape, but is preferably planar and generally rectangular for engaging the outside surface of the form. That is, aperture 34 and form connector are co-operating indexing fittings where the as-installed location of aperture 34 establishes a location datum for both the first or interior portion 70 of connector 26 having the anchor or key defined by one or more fittings such as surfaces 48 and 50; for the second or "bridging" portion 72 of connector 26 that, as installed, extends through the thermally insulative member of form 18, for example; and a third outwardly protruding portion 74 that, as installed, stands outwardly proud of the outer surface of form 18. Form connector 26 also establishes a datum, which may in effect be the same datum, since the plane of the inner face of connector 26 may tend to lie flat against the outside face of form 18, thereby tending to cause the inward side of connector aperture 56 to be flush with the outside face of form 18. That relationship also fixes the distance by which the outermost extremity of connector 24, namely rearward end 38, stands outwardly proud of form 18, that distance being indicated as d_{38} .

[0047] Form connector 26 may be connected to form 18 in any suitable way. For example, form connector 26 may be secured to, and preferably removably secured to, form 18 by fasteners 28 which may be, for example, nails or screws. In this scenario, form connector 26 may be made from a relatively soft material that is relatively easily penetrated by a nail being hammered therethrough. For example, form connector 26 may be made from a polymeric material (e.g., plastic), or wood.

[0048] The assembly shown in Figures 2 and 3, namely that including backup wall connector 24, form connector 26 and fasteners 28, may be referred to as an initial tie assembly 64. Referring to Figure 3, after cementitious material 16 has been poured and has cured sufficiently, fasteners 28 may be removed from form 18 and form connector 26 may be removed from connector aperture 56.

[0049] After removal of form connector 26 (Figure 3) from aperture 56 (Figure 4), wall tie 30 may be positioned in connector aperture 56. Referring to Figure 4, wall tie 30 may

have any suitable configuration for connecting between backup wall connector **24** and veneer **14**. Wall tie **30** may, for example, be a generally V-shaped wire or rod, which has a first, closed end **66** and a second, open end **68**.

[0050] First end **66** connects to connector aperture **56**. Forward-facing and rearward-facing wall tie surfaces **58** and **60** may cooperate with first end **66** to substantially prevent forward and rearward movement between backup wall connector **24** and wall tie **30**, and therefore between backup wall connector **24** and veneer **14**. The second end of wall tie **30** connects to veneer **14**. It may be buried in mortar between adjacent rows of veneer elements **22**.

[0051] Referring to Figure **5**, connecting aperture **56** may be sufficiently tall to provide some freedom of movement over a selected vertical range for wall tie **30**. This permits the height of the wall tie, i.e., the vertical location, to be adjusted to account for variability in the exact height of, e.g., a row of bricks **22** upon which second end **68** of wall tie **30** will rest.

[0052] Connecting aperture **56** may be a closed aperture, as shown in Figures **1**, **2**, **3** and **5** such as may tend to reduce or to eliminate risk that wall tie **30** may inadvertently disconnect from backup wall connector **24** in the event that one or both of veneer **14** and backup wall **12** move vertically relative to the other. Referring to Figures **4** and **5**, the assembly of backup wall connector **24** and wall tie **30** is a final tie assembly **11**.

[0053] Penetrable form **18** may be made from a polymeric foam material, such as the foam material that it is used currently in slabs to make a form at certain construction sites. Such foam material is penetrable by means such as a nail or blade. Additionally, such foam material can be left in the erected structure to act as an insulation material. It is alternatively possible, however, to make the form out of some other material that is penetrable by a fastener such as a nail or cutting tool such as a utility saw (of which Skilsaw (t.m. is one brand) or multi-purpose reciprocating saw (of which the Milwaukee Sawzall t.m. is a brand).

[0054] The structure of backup wall connector **24** may be selected to permit it to be manufactured inexpensively. For example, backup wall connector **24** shown in Figure **1** may be made simply from a rectangular piece of plate material with two apertures therein (i.e., the aperture **52** and the connector aperture **56**), such as by stamping. The structure of form connector **26** may be selected to permit it to be manufactured inexpensively. For example,

the form connector **24** shown in Figure 1 is simply a rectangular piece of plate material with apertures for fasteners to pass therethrough.

[0055] Tie system **10** (Figure 1) may be provided without some of the above described components, with the expectation that the user may acquire those omitted components separately. For example, the fasteners **28** may be omitted from tie system **10** and the user may provide their own fasteners. As another example, wall tie **30** may be omitted with the expectation that the customer (i.e., the user) may already have a supply. Further, form connector **26** may be reusable, i.e., it may be removed prior to wall tie **30** being used.

[0056] In the embodiment of Figure 7, a tie apparatus **80**, generally similar to backup wall connector **24**, may include three portions, namely a first, or innermost portion **82**; a second medial or transition portion **84**; and a third or outermost portion **86**. Medial or transition portion **84** may be located intermediate to, and may form an interconnection of, first portion **82** and third portion **86**. As in the embodiments described above, first portion **82** defines or includes a key, or root, embedment fitting, or anchor or anchor fitting, or embedment fitting, however it may be termed, and indicated generally as **88**.

[0057] As above, anchor fitting **88** may most typically be embedded in poured concrete, and, by its contours, once the concrete is poured define a root that cannot be extracted without bodily extraction of the concrete as well. However, it may be that anchor fitting may be secured to wall structure, be it concrete or steel or other framing structure, and so on by other means, such as threaded fasteners, be they mounted in concrete-anchor threaded seats or by laterally extending threaded fasteners, rivets Huck (t.m.) bolts or otherwise. However, the balance of the description will assume concrete embedment. To that end anchor fitting may include such features as apertures **52** or **54**, as may be.

[0058] Third portion **86** may include a first portion or region **90** and a second portion or member or region **92**. First region **90** may be termed the proximate region, because it is proximate to form **18**, and is proximate to, and joined to, second portion **84**. Second region **92** is the distal region, being more distant from form **18**. Second region **92** may be termed more outward than region **90**, or conversely, that region **90** is oriented to extend in the inward direction (toward back-up wall **12**) relative to region **92**.

[0059] First region 90 may be substantially planar, and may be co-planar with second portion 84, and may be co-planar with first portion 82. Second region 92 may define an end-fitting, or flange 96. Flange 96 may tend to extend in a plane to which first region 92 is normal, that plane being such that, on installation in form 18, the outside face of flange 96 is generally parallel to, and spaced from, form 18 by a gap distance G. In some embodiments, flange 96 may be provided with pre-formed fastener apertures 98, such as may accept threaded or other fasteners of a facing material, be it some kind of siding, boards, paneling, veneer masonry or a masonry simulacrum, and so on. More generically, second region 92 may be said to define an out-of-plane attachment interface fitting formed as an integral part of tie apparatus 80 (they can be made from a single monolith of metal stock).

[0060] First region 92 may have an array of indexing fittings 100. In one embodiment of array 100 the indexing fittings may include an upper aperture 102 and a lower aperture 104, spaced vertically from each other (i.e., as installed). Apertures 102, 104 may be of any shape. However a square, rectangular, round punched or drilled hole may be convenient. In use, the position of tie apparatus 80 may be established relative to the datum of the outside surface of form 18 by the expedient of driving a peg, dowel pin, roll pin, cotter pin, rod, shiv, wedge, drift, abutment, plug, dog, or like member 110 there-through such that the inside extremity of the aperture may tend to align with, e.g., be flush with, the outside of form 18, two such dogs 110 being used to encourage connector 80 to run horizontally (as the generally bodily stiffness of e.g., EPS or XPS insulation board may tend also to do). Where a wall tie such as wall tie 30 is to be used, once the wall has cured, one or both of dogs 110 may be knocked out, and tie 30 substituted.

[0061] In the embodiment of Figures 8 and 9, first, second, and third portions 82, 84 and 86 are shown having respective x-direction extents L_{82} , L_{84} , and L_{86} . In this embodiment, array 100 includes a larger number of apertures 112 providing more choice in selection for the appropriate height of brick tie 30. Further, by use of a larger number of apertures, it may be that there may be no need to knock out dogs 110 after curing.

[0062] In the embodiments of Figures 7 – 11, it is seen that second portion 84 is perforate. That is, a substantial portion of the section has been removed, such as by means of making a plurality of perforations, such as may tend to reduce heat transfer along apparatus

80 in the x-direction. In Figures 7 – 9, holes 114, 116 may be circular drilled or punched holes, leaving an uninterrupted upper fiber or chord 118, a lower fiber or chord 120, and interstitial connecting regions 122.

[0063] In the embodiment of Figures 10 – 11, second portion 84 includes a top chord 124, a bottom chord 126, and diagonal bracing 128. In these examples the intermediate portion 84 that will, in use, traverse the thermal insulation layer defined by form 18 may tend to have reduced effective cross-sectional area for the purposes of heat transfer. Intermediate portion 84 may then be said to be perforate; may be predominantly perforate; may be more predominantly perforate than first portion 82 in the sense of having a higher percentage of material removed; and, as in the example of Figures 7 – 9, be more perforate, and more predominantly perforate than the third, outward portion 84.

[0064] Another feature of the embodiment of Figures 10 and 11 is that third portion 86 includes an array of indexing features 130, that includes more than one external air-space gap setting. That is, there is a first vertical set of apertures 132, a second set 134, a third set 136, a fourth set 138 and a fifth set 140. The respective gap spacings are indicated as G_{132} , G_{134} , G_{136} , G_{138} and G_{140} . The gap spacing may be on $\frac{1}{4}$ ", $\frac{3}{8}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ " increments, and so on. They need not be equal spacing, although it may be convenient that they be; and the first spacing, G_{132} , may be larger than the others, reflecting a minimum gap. As may be appreciated, there is a solid vertical band of material 142 between array 130 and the perforations of intermediate portion 84. As installed, the "intermediate portion" 84 will be that portion between the set of apertures in which dogs 110 are installed and first portion 82, with the length of second portion 84, L_{84} , shifting accordingly. As with the embodiments of Figures 7 – 9, the embodiments may have thermal conduction reduction features, such as section-reducing apertures, or it may have, or it may have multiple sets of gap-depth setting indexing features, or both, and in each case the structure may accept either a brick tie such as brick tie 30, or flange 98 may present a fastening interface at which to secure facing materials, such as their nature may be.

[0065] In the embodiments of Figures 7 – 11, the members shown are provided with both a set of first features, such as may be used with a brick-tie such as item 68; and also with a second feature, or set of features, at which to connect a different form of external cladding, or

external veneer, such as may provide an alternate attachment capability. It may also be that one or more of the apertures or fittings that are provided may be used as depth setting indexing features, e.g., in which to engage a pin or dog that locates the inward portion 82, and determines depth of embedment in the concrete; while one or more others of the apertures may be used as an aperture for a veneer link, such as a brick-tie 68, the placement of that link or tie then being set as a function of a desired air-gap through thickness.

[0066] Although it may be most common for the apparatus of the various embodiments shown and described herein to be in a vertical plane, as in a poured concrete wall, they may also be employed, as may be suitable, in a horizontal orientation between courses of a block or brick wall.

[0067] Various modifications and adaptations of the embodiments shown herein can be made without departing from the present invention, the scope of which is defined in the appended claims.

CLAIMS

1. A tie apparatus comprising:
a first portion, a second portion and a third portion;
said first portion defining an anchor fitting for permanent engagement of wall structure;
said second portion defining a web intermediate said first portion and said third portion;
said third portion defining a veneer connection interface; and
said third portion also including an array of indexing fittings, said indexing fittings providing accommodations for at least one of (a) a form dog; and (b) an engagement tie retainer.
2. The tie retaining apparatus of claim 1 wherein said second portion has a lengthwise extent between said first and third portions corresponding to an insulation thickness.
3. A combination of the tie retaining apparatus of any one of claims 1 and 2, and a wall form member, the wall form member being formed of thermal insulation material, the wall form member being penetrable by the tie retaining apparatus, the wall form member having a through thickness, on installation said second portion extending through said through thickness of said thermal insulation member, and, in use, said indexing fittings locating outwardly proud of said thermal insulation material.
4. The tie retaining apparatus of any one of claims 1 and 2 wherein said third portion includes a flange formed thereon most distantly from said first portion.
5. The tie retaining apparatus of claim 4 wherein said first portion and said second portion are substantially co-planar, and said flange of said third portion is oriented out-of-plane relative to said first portion and said second portion.
6. The tie retaining apparatus according to any one of claims 4 and 5 wherein said array of indexing fittings includes at least a first set of indexing members offset from said flange and a second set of indexing members offset from said flange, said first set of indexing members being more offset from said flange than is said second set of indexing members.
7. The tie retaining apparatus of any one of claims 1 to 6 wherein said second portion is predominantly perforate.
8. The tie retaining apparatus of claims 1 to 6 wherein said second portion is more predominantly perforate than is said first portion.

9. The tie retaining apparatus of claim 4 wherein said second portion is perforate.
10. The tie retaining apparatus of claim 9 wherein said second portion is more predominantly perforate than is said first portion.
11. The tie retaining apparatus of claim 10 wherein said third portion includes a flange formed thereon most distantly from said first portion.
12. The tie retaining apparatus of claim 11 wherein said first portion and said second portion are substantially co-planar, and said flange of said third portion is oriented out-of-plane relative to said first portion and said second portion.
13. The tie retaining apparatus according to claim 11 wherein said array of indexing fittings includes at least a first set of indexing members offset from said flange and a second set of indexing members offset from said flange, said first set of indexing members being more offset from said flange than is said second set of indexing members.
14. A tie system for use with a penetrable form for a cementitious backup wall and for use with a wall tie to connect between the cementitious backup wall and a veneer, the tie system comprising:
 - at least one form dog connectable to a form;
 - a backup wall connector shaped to extend through an aperture in the form, the backup wall having at least one dog engagement seat that, in use, engages the at least one dog co-operably to discourage forward and rearward relative movement between the backup wall connector and the at least one dog;
 - the backup wall connector having a plurality of outwardly oriented seats defining respective accommodations for the at least one dog;
 - said plurality of outwardly oriented seats including at least a first seat and a second seat, said first seat defining a first form connector embedment depth, and said second seat defining a second form connector embedment depth;
 - at least one of the accommodations in said backup wall connector also defining a respective brick-tie engagement fitting; and
 - each said dog being removable from engagement with its respective seat.
15. The tie apparatus of claim 14 wherein:
 - said backup wall connector has a first portion, a second portion and a third portion;
 - said first portion defines an anchor fitting for permanent engagement of wall structure;
 - said second portion defines a web intermediate said first portion and said third portion;

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said third portion defines a veneer connection interface; and
said second portion has a lengthwise extent between said first portion and said third portion corresponding to an insulation thickness of said form.

16. A combination of the tie apparatus of any one of claims 14 and 15, and the form, the form being made of a thermal insulation material, the form being penetrable by the backup wall connector, the form having a through thickness, on installation said second portion extending through said through thickness of said form, and, in use, at least some of said seats being located outwardly proud of said form.

17. The tie retaining apparatus of any one of claims 14 and 15 wherein said backup wall connector has a flange formed thereon most distantly outward from the form.

18. The tie retaining apparatus of any one of claim 15 wherein:
said third portion of said backup wall connector has a flange formed thereon, said flange including said veneer connection interface;
said first portion and said second portion are substantially co-planar; and
said flange is oriented out-of-plane relative to said first portion and said second portion.

19. The tie retaining apparatus according to any one of claims 17 and 18 wherein said seats include at least a first set of accommodations offset from said flange and a second set of accommodations offset from said flange, said first set of accommodations being more offset from said flange than is said second set of accommodations.

20. The tie retaining apparatus of any one of claims 15 and 18 wherein said second portion is predominantly perforate.

21. The tie retaining apparatus of any one of claims 15 and 18 wherein said second portion is more predominantly perforate than is said first portion.

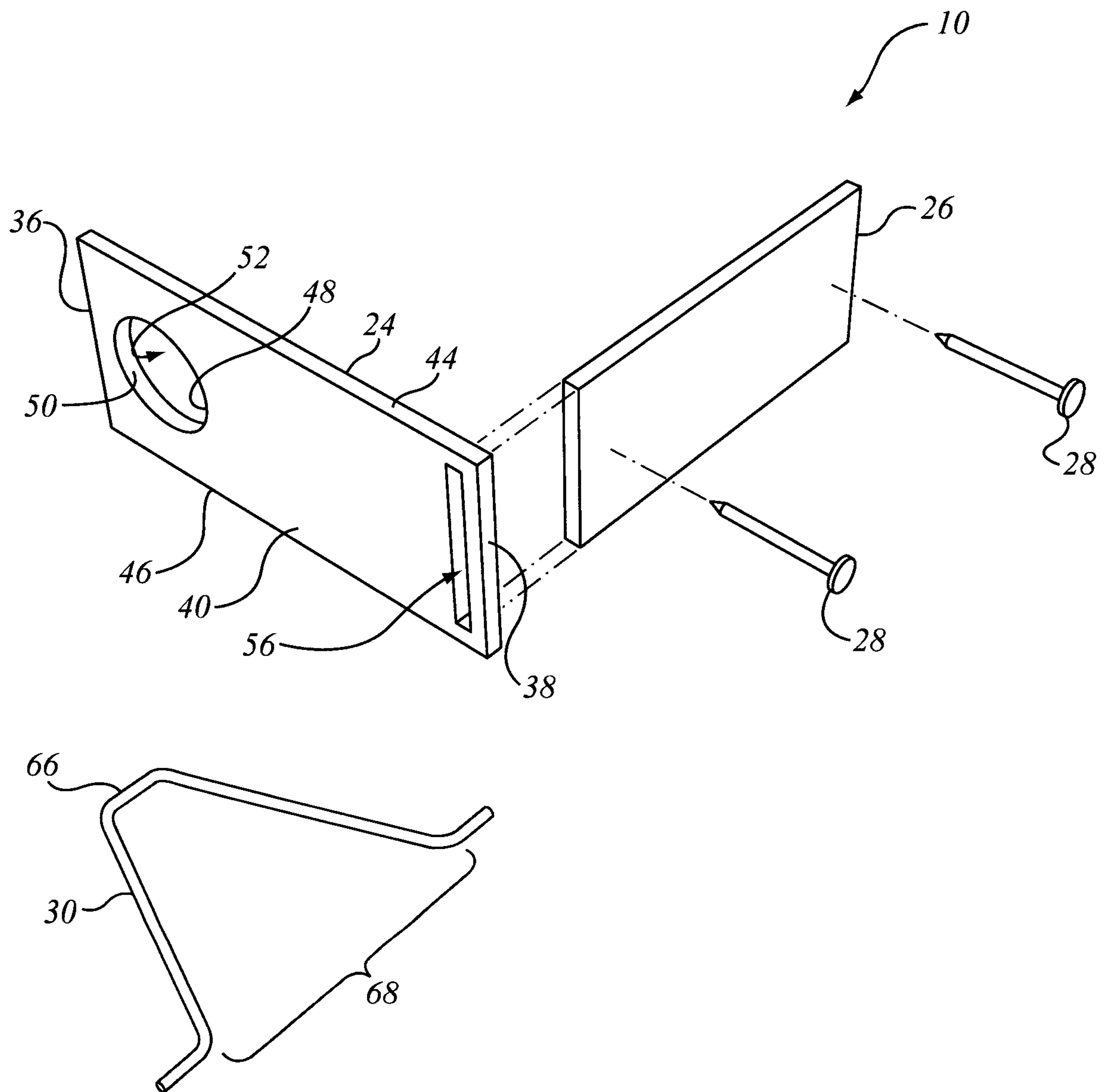


FIG. 1

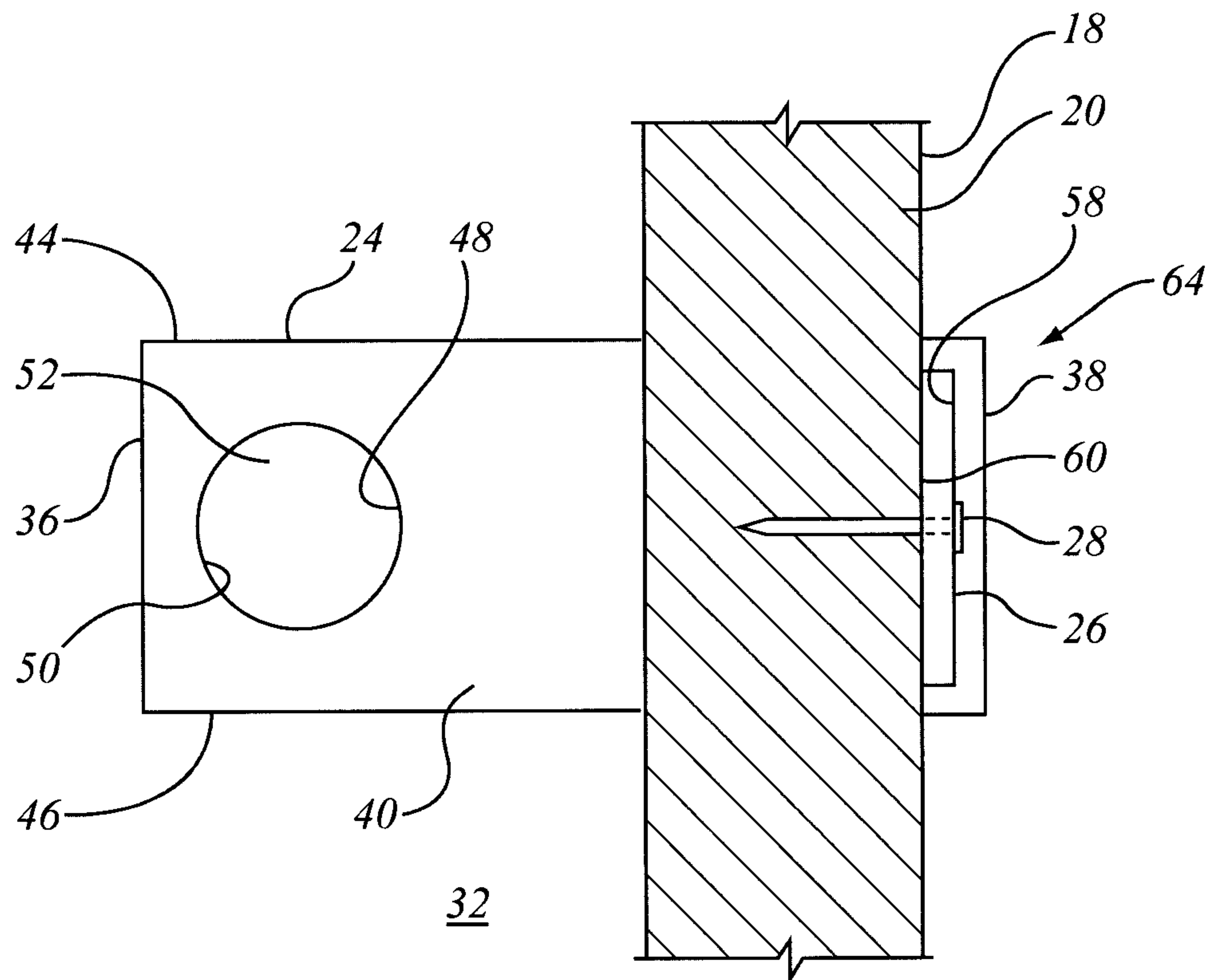


FIG. 2

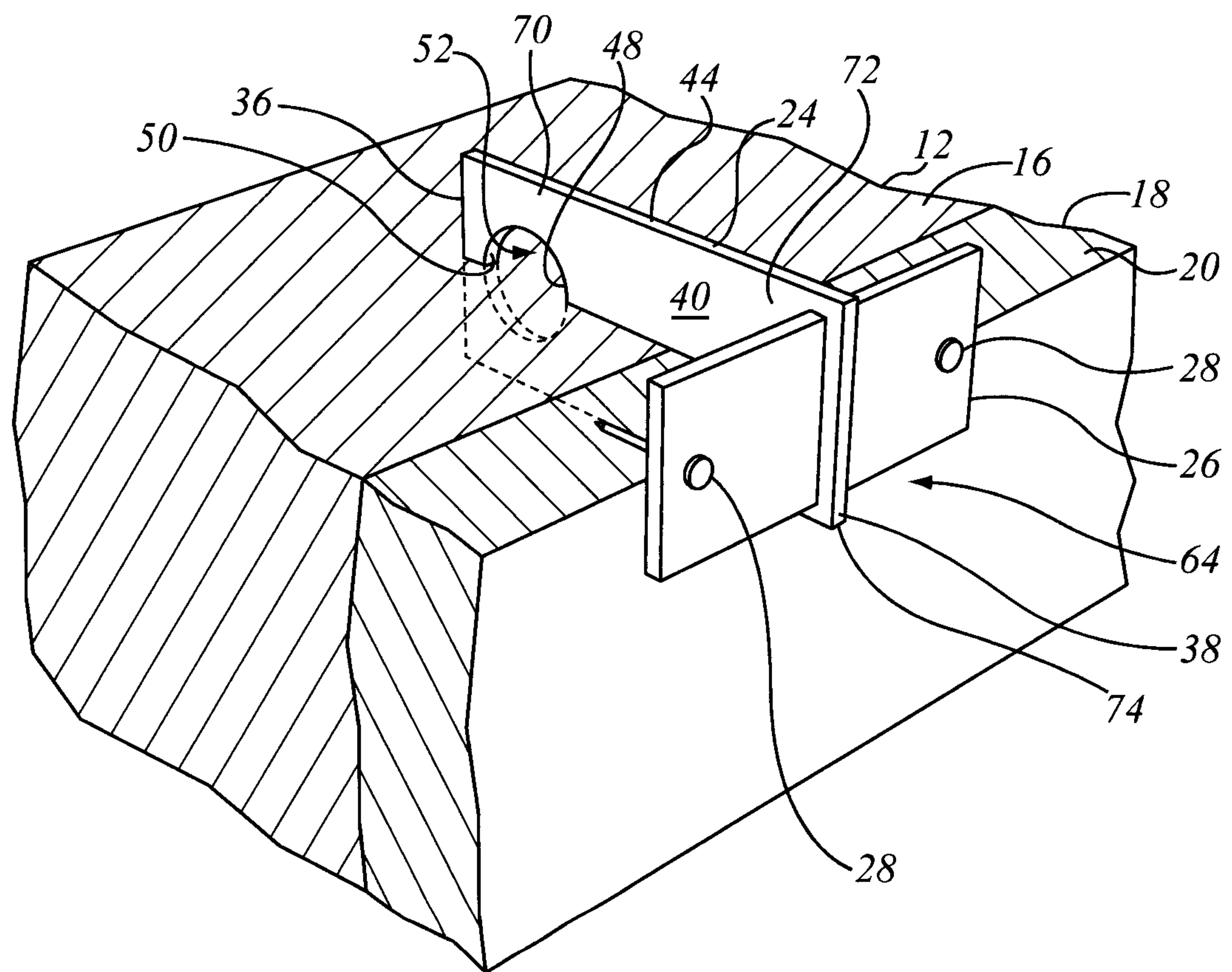


FIG. 3

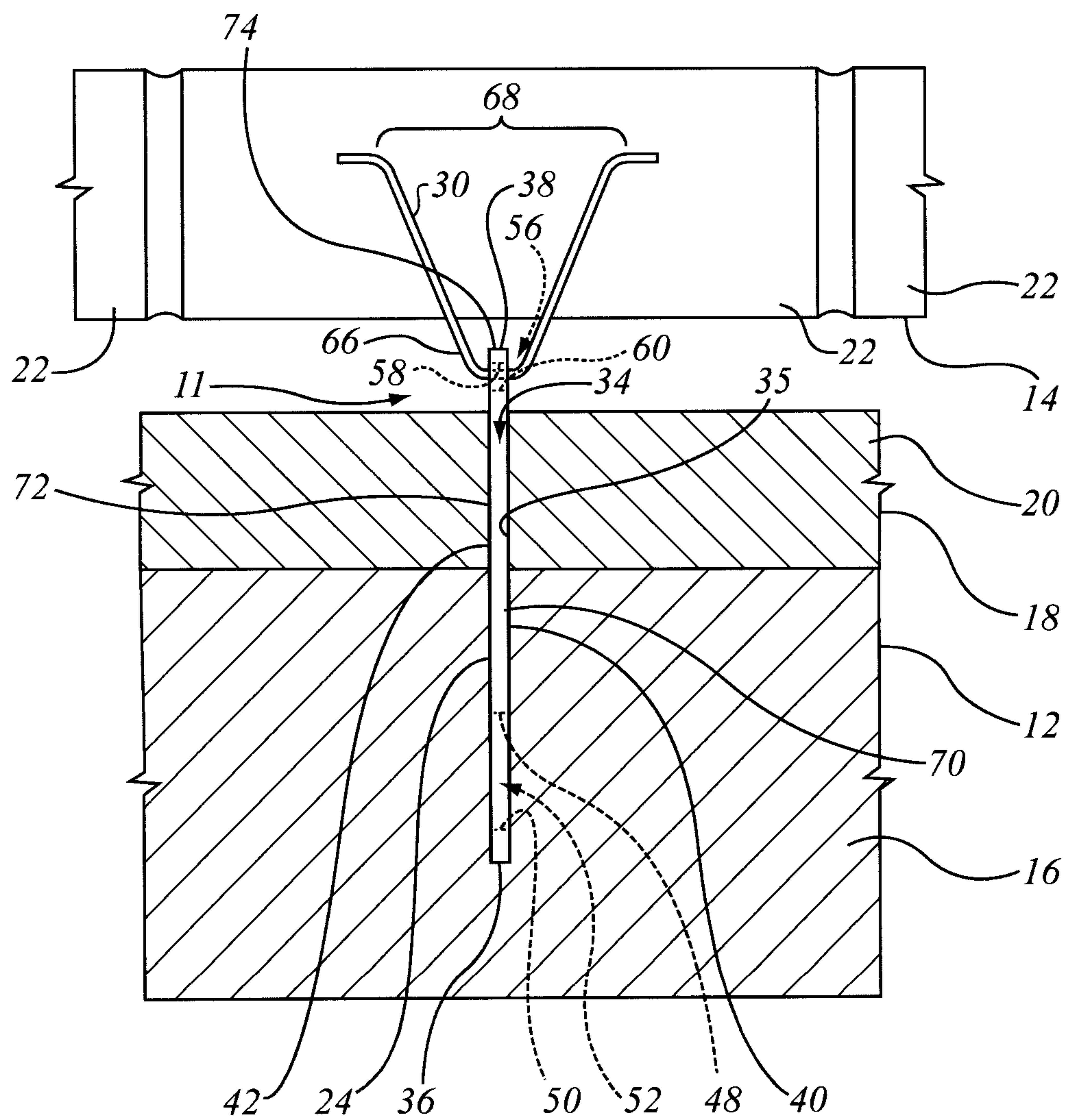


FIG. 4

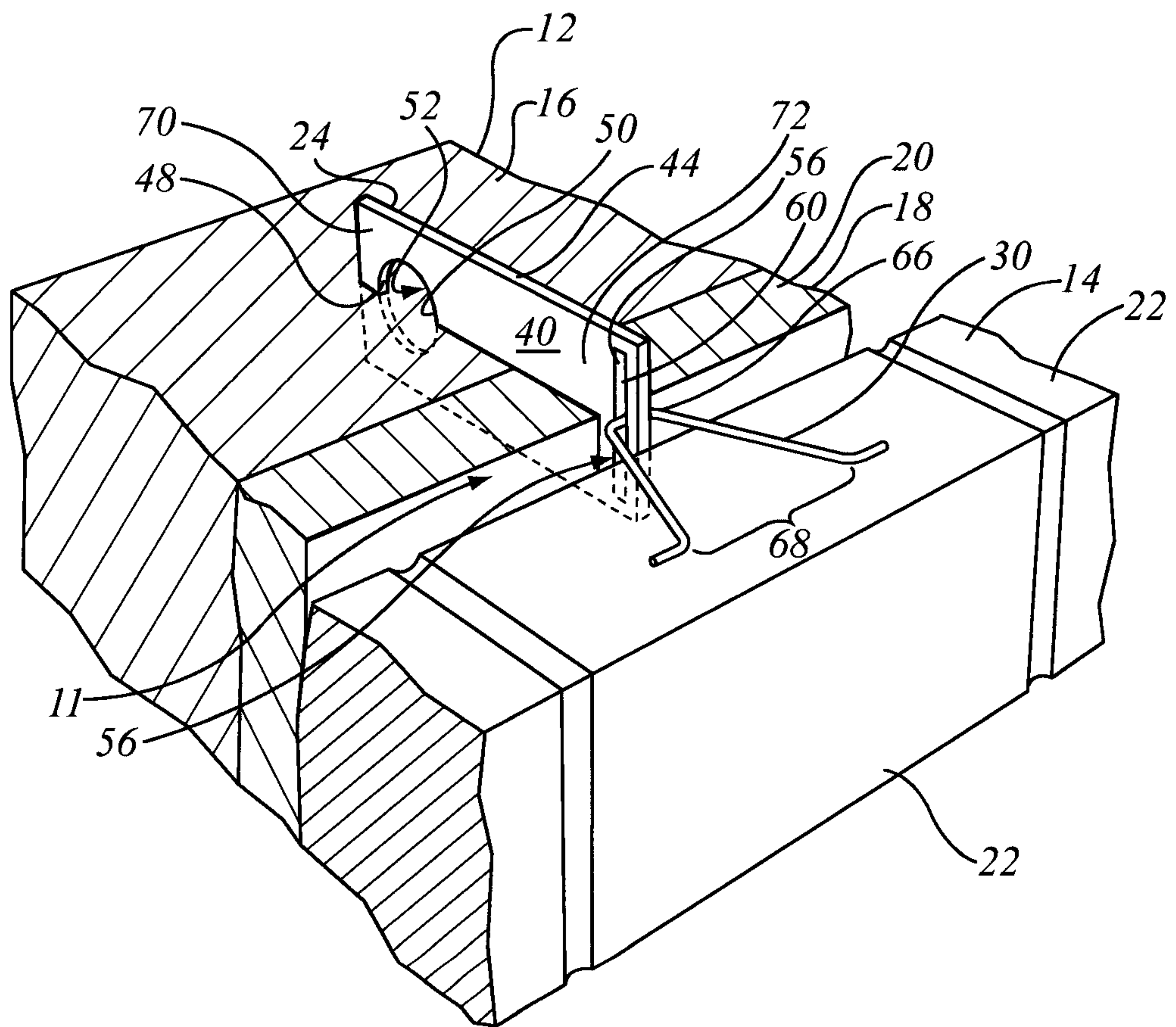


FIG. 5

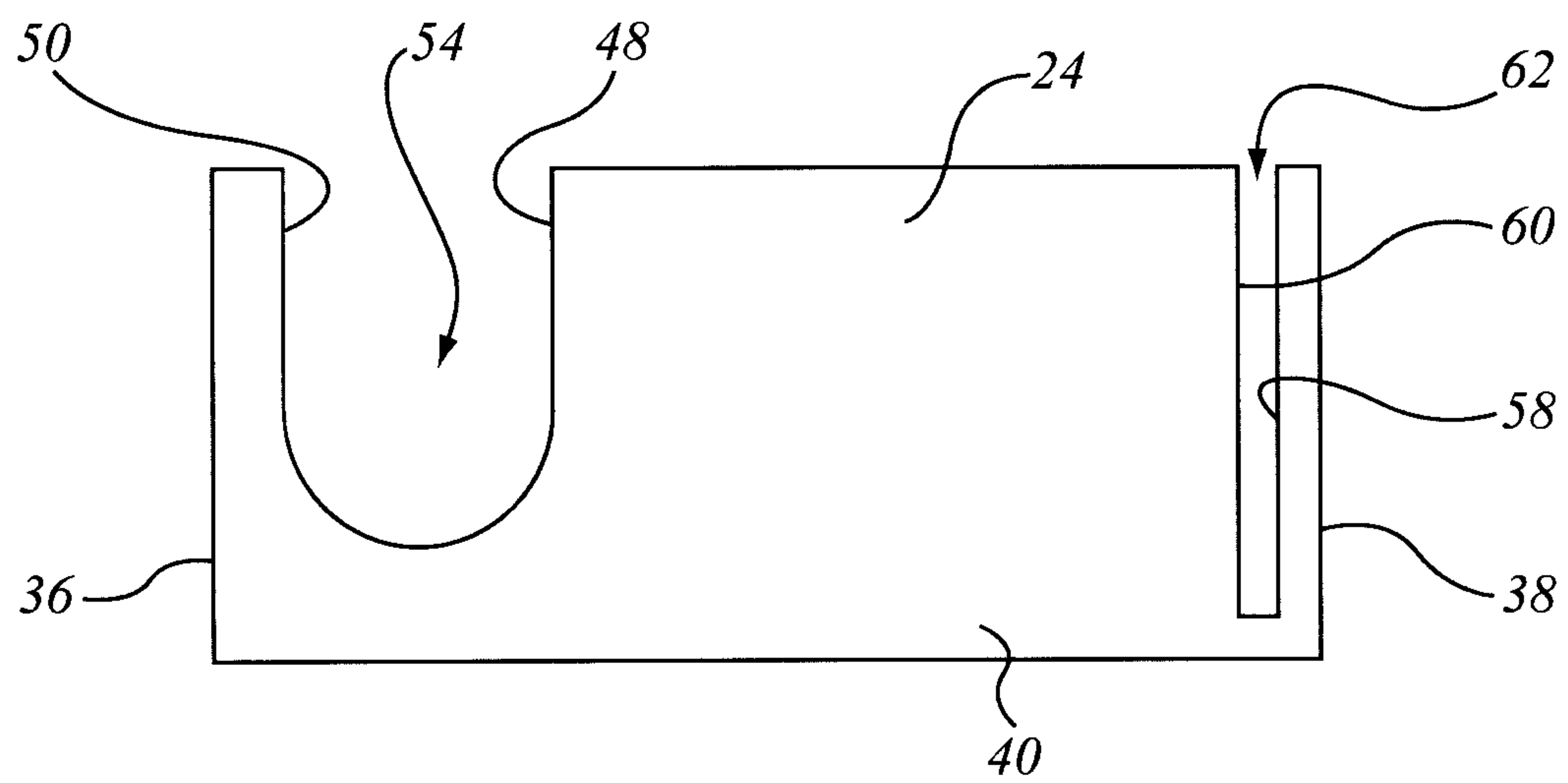


FIG. 6

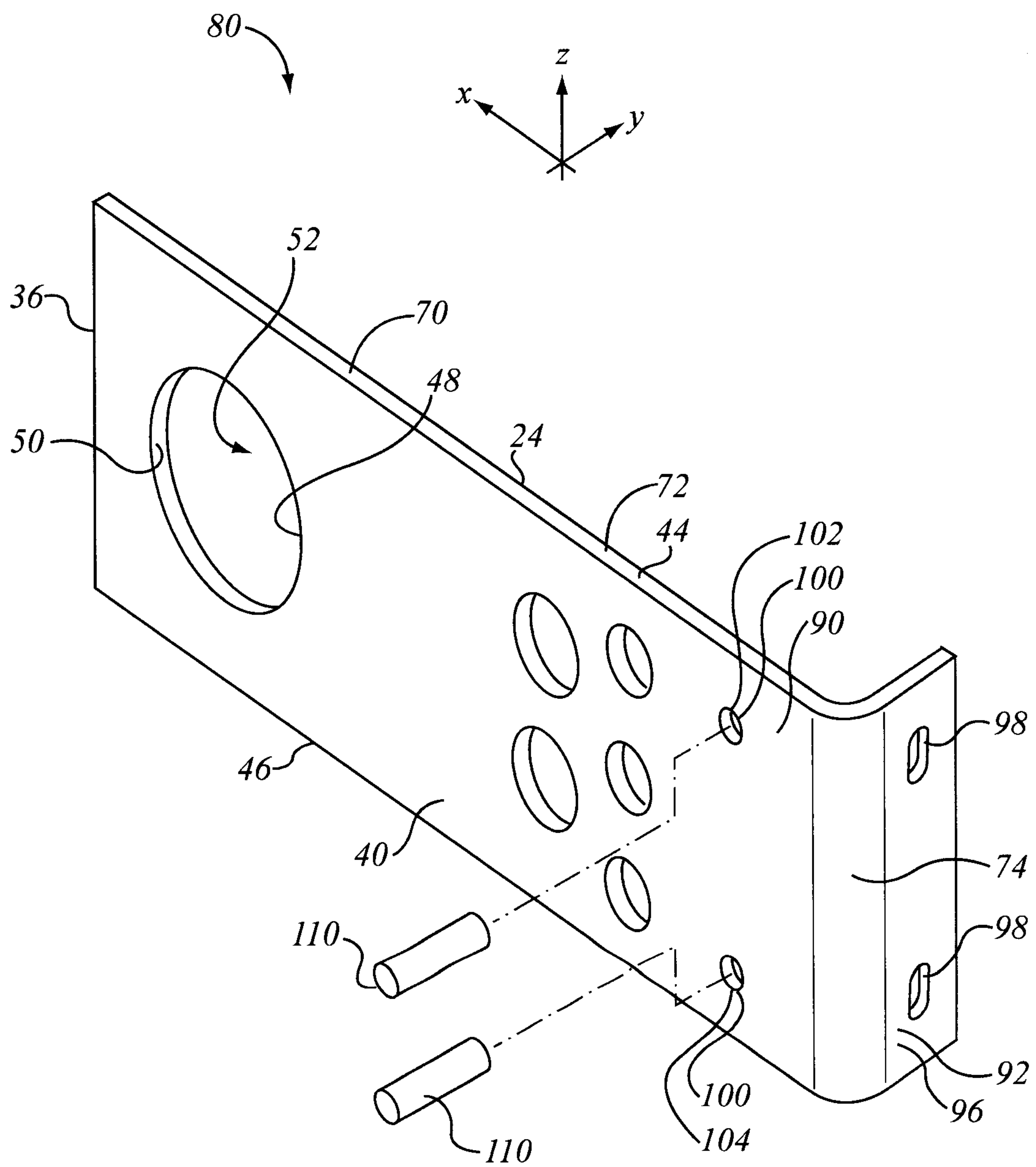


FIG. 7



