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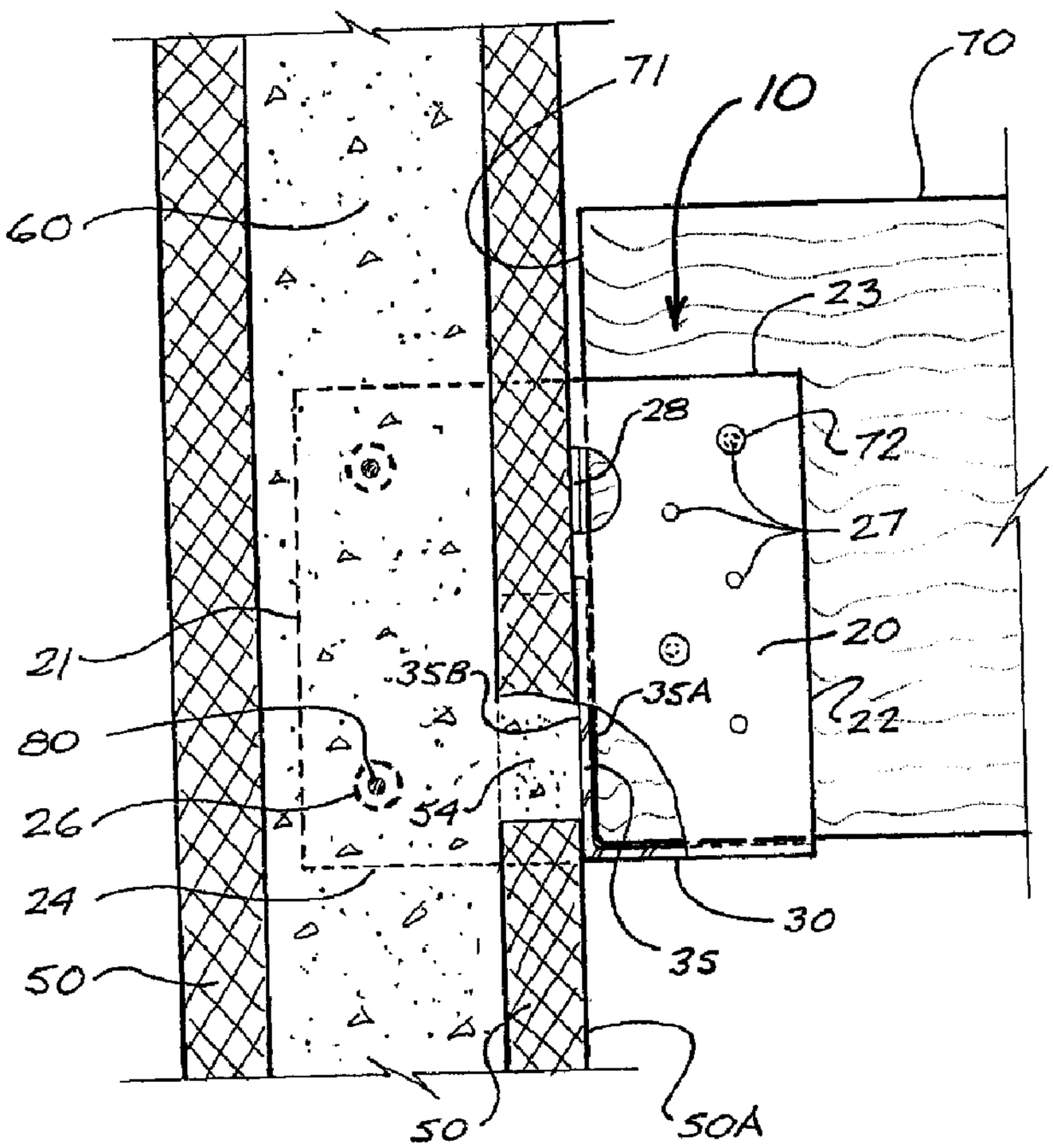
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(57) Abrégé/Abstract:
A hanger for supporting joists or beams in insulated concrete formwork (ICF) systems has two parallel side plates having inner and outer sections, plus an L-shaped support member comprising a horizontal leg extending between the lower edges of the outer

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(57) Abrégé(suite)/Abstract(continued):
sections of the side plates, and an upward-extending vertical leg which demarcates the inner and outer side plate sections. The inner sections of the side plates are passed through slits in one insulation panel of an ICF wall-forming system, until the support member's vertical leg abuts the outer face of the insulation panel, leaving the side plate inner sections extending partially into the formwork cavity. The joist or beam to be supported may be set on the horizontal leg of the support member either before or after the concrete wall is cast. Preferably, a cut-out is made in the insulation panel behind the vertical leg of the support member to allow concrete to flow against the vertical leg and the supported joist or beam is cut for a close fit against the vertical leg, such that external horizontal loads on the wall can pass into the joist or beam by direct compression.

ABSTRACT OF THE DISCLOSURE

A hanger for supporting joists or beams in insulated concrete formwork (ICF) systems has two parallel side plates having inner and outer sections, plus an L-shaped support member comprising a horizontal leg extending between the lower edges of the outer sections of the side plates, and an upward-extending vertical leg which demarcates the inner and outer side plate sections. The inner sections of the side plates are passed through slits in one insulation panel of an ICF wall-forming system, until the support member's vertical leg abuts the outer face of the insulation panel, leaving the side plate inner sections extending partially into the formwork cavity. The joist or beam to be supported may be set on the horizontal leg of the support member either before or after the concrete wall is cast. Preferably, a cut-out is made in the insulation panel behind the vertical leg of the support member to allow concrete to flow against the vertical leg and the supported joist or beam is cut for a close fit against the vertical leg, such that external horizontal loads on the wall can pass into the joist or beam by direct compression.

JOIST HANGER FOR ICF WALL SYSTEMS

FIELD OF THE INVENTION

The present invention relates in general to support hardware for structural joists and beams, and relates in particular to joist and beam hangers for use in association with concrete walls constructed using insulated concrete formwork systems.

BACKGROUND OF THE INVENTION

It is increasingly common for both below-grade and above-grade concrete walls to be constructed using insulated concrete formwork (or "ICF") systems. In conventional concrete wall-forming systems, a pair of wood or metal form panels are set up at a spacing corresponding to the desired thickness of the finished wall, thus creating a cavity between the panels. As necessary or desired, steel reinforcing bars are positioned within the formwork cavity. The form panels are secured in position using form ties extending between the form panels, and/or by means of external temporary bracing. Fluid concrete is then introduced into the formwork cavity. After the concrete has cured sufficiently, the formwork panels are removed (or "stripped") from the concrete wall.

It is generally desirable to insulate both above-grade and below-grade building walls, in order to minimize through-wall heat transfer both from inside the building to the outside (e.g., during winter) and from the outside into the building (e.g., during summer). By minimizing heat transfer, wall insulation reduces heating costs in cold weather, and reduces air conditioning costs in warm weather (or enhances the comfort of persons in buildings that do not have air conditioning). For concrete walls constructed using conventional methods, insulation is typically applied to one or both wall surfaces, such as in the form of plastic foam insulation panels glued or otherwise attached to the concrete surface, or (particularly in the case of inside wall surfaces) in the form of fiberglass batts incorporated into stud walls or strapping systems installed adjacent to the wall surface.

These conventional wall insulation methods and systems add to the total time and cost of building construction.

ICF systems combine plastic foam insulation panels and spacing means (such as plastic tie members) to create assemblies in which the insulation panels take the place of conventional wall form panels (e.g., plywood forms), and remain in place as permanent insulation after the concrete wall has been cast and cured. ICF systems thus reduce or eliminate the need to strip forms from the finished wall, thereby reducing construction labour costs. As well, construction time and costs are further reduced because wall insulation does not have to be installed as a separate task subsequent to wall construction.

It is commonly necessary or desirable for floor (or roof) beams and joists to act as struts providing effective lateral bracing to the walls that support them. In some cases, such bracing action may be structurally required on a long-term basis; in other (and perhaps most) cases, the beams and joists may need to provide bracing only until the complete floor (or roof) structure is in place. This bracing effectiveness is easily achieved in conventional concrete wall construction by embedding the supported ends of the beams and joists into the walls as the walls are being cast, thus providing solid support for the beams and joists both vertically and laterally. However, it is somewhat difficult to embed beams and joists in concrete walls formed using ICF systems. This would typically require cutting out sections of insulation to accommodate the beams and joists, and in some cases temporary shoring may be needed because the ICF panels may not be strong enough to support the weight of the embedded beams and joists during wall construction.

For these reasons, a variety of joist and beam hanger designs have been developed for use with ICF systems. One known ICF joist hanger system, the ICF-Connector™ made by ICF-CONNECT Ltd. of Woodbridge, Ontario, uses a pair of flat metal side plates that are inserted partway through corresponding and suitably spaced vertical slots in an ICF form panel, such that an inner portion of each plate will be cast into the concrete wall and an outer portion will protrude from the outer face of the form panel. After the concrete wall has been cast, a U-shaped metal bracket is positioned under the

end of the joist to be supported. The joist end is then positioned between the protruding side plates, and suitable fasteners (e.g., sheet metal screws) are installed to connect both side plates to the vertical legs of the U-shaped bracket. Because the side plates are rigidly anchored in the concrete wall, their connection to the bracket allows the hanger assembly to transfer loads both vertically and laterally between the joist and the concrete wall (subject to proper structural design of the hanger components and fasteners).

However, all load transfer in such hanger systems is by way of shear across the fasteners. If the fasteners are corroded, insufficiently tight, or installed in oversized holes, the hanger assembly's bi-directional load transfer capability can be seriously compromised. Accordingly, there is a need for an ICF joist hanger that provides secure bi-directional load transfer capability without relying on shear-loaded fasteners, and without requiring extensive cutouts in the ICF form panels. Moreover, there is a need for such an ICF hanger of unitary or one-piece construction, to minimize hanger fabrication costs. The present invention is directed to these needs.

BRIEF SUMMARY OF THE INVENTION

The present invention provides a hanger specially adapted for supporting joists or beams in association with concrete walls constructed using insulated concrete formwork (ICF) systems. In preferred embodiments, the hanger has a pair of typically parallel side plates each having inner and outer sections, plus a generally L-shaped support member comprising a typically horizontal base leg extending between the lower edges of the outer sections of the side plates and an upward-extending vertical leg which demarcates the inner and outer sections of the side plates. The hanger may be mounted to an ICF wall-forming system by passing the inner sections of the side plates through slits cut or otherwise formed in one of the ICF insulation panels, until the vertical leg of the support member abuts the outer face of the insulation panel, such that the inner sections of the side walls extend partially into the cavity between the ICF insulation panels and thus will be cast into the finished concrete wall. Preferably, the inner sections of the side plates will have openings through which reinforcing bars can be inserted for enhanced anchorage of the hanger in the concrete wall.

After the concrete wall has been cast and cured, one end of the joist or beam to be supported is set onto the base leg of the support member. Alternatively, the joist or beam can be supported on the base leg (and temporarily shored if necessary) prior to placing concrete in the ICF system. In either scenario, nails, screws, or other fasteners may optionally be used to connect the joist or beam to the hanger, and for this purpose the hanger may optionally have fastener holes in the outer sections of the side plates and/or in the base leg. However, such fasteners are not necessary for vertical support of the joist or beam, since all vertical joist or beam reactions are transferred directly into the concrete wall through the base leg and the side plates.

In another aspect, the invention provides methods of supporting a joist or beam in association with an ICF-formed concrete wall, using a hanger as described and illustrated. In preferred methods of using the hanger, an opening will be formed in the insulation panel behind the vertical leg of the support member such that when the wall is being cast, concrete will flow into the panel opening and against the vertical leg. As well, the supported joist or beam will be cut for a close fit against the outer face of the vertical leg. Therefore, external horizontal loads acting on the wall (such as from backfill pressure) can be transferred from the wall into the joist or beam by direct compression, without need for fasteners connecting the joist or beam to the hanger.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will now be described with reference to the accompanying figures, in which numerical references denote like parts, and in which:

FIGURE 1 is an isometric view of a joist / beam hanger in accordance with a first embodiment of the present invention.

FIGURE 2 is a further isometric view of the hanger shown in Fig. 1.

FIGURE 3 is a cross-section through a hanger of a type as shown in Figs. 1 and 2, shown installed in a typical ICF formwork assembly prior to concrete placement.

FIGURE 4 is a cross-section through a concrete wall constructed using ICF formwork with a hanger cast into the concrete wall as in Fig. 3, with a structural wood joist mounted in the hanger.

FIGURE 5 illustrates a piece of flat stock which has been cut for brake-forming into a one-piece hanger in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Figures 1 and 2 are isometric views of an ICF joist hanger in accordance with a first embodiment of the present invention, in the form of a one-piece joist hanger **10** having:

- a pair of spaced side plates **20**, each having an inner edge **21**, an outer edge **22**, an upper edge **23**, and a lower edge **24**, with each side plate **20** being subdivided into an inner section **20A** and an outer section **20B** (by a notional and typically vertical demarcation line **DL**); and
- a generally L-shaped support member comprising:
    - a base leg **30** extending widthwise between the lower edges **24** of outer sections **20B** of side plates **20**; and
    - a vertical leg **35** extending upward from base leg **30** along demarcation line **DL**, and having an outer face **35A** and an inner face **35B**.

In typical cases, vertical leg **35** will be perpendicular to base leg **30**, and also perpendicular to both side plates **20** (which in turn will be parallel to each other in typical cases). In special cases, however, vertical leg **35** may be other than perpendicular to base leg **30** (such as when a supported beam or joist is not horizontal, and when for that reason base leg **30** is not perpendicular to the wall). In the case of a skewed connection (i.e.,

where a supported beam or joist, as view in plan, is not perpendicular to the supporting wall), vertical leg **35** may be other than perpendicular to side plates **20**.

The installation and use of hangers **10** in conjunction with ICF formwork systems may be readily understood with reference to Figures 3 and 4. Figure 3 is a cross-section through a hanger **10** in accordance with the present invention, installed in a typical ICF formwork assembly prior to concrete placement. Figure 4 is a cross-section through a concrete wall **60** constructed using ICF formwork, showing a structural wood joist **70** mounted in a hanger **10** cast into wall **60**.

As shown in Figures 3 and 4, the ICF assembly comprises a pair of rigid insulation form panels **50** spaced apart to form a cavity **55** having a width corresponding to the desired thickness of the finished concrete wall. Two parallel vertical slits **52**, spaced to match the distance between side plates **20** of hanger **10**, are cut into the appropriate form panel **50** at each desired joist (or beam) location in the finished wall. A hanger **10** is then installed at each location by inserting side plates **20** through the corresponding slits **52** (inner edges **21** first) until vertical leg **35** abuts or is substantially aligned with outer face **50A** of the corresponding form panel **50**.

As best seen in Figure 3, an opening **54** is preferably cut into form panel **50** in the area behind each vertical leg **35** such that concrete placed within formwork cavity **55** will flow up against inner face **35B** of vertical legs **35**. Preferably, form panel openings **54** will be of generally rectangular shape corresponding to but slightly smaller than vertical leg **35**. This configuration of openings **54** maximizes the area of concrete contact against vertical legs **35** while preventing or minimizing leakage of fluid concrete.

In preferred embodiments, at least one side plate **20** of hanger **10** is formed with one or more tabs **28** extending outward from (and typically but not necessarily perpendicular to) side plate **20** and positioned for alignment with outer face **50A** of the form panel **50** (i.e., with the plane of each tab **28** generally coinciding with notional demarcation line **DL**). As best seen in Figure 4, tabs **28** make it easier for construction workers to ensure that hangers **10** are plumb after installation in form panels **50** and that side plates **20** of hangers **10** project the appropriate distance into formwork cavity **55**; it is

simply a matter of pushing side plates **20** through slits **52** until tabs **28** abut outer face **50A**. The precise position of tabs **28** in side plates **20** of a given hanger **10** will depend on the thicknesses of form panels **50** and concrete wall **60**.

In the preferred embodiments shown in the Figures, each side plate **20** of hanger **10** has one or more openings **26** proximal to inner edge **21** such that when hanger **10** is installed in association with an ICF formwork assembly, openings **26** will be disposed within formwork cavity **55**. Reinforcing bars **80** inserted through openings **26** will therefore become cast into concrete wall **60**, thereby enhancing the strength and security of the hanger's anchorage within the finished wall.

Each side plate **20** of hanger **10** preferably has multiple fastener holes **27** to allow installation of fasteners **72** (for example, wood screws or spikes) through side plates **20** into wood joist (or beam) **70**. As will be readily appreciated by persons skilled in the art, fasteners **72** will typically be subject to little or no structural loading in the completed structure. In fact, the use of fasteners **72** is not essential to proper installation of joists and beams in association with hangers **10**, although it will often be convenient to use at least one or two fasteners **72** to facilitate initial joist (or beam) installation and positioning. In an alternative embodiment, hanger **10** has one or two fastener holes **27** in base leg **30** (in lieu of or in addition to holes **27** in side plates **20**), allowing fasteners **72** to be installed upward into the bottom of joist **70**.

For optimal structural effectiveness of the joist / hanger connection, joist **70** will preferably be cut to length such that after installation in hanger **10**, a lower portion of the vertical end face **71** of joist **70** will be substantially in contact with outer face **35A** of vertical leg **35**. Since inner face **35B** of vertical leg **35** is in direct contact with concrete wall **60** (by virtue of concrete flowing into panel openings **54** as previously described), lateral loads can thus be transferred by direct compression between joist **70** and wall **60**.

Although the installation and use of hangers **10** have been described in the context of solid wood joists and beams, persons skilled in the art will appreciate that hanger installation methods can be readily adapted to accommodate other types of structural

members including light wood trusses, I-shaped wood joists (e.g., TJI® joists), cold-formed channels, and even hot-rolled steel members.

Hangers **10** will preferably be fabricated from galvanized steel or stainless steel. However, the invention is not limited or restricted to the use of any particular material, and other structurally suitable materials may be used without departing from the scope of the invention.

Hangers **10** will preferably be of unitary construction. FIG. 5 illustrates one way of doing this using a hanger blank **100** from suitable flat stock, with pre-cut rebar openings **26**, fastener holes **27**, and slits **28A** for tabs **28** as desired or required. It is then a simple matter of forming hanger **10** in its final configuration by making bends in blank **100** along bend lines **BL** as indicated, using a conventional metal-working brake or other suitable equipment.

Alternatively, of course, hanger **10** could also be fabricated from multiple subcomponents, such as by welding.

It will be readily appreciated by those skilled in the art that various modifications of the present invention may be devised without departing from the scope and teaching of the present invention, including modifications which may use equivalent structures or materials hereafter conceived or developed, and all such modifications are intended to come within the scope of the present invention and the claims appended hereto. It is to be especially understood that the invention is not intended to be limited to described or illustrated embodiments, and that the substitution of a variant of a claimed element or feature, without any substantial resultant change in the working of the invention, will not constitute a departure from the scope of the invention. It is also to be appreciated that the different teachings of the embodiments described and discussed herein may be employed separately or in any suitable combination to produce desired results.

In this patent document, any form of the word "comprise" is to be understood in its non-limiting sense to mean that any item following such word is included, but items not specifically mentioned are not excluded. A reference to an element by the indefinite

article "a" does not exclude the possibility that more than one of the element is present, unless the context clearly requires that there be one and only one such element. Any use of any form of the terms "connect", "engage", "couple", "attach", or any other term describing an interaction between elements is not meant to limit the interaction to direct interaction between the subject elements, and may also include indirect interaction between the elements such as through secondary or intermediary structure. Relational terms such as “parallel”, “perpendicular”, “coincident”, “intersecting”, and “equidistant” are not intended to denote or require absolute mathematical or geometrical precision. Accordingly, such terms are to be understood as denoting or requiring substantial precision only (e.g., “substantially parallel”) unless the context clearly requires otherwise.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. A joist hanger for use with ICF formwork systems, said joist hanger comprising:

(a) a pair of spaced side plates, each having an inner edge, an outer edge, an upper edge, and a lower edge, and each side plate comprising an inner section adjacent the side plate's inner edge and an outer section adjacent the side plate's outer edge; and

(b) a generally L-shaped support member comprising:

b.1 a base leg fixed to and extending between the lower edges of the outer sections of the side plates; and

b.2 a vertical leg extending upward from said base leg, and having an outer face and an inner face; wherein the inner and outer sections of the side plates are demarcated by the plane of the vertical leg.

2. The joist hanger of Claim 1 wherein the outer section of at least one side plate has one or more fastener holes.

3. The joist hanger of Claim 1 or Claim 2 wherein the base leg of the support member has one or more fastener holes.

4. The joist hanger of any of Claims 1-3 wherein the inner section of each side plate has one or more openings, said one or more openings being configured to permit insertion of a reinforcing bar.

5. The joist hanger of any of Claims 1-4 wherein at least one side plate has at least one tab extending perpendicularly outward from the side plate, with the plane of said at least one tab being coincident with the plane of the vertical leg.

6. The joist hanger of any of Claims 1-5 wherein said joist hanger is fabricated from a material comprising galvanized steel.

7. The joist hanger of any of Claims 1-6 wherein said joist hanger is of unitary construction.

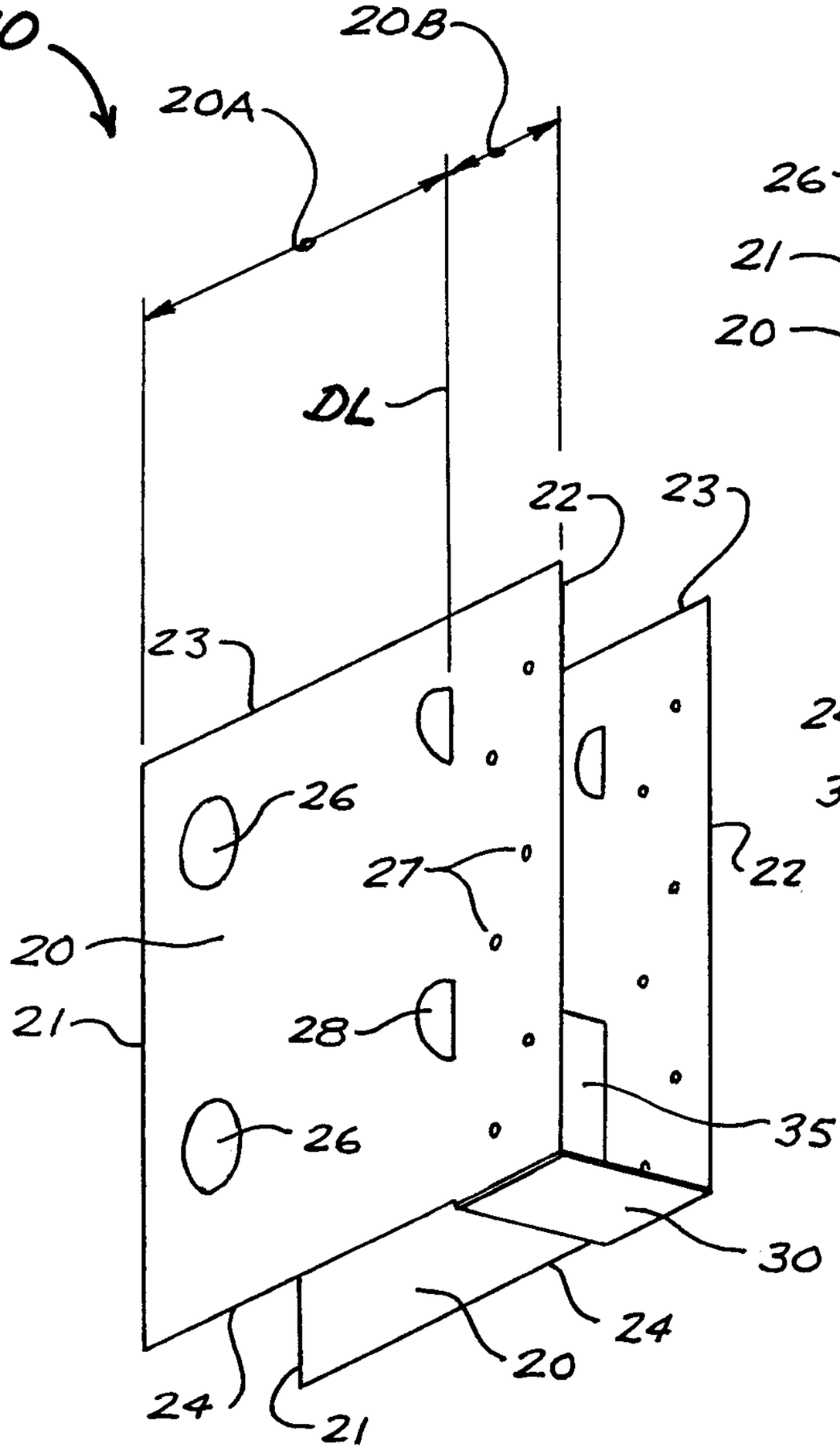

10
20A
20B
DL
22
23
23
26
27
22
20
21
28
26
35
30
24
20
24
21

FIG. 1

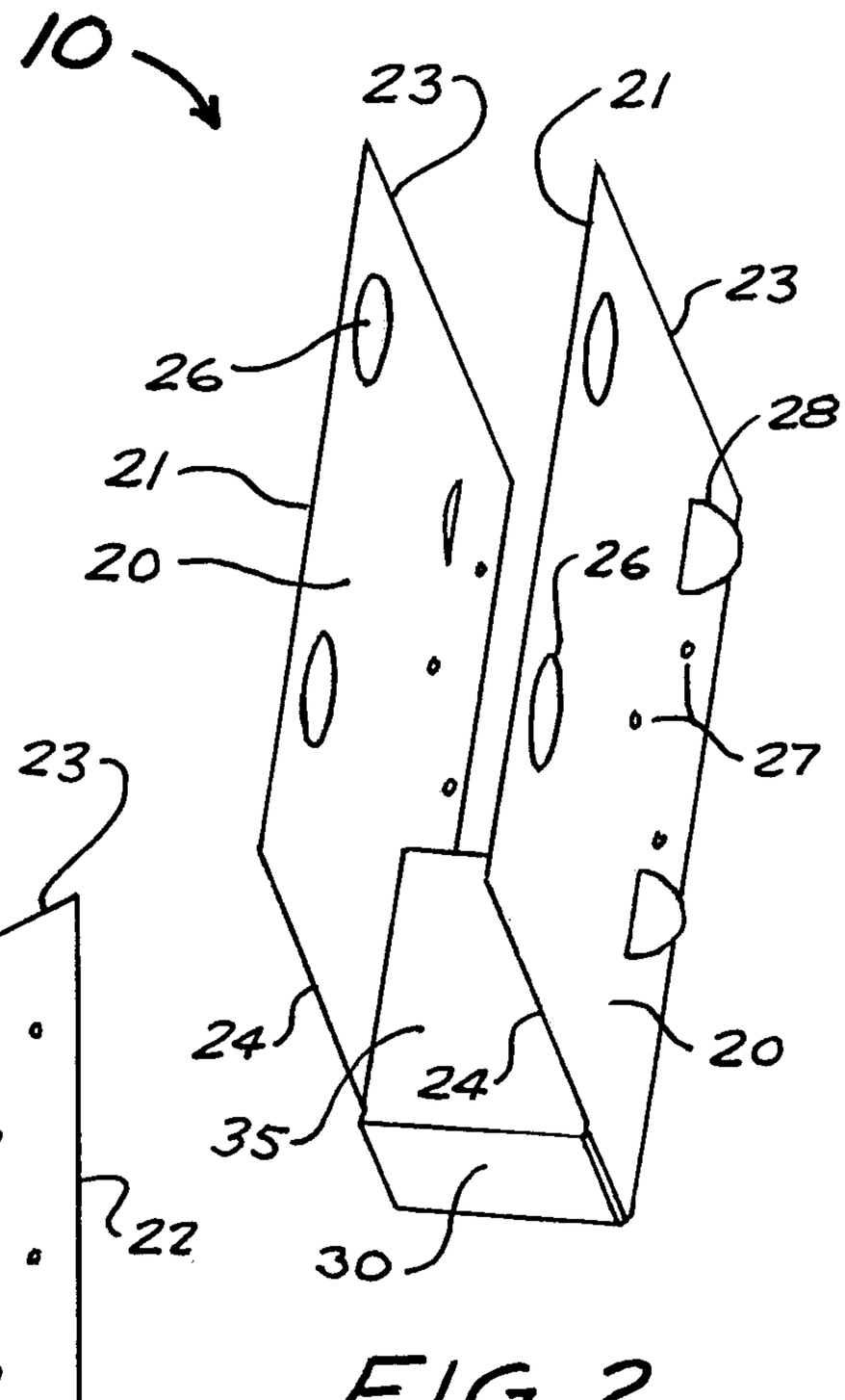

10
23
21
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26
28
21
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24
24
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35
30

FIG. 2

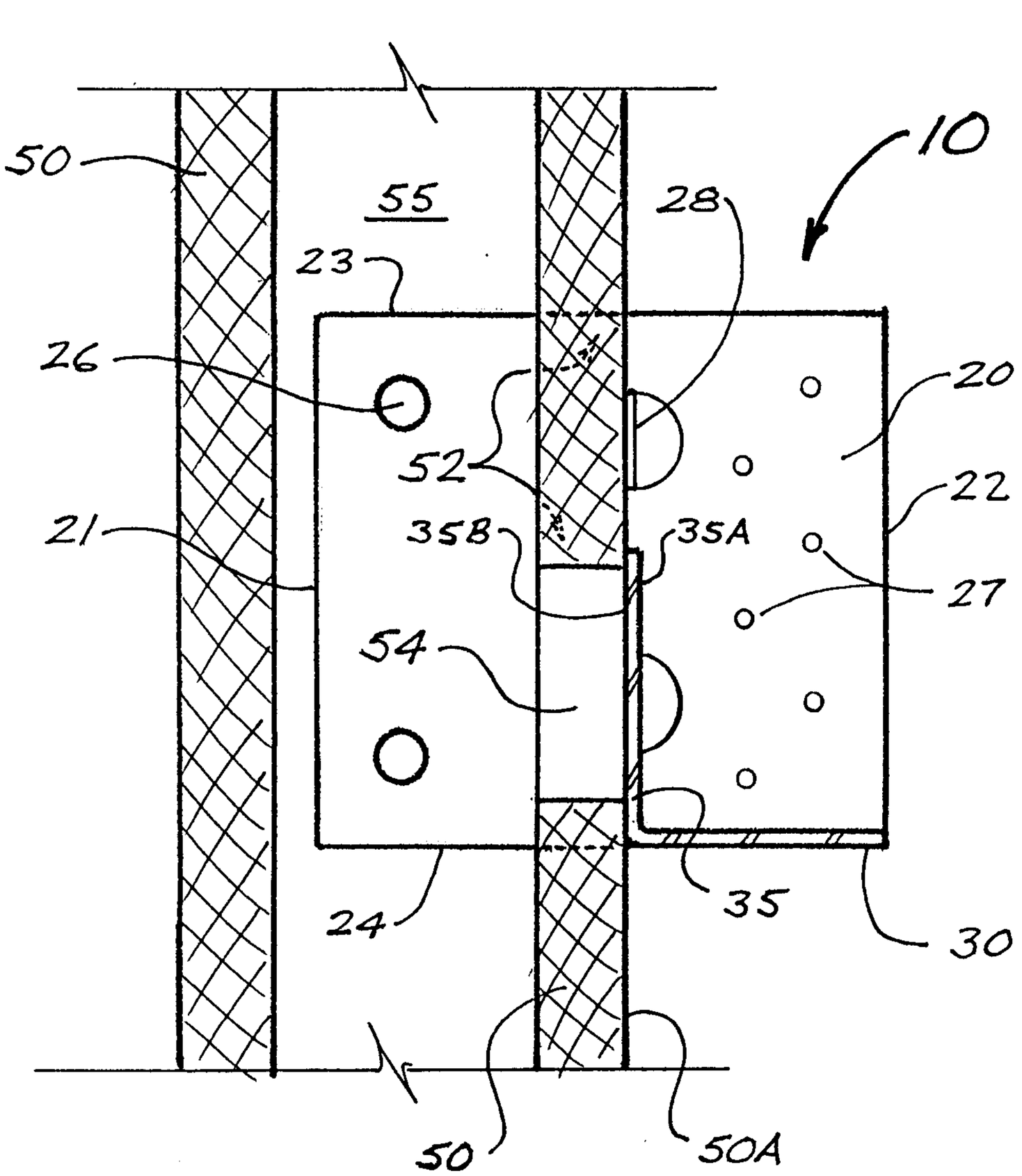


FIG. 3

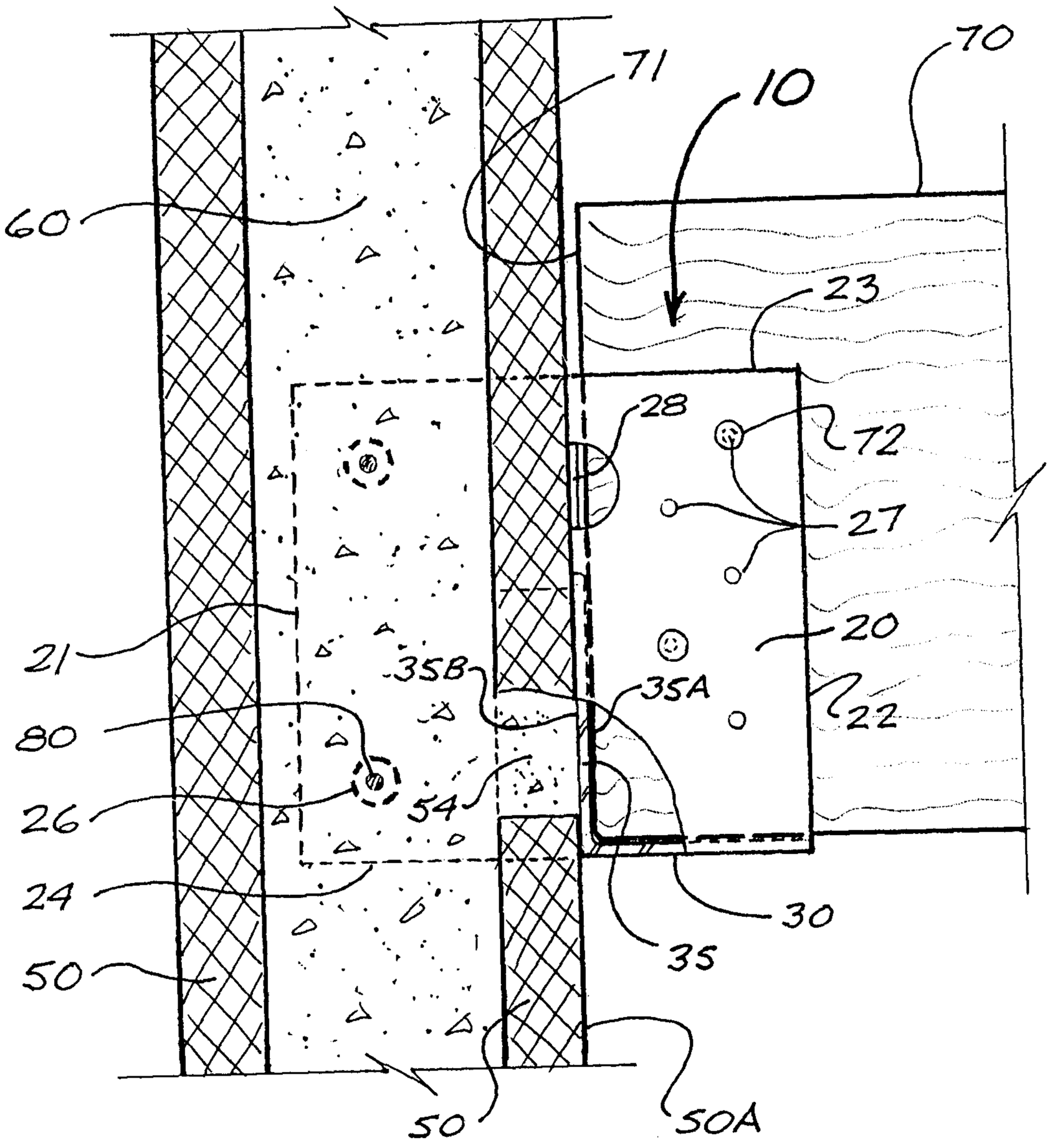


FIG. 4

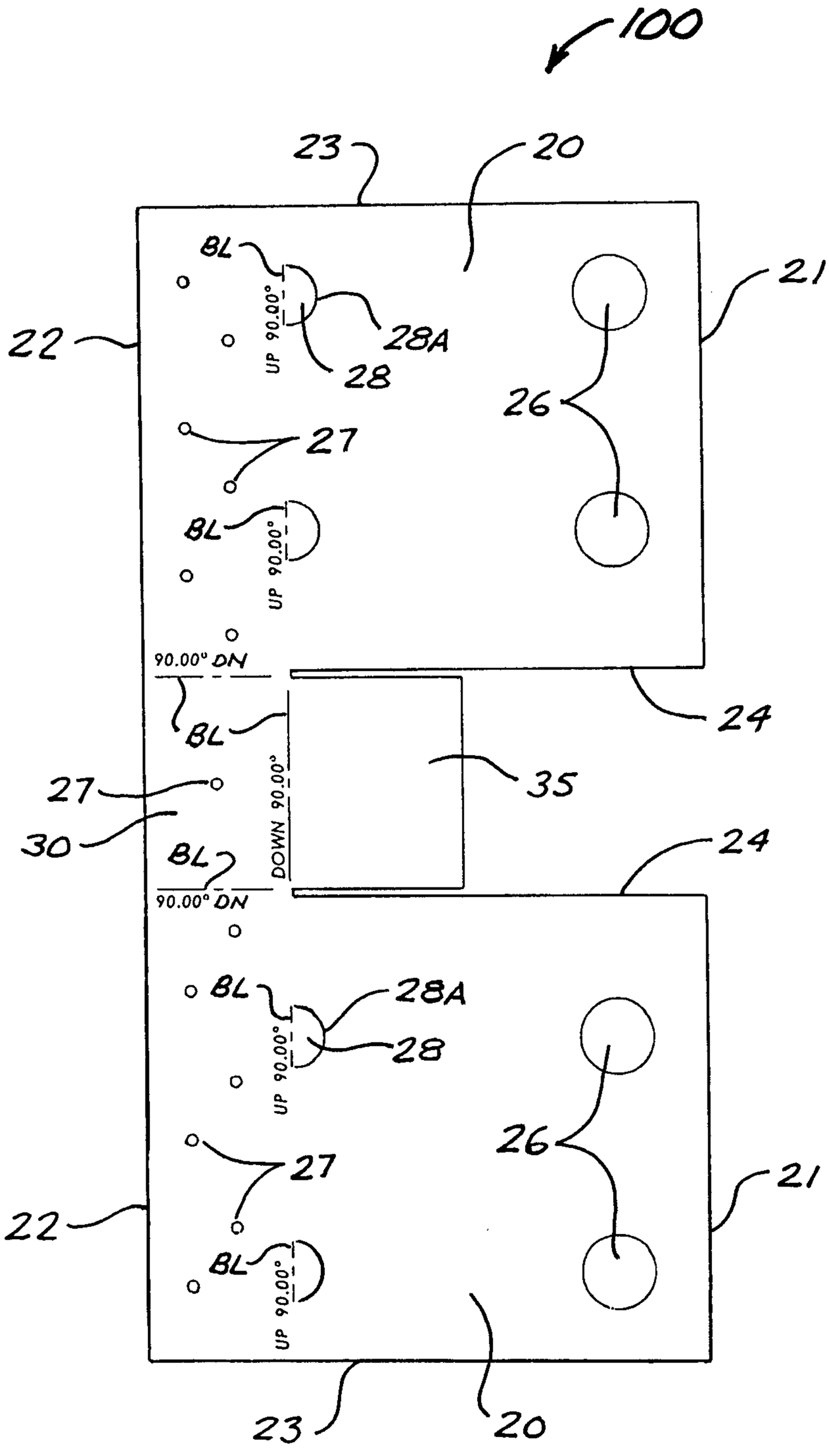
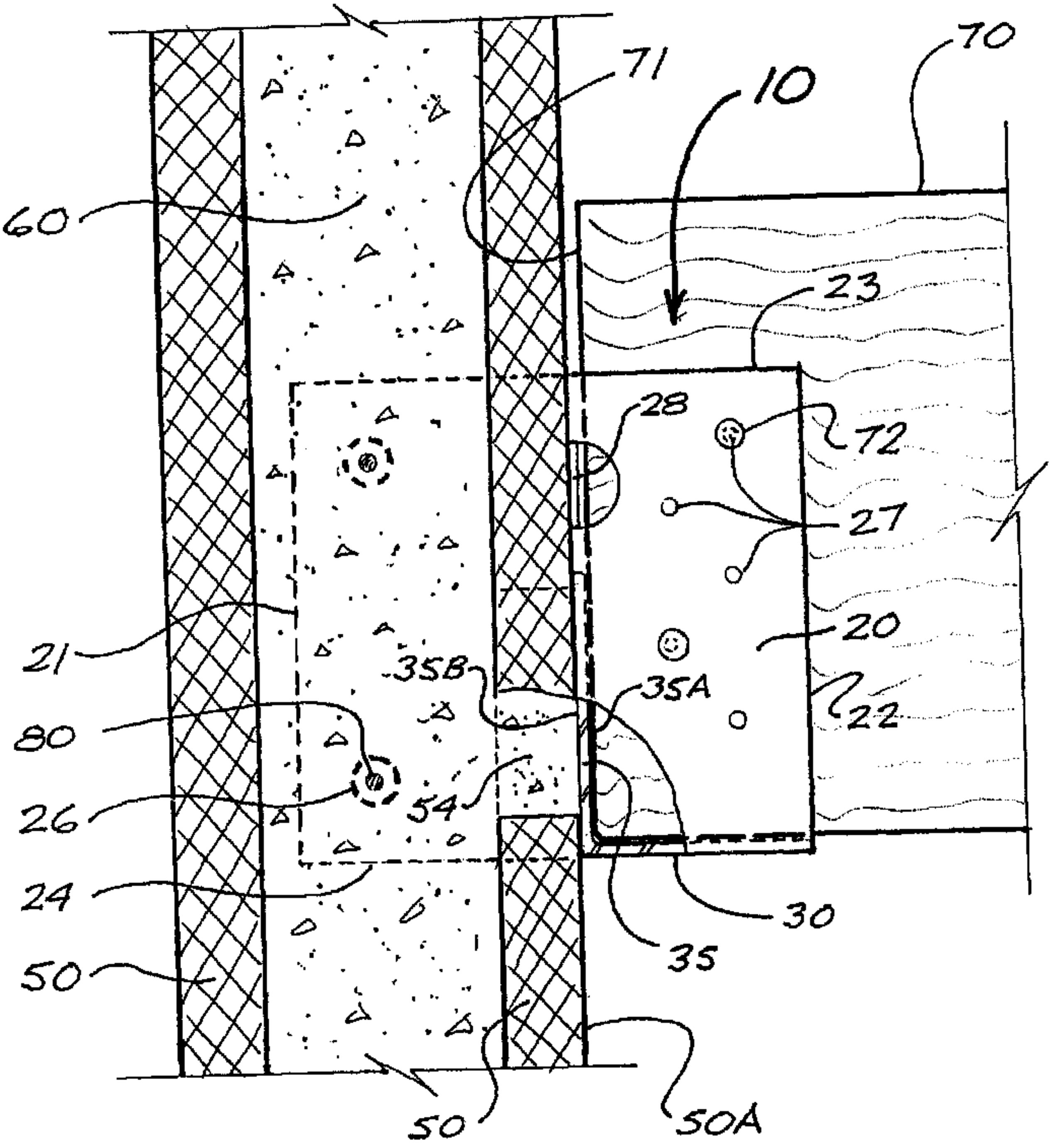

100
23
20
BL
UP 90.00°
28A
28
21
22
26
27
BL
UP 90.00°
90.00° DN
24
BL
DOWN 90.00°
35
27
30
24
BL
90.00° DN
BL
28A
UP 90.00°
28
26
27
21
22
BL
UP 90.00°
23
20

FIG. 5


70
71
10
60
23
28
72
27
20
21
35B
35A
22
80
26
54
24
30
50
35
50
50A