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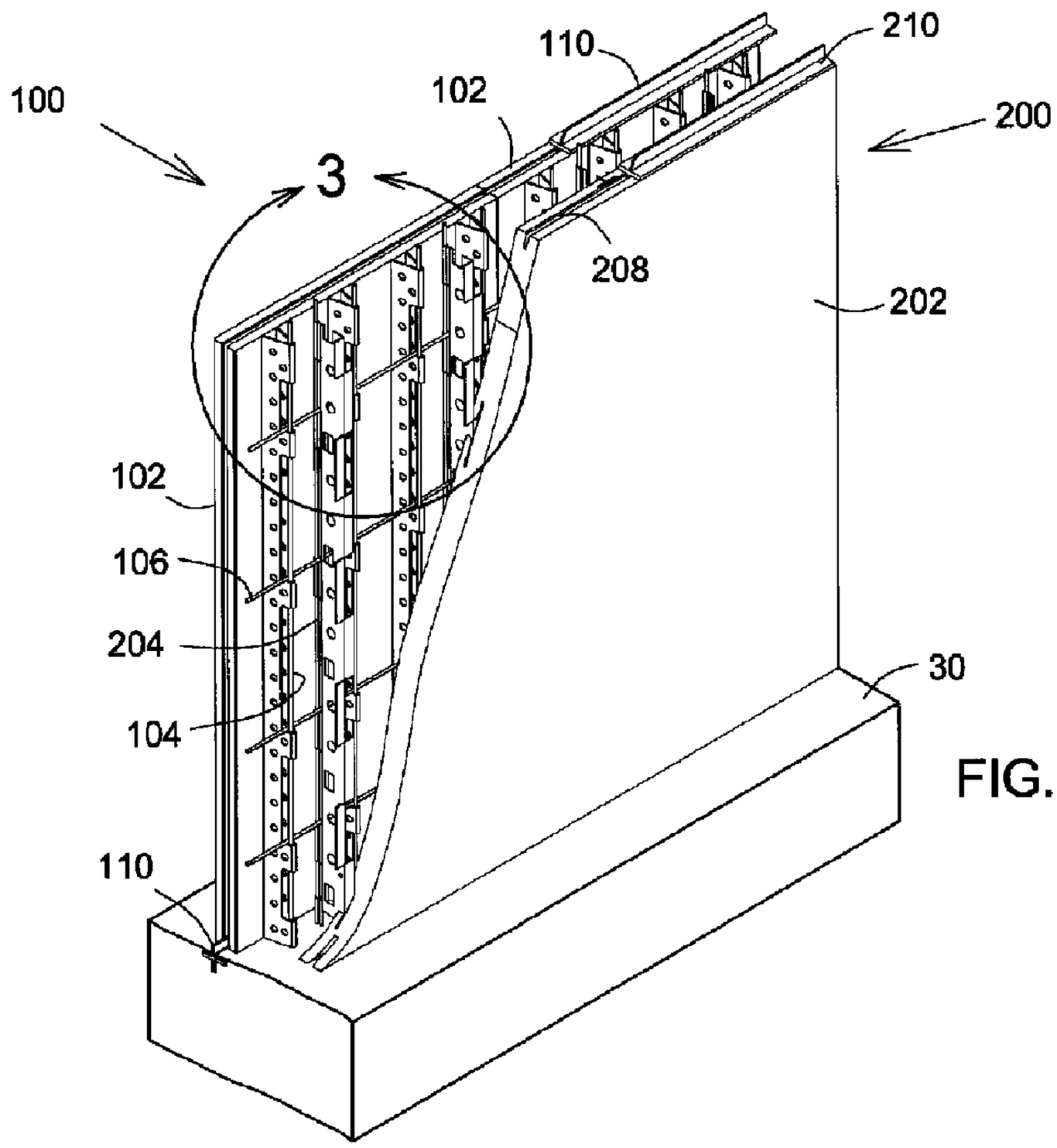

FIG.1

(57) Abrégé/Abstract:
A panel interlocking system (100) for locking a panel (102) to an opposite panel structure (202) via substantially vertical (104) and horizontal (106) rods positioned generally parallel to a plane defined by the panel (102) and to be embedded therewith within a filler

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(57) Abrégé(suite)/Abstract(continued):
material poured adjacent the panel (102) in a direction toward the panel structure (202). The system (100) includes at least one panel securing bracket (112) having a body (114) with a first end (116) for connecting to the panel (102) and a generally opposite second end (118) for connecting to the rods (104,106). The second end (118) has a rod opening (120) extending there through for receiving the vertical rod (104) therein and defines a rod abutting region (122) adjacent the rod opening (120) toward the first end (116) for abutment with the horizontal rod (106), such that the horizontal rod (106) abuts to and between the vertical rod (104) and a structure rod (204) to be interlocked there between for locking the panel (102) to the panel structure (202).

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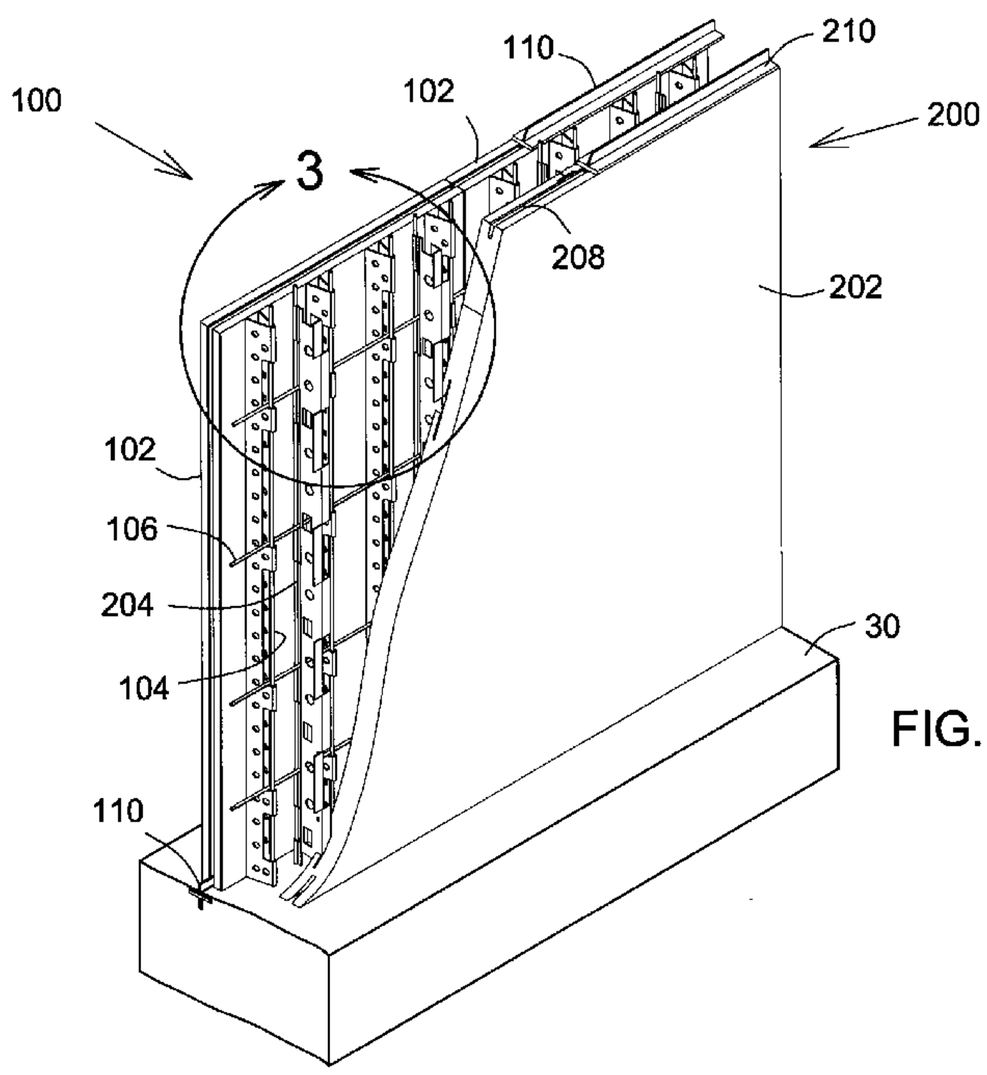

FIG.1

(57) **Abstract**: A panel interlocking system (100) for locking a panel (102) to an opposite panel structure (202) via substantially vertical (104) and horizontal (106) rods positioned generally parallel to a plane defined by the panel (102) and to be embedded therewith within a filler material poured adjacent the panel (102) in a direction toward the panel structure (202). The system (100) includes at least one panel securing bracket (112) having a body (114) with a first end (116) for connecting to the panel (102) and a generally opposite second end (118) for connecting to the rods (104,106). The second end (118) has a rod opening (120) extending there through for receiving the vertical rod (104) therein and defines a rod abutting region (122) adjacent the rod opening (120) toward the first end (116) for abutment with the horizontal rod (106), such that the horizontal rod (106) abuts to and between the vertical rod (104) and a structure rod (204) to be interlocked there between for locking the panel (102) to the panel structure (202).

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PANEL INTERLOCKING SYSTEM

FIELD OF THE INVENTION

The present invention relates to composite paneling and the forming of concrete walls, and more specifically to an interlocking system for securing forming panels to a panel facing structure via orthogonal rods that remain within the filler material as reinforcing structure.

BACKGROUND OF THE INVENTION

It is well known in the art to have forming panels made out of wood or other type material that are typically removed after the concrete has dried. Alternatively, the panels may be of polystyrene material or the like foam type materials that typically remain part of the wall construction (stay-in-place type form) along with the concrete to provide some insulation. To this end a plurality of intermediate bridging web structure pieces, typically made out of metallic or plastic type material, allow for relatively quick and adjustable assembly of the panels to each other, adjacent panels as well as facing panels. Rebars are typically added to increase the structural characteristics of the wall.

Concrete walls are formed by pouring concrete between forms facing each other with rebars (horizontal and vertical) in-between for the construction of buildings /houses. In this case the forms are typically removed after the concrete is cured /dried.

In the case the forms are not removed they are of the stay-in-place form type such as those found in ICF (insulated concrete form) systems. Many types of insulated forms are on the market and three main types are found, Lego™ type blocks, planks and narrow panels.

Systems to link two opposite panels together allow for a gap between two such panels. This gap or void is being filled with a filler material made of one or more components usually in a liquid, semi liquid or paste like material that hardens to

become a solid after the cure is completed. The solid can be a foam type material. Once it solidifies the result is a composite wall where the two panels facing each other are part of the resulting wall with the linking rods embedded inside.

In conventional reinforced concrete structure such as a wall the reinforcement is achieved with horizontal and vertical rebars, these rebars are held together with wire tied around both bars at a certain angle relative to each other.

Some devices or parts of these wall structures are discrete and made of steel or plastic while other linking system accomplishing the same purpose are not wire made but are built more like a cage such as in US Patent No. 7,143,563 where once the bar is inserted either parallel wise or at a 90 degree angle relative to each other, a sliding cap is put on to close the cage and locks the bars together. US Patent No. 5,893,252 shows a plastic support where bars are positioned at a 90-degree angle relative to each other, the top bar is then locked thanks to two clips pivoting over the top bar and encapsulating said bar.

Preformed permanent opposite panels attached to each other via vertical rods are found in US Patent Application No. 10/506,465 published on September 22, 2005 under publication No. 2005/0204695A1, but do not allow for horizontal rods to be inserted for interconnection purposes. Since the panels are molded, they are expensive to manufacture and limited to relatively small sizes, and the use of these panels is usually too limiting in term of wall dimensions with no flexibility in that respect.

In the case of a liquid becoming a solid foam, the expansion of the foam will exert a pressure that will push apart the two facing panels, the spreading apart of the panels is restrained by the interlocking device composed of the grid made by the horizontal and vertical bars or rods.

In the case of concrete walls, the concrete is poured between the panels (forms), and the hydrostatic pressure of the liquid or paste like mixture pushes apart the forms.

Some examples of such foam panel structures are found in US Patent Nos. 3,788,020; 4,574,550; 4,730,422; 4,889,310; 6,240,692; 6,247,280; 6,935,081; and 7,082,732.

Although the insulation panel systems provide some advantages over more conventional removable wooden plank systems, they do suffer from a plurality of drawbacks such as the lack of versatility, the relatively high material cost, the long and costly (labour) assembly time, non-uniform spacing between adjacent rebars (both horizontal and vertical), relatively susceptible to blow out (thereby the need for extensive retaining structure system), small panels that need to be covered for protection and/or finishing, etc.

Accordingly, there is a need for an improved panel interlocking system.

SUMMARY OF THE INVENTION

It is therefore a general object of the present invention to provide an improved panel interlocking system that obviates the above-mentioned problems.

An advantage of the present invention is that the panel interlocking system provides permanent forms or panels linked from the inside with a device tying the bars together all in one system.

An advantage of the present invention is that the panel interlocking system allows for any size panels to be easily secured to a facing panel structure using orthogonal rods, bars, rebars or the like of any cross-sectional shape.

Another advantage of the present invention is that the panel interlocking system allows for the panels to be pre-assembled with securing brackets before installation with other panels or panel structure, to save on-site working time.

A further advantage of the present invention is that the panel interlocking system provides easy customization of the panel and/or bracket types that may be different than the facing panel, the panel may also be removable for finishing directly on the concrete wall or change the panel type after hardening of the filler material such as the drying of the concrete or the like.

Still another advantage of the present invention is that the panel interlocking system allows for simple and rapid installation.

Another advantage of the present invention is that the panel interlocking system is easily adaptable to existing structures for wall repairs and/or insulation.

One of the advantages of the present invention is to have a link between orthogonal bars relative to each other to form a grid. The grid system can then be linked to the two panels facing each other also called forms. In the case of an existing wall, only one panel may be used to create a space between the existing wall and said panel. With either the panels facing each other or a panel facing an existing vertical wall, and the bar system in between; this panel locking system permits a positioning and an interlocking between bars and facing panels, the space between the two vertical surfaces can be filled with a filler material made of one or more compound with a predetermined curing time varying according to the nature of these compounds and their additives. Once completely cured the assembly becomes one monolithic block commonly called a sandwich wall or panel.

The present invention also advantageously allows the manufacturing of composite paneling, i.e. two panel (thin skin) linked together from the inside via a grid made of vertical and horizontal rods, with the gap between the two skins being filled with a polyurethane like liquid that foams to form a solid. The expansion of the foam spreads the two skins apart and exerts a pressure at the knots between vertical and horizontal rods. These composite panels can be used as a stand alone wall for separation of open offices or can be used as non-bearing wall in a building /house.

Furthermore, the present invention permits a positioning and locking of the rebars usually positioned at a 90-degree angle between each other, this grid is either self-attached to one form forming one side of a panel or attached to two forms facing each other with a variable gap there between, which determines the thickness of the panel. This present system can use insulated forms or not and the forms typically stay in place, and can apply to other medium than concrete to be poured, injected, and foamed between two panels to form then a

composite paneling system. An advantage of the present invention resides in the positioning and linking of the rebar which constitutes a mesh or trellis system for the reinforcement of concrete.

Advantageously, the permanent form of the present invention can be made of a thin concrete panel, steel, plastic, reinforced polypropylene, glass and/or carbon fiber, etc. or even a combination of several different materials. And the bars can have any section and be of any material.

Another advantage of the system over ICF is that if it is only insulated on the outside of the wall, which is the side exposed to the elements of nature, the inside of the building can make full use of the thermal mass of the concrete wall.

Yet another advantage of the present invention is that panel connectors can be moulded while the extruded panels can be pierced or perforated.

A further advantage of the present invention is that it enables production of a wall with shotcrete on one or both sides, such as used for separation walls (with good sound insulation) between adjacent lands or properties.

Another advantage of the present invention is that it can be used where an existing wall (usually old foundation wall) is to be refurbished and may act as a form; the present interlocking system therefore including the opposite form.

When used below grade, a further advantage of the present invention is that panels, when covered with fiber glass, act as a waterproof skin on top of the extruded polystyrene, there is no need to put an additional water proof membrane afterward. Only a narrow sealing membrane on the joints between adjacent panels and at the junction between panels and footings may complete the installation.

Yet another advantage of the present invention is that it allows for a precise positioning of the rebar grid. All outside panels are placed on the perimeter with bracing, then positioning of the horizontal and vertical rebars, followed by the placement of inside panels just after cleaning of footings. A short time between installing inside panels and pouring of concrete minimizes the chances of further

contamination of bottom of concrete footings, which further allows for a better bond between concrete wall and footing, with no cold joints.

According to a first aspect of the present invention, there is provided a panel interlocking system for locking a panel to an opposite panel structure, the system being adapted to connect to substantially orthogonal first and second rods positioned generally parallel to a plane defined by the panel, and to be embedded therewith within a filler material poured adjacent the panel in a direction toward the panel structure, the system comprising at least one panel securing bracket having a body with a first end for connecting to the panel and a generally opposite second end for connecting to the orthogonal rods, the second end having at least one first rod opening extending therethrough for slidably receiving the first rod therein, the second end defining a second rod abutting region adjacent the at least one first rod opening in a direction toward the first end for being in abutment contact with the second rod, whereby the second rod being adapted to be in abutment contact to and between the first rod and a structure rod so as to be interlocked therebetween for locking the panel to the panel structure.

In a second aspect of the present invention, there is provided a panel interlocking system for attachment to an opposite panel structure, the system comprising:

- a panel for locking to the panel structure;
- at least one first rod and at least one second rod, substantially orthogonal to each other, positioned generally parallel to a plane defined by the panel; and
- at least one bracket having a body with a first end connecting to the panel and a generally opposite second end connecting to the orthogonal rods, the second end having at least one first rod opening extending therethrough for slidably receiving the first rod therein, the second end defining a second rod abutting region adjacent the at least one first rod opening in a direction toward the first end for being in abutment contact with the second rod, the second rod being adapted to be in abutment

contact to and between the first rod and a structure rod so as to be interlocked therebetween for locking the panel to the panel structure, whereby at least one bracket, the first and second rods and the structure rod being adapted to be embedded within a filler material poured adjacent the panel in a direction toward the panel structure.

In a further aspect of the present invention, there is provided a method for interlocking a panel to an opposite panel structure, said panel connecting to a first end of a body of at least one bracket, the bracket having a generally opposite free second end, said method comprising the steps of:

- positioning the panel in a face-to-face configuration with the structure panel, with the at least one bracket extending toward the panel structure;
- slidably engaging, in a first direction generally parallel to a plane defined by the panel, a first rod into at least one first rod opening extending through the second end;
- engaging, in a second direction substantially perpendicular to the first direction and generally parallel to the panel plane, a second rod in abutment contact with a second rod abutting region adjacent the at least one first rod opening, said second rod being located adjacent said first rod between said first rod and said panel; and
- slidably engaging, in a direction substantially parallel to the first direction, a structure rod into at least one rod receiving structure bracket, said second rod being adapted to be in abutment contact to and between the first rod and the structure rod so as to be interlocked therebetween for locking the panel to the panel structure.

Other objects and advantages of the present invention will become apparent from a careful reading of the detailed description provided herein, with appropriate reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Further aspects and advantages of the present invention will become better understood with reference to the description in association with the following Figures, in which similar references used in different Figures denote similar components, wherein:

Figure 1 is a perspective view of panel interlocking systems in accordance with embodiments of the present invention;

Figure 2 is a partially broken enlarged top view of the embodiments of Fig. 1;

Figure 3 is a partially broken enlarged perspective view taken along line 3 of Fig. 1;

Figure 4 is a perspective view of other embodiments of panel interlocking systems in accordance with the present invention;

Figure 5 is a partially broken enlarged top plan view of the embodiments of Fig. 4;

Figure 6 is a partially broken enlarged perspective view taken along line 6 of Fig. 4;

Figure 7 is a perspective view of other embodiments of panel interlocking systems in accordance with the present invention;

Figure 8 is a partially broken enlarged top plan view of the embodiments of Fig. 7;

Figure 9 is a partially broken enlarged perspective view taken along line 9 of Fig. 7;

Figure 10 is a perspective view of another embodiment of a panel interlocking system in accordance with the present invention;

Figure 11 is a broken enlarged side elevation view of the embodiment of Fig. 10;

Figure 12 is a partially broken enlarged perspective view taken along line 12 of Fig. 10;

Figure 13 is a perspective view of other embodiments of panel interlocking systems in accordance with the present invention;

Figure 14 is a partially broken enlarged top plan view of the embodiments of Fig. 13;

Figure 15 is a partially broken enlarged perspective view taken along line 15 of Fig. 13;

Figure 16 is an enlarged partially broken sectioned perspective view of a bracket fastener connected to the panel of the embodiment of Fig. 13;

Figure 17 is a view similar to Fig. 16 showing another fastener-panel connection type;

Figure 18 is an enlarged partially broken section view of a double bracket fastener connected to an intermediate panel as in Fig. 23;

Figure 19 is another embodiment of a panel interlocking system, similar to one of the embodiments of Figure 13;

Figure 20 is a view similar to Figure 15 showing the embodiment of Figure 19;

Figure 21 is a partially broken top plan view of other embodiments of panel interlocking systems in accordance with the present invention;

Figure 22 is a partially broken side elevation view of the embodiments of Fig. 21;

Figure 23 is a perspective view of other embodiments of panel interlocking systems in accordance with the present invention; and

Figure 24 is a partially broken enlarged top plan view of the embodiments of Fig. 23.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

With reference to the annexed drawings the preferred embodiments of the present invention will be herein described for indicative purpose and by no means as of limitation.

Reference is now made to Figures 1 to 3, which show two embodiments 100, 200 of panel interlocking system in accordance with the present invention for locking a respective panel 102 or panel structure to an opposite panel structure, namely the facing panel 202 in this case; an opposite panel structure can also be an intermediate wall structure, an existing wall or the like. Each system 100, 200 is adapted to connect to substantially orthogonal linking rods 104, 106, 204, bars, rebars (reinforcing bars) or the like elongated piece, namely respective generally vertical first rods 104, 204 and common second generally horizontal rods 106, with all first and second rods being positioned generally parallel to a plane defined by the panels 102, 202. The orthogonal rods 104, 106, 204 are adapted to be embedded therewith within a filler material such as concrete or the like hardening or drying mixture (not shown) that will be poured adjacent and in-between the panels 102, 202, i.e. in a direction toward the facing panel relative to each panel.

Each panel 102, 202 used as a form for a concrete wall may include elongated channels 108, 208 extending along predetermined sides of the panel 102, 202 for receiving elongated panel linking members 110, 210, in the form of '+' shape cross-section bars or the like, to be positioned between adjacent panels (top side, bottom side and/or lateral sides) or even partially pre-embedded into a concrete footing 30 for location and securing of the panel 102, 202 thereon, as shown in Figure 1.

As shown more specifically in Figures 2 and 3, each system 100, 200 includes at least one, preferably a plurality of panel securing brackets 112, 212. Each bracket 112, 212 has a body 114, 214 with a first end 116, 216 connecting to the panel 102, 202 and a generally opposite second end 118, 218 connecting to the orthogonal rods 104, 106, 204. The second end 118, 218 has at least one first rod opening 120, 220 extending there through for slidably receiving the respective vertical first rod 104, 204 therein and to keep the vertical rod 104 at a predetermined distance from the panel 102 while preventing it from moving away therefrom, and defines a second rod abutting region 122, 222 adjacent the first rod opening 120, 220 in a direction toward the first end 116, 216 adapted to be in abutment contact with the common respective horizontal rod 106, such

that the horizontal rod 106 is so positioned to be in abutment contact to and between the respective vertical rods 104, 204 and therefore interlocked there between to lock the facing panels 102, 202 to each other, especially when the concrete is being poured between the two facing panels.

In the first embodiment 100, the body 114 has a generally V-shape, such as a folded plate or the like, defining an open end 116 and an opposite closed end 118 forming the first and second end respectively. The open end 116 is secured to the panel 102 by welding, bonding, embedded in a thin concrete or foam panel or the like fastening mechanism known in the art, which depends on the panel and/or bracket materials, or may even include folded ear pieces (not shown) to abut against and secured the panel internal surface, and the closed end 118 is essentially rounded to form the first rod opening.

Furthermore, in the first embodiment 100, the folded elongated plate 114 defines a plurality of said brackets 112 positioned in an end-to-end configuration with all the respective first rod openings 120 being in register with each other for slidably receiving a common vertical rod 104 therein. The closed end 118 of the elongated plate 114 includes a plurality of cutouts 124 extending from the second end 118 toward the first open end 116, with each cutout 124 spacing adjacent first rod openings 120 from one another and defining the respective second rod abutting region 122 that abuttingly support the respective horizontal rod 106.

The bottom surface of each cutout 124 (cutout depth) defines a back ridge 126 that extends substantially perpendicularly to the direction extending between the bracket first 116 and second 118 ends and faces toward the second end 118. The ridge 126, being part of the horizontal rod abutting region 122, is also used to be in abutment contact with the horizontal rod 106 to substantially retain the same against, typically in abutment contact, with the first rod 104 positioned through the first rod opening 120.

In the second embodiment 200, the body 214 of each bracket 212 is made out of a plate having its first end 216 folded substantially orthogonally relative to the plate 214 for securing to the panel 202 by sliding into a corresponding T-shape

channel 228 extending along the panel 202. The plate 214 has its second end 218 arcuately folded to form a saddle facing toward the first end 216 and defining the first rod opening 220 for slidably receiving the vertical rod 204 therein. The saddle 220 typically extends over at least an angle of about 270 degrees for defining an almost closed first rod opening and properly retaining the rod 204 therein.

Typically, as shown in Figures 1 and 3, the plate 214 defines a plurality of brackets 212 being positioned in an end-to-end configuration with all the first rod openings 220 being in register with each other for slidably receiving the common vertical rod 204 therein. Similarly to the above first embodiment 100, the plate 214 includes a plurality of cutouts 224 extending from the second end 218 toward the first end 216, and defining adjacent first rod openings 220. Each cutout 224 defines a respective second rod abutting region 222 to support in abutment the respective horizontal rod 106, along with a back ridge 226.

Furthermore, the first ends 216 of the plate 214 are folded orthogonally relative to the plate in an alternating configuration, in opposite directions, either between adjacent brackets 212 or between each bracket 212 and adjacent bracket spacing sections of the plate 214. This alternating configuration of folded first ends 216 allows the plate 214 to fully engage the corresponding T-shape channel 228.

For the assembly of the two panel interlocking systems 100, 200 to each other, the first panel 102 is installed onto its supporting surface 30 (footing for example), and the horizontal rods 106 are then slidably inserted onto the corresponding rod abutting regions 122 of the brackets 112 extending from the first panel 102. The first vertical rods 104 are then slidably inserted into the corresponding first rod openings 120 of the brackets 112 in front of the horizontal rods 106 to lock the latter in place between the vertical rods and the panel. It is noted that the vertical rods 104 could alternatively be installed prior to the horizontal rods 106. Subsequently, the second panel 202 is installed facing the first panel 102 with the first rod openings 220 of the brackets 212 extending beyond the horizontal rods 106 to allow insertion of the vertical rods 204 of the second panel 202 to be slidably inserted into the corresponding first

rod openings 220 and to be locked between the horizontal rods 106 and the first panel 102, to interlock the two panels 102, 202 to each other.

Alternatively, if there is enough access from the sides of the panel systems 100, 200, the first 102 and second 202 panels could be installed with their respective vertical rods 104, 204 before slidably inserting the interlocking horizontal rods 106 between the vertical rods 104 of the first panel 102 and those 204 of the second panel 202, to lock the vertical rods 104, 204 of one panel 102, 202 between the horizontal rods 106 and the facing panel 202, 102.

Now referring more specifically to Figures 4 to 6, two other embodiments 300, 400 of the panel interlocking system in accordance with the present invention are interlocked to each other, with respective vertical 304, 404 and horizontal 306, 406 rods, via an embodiment 90 of an intermediate panel structure allowing for a thicker concrete wall. In such a case, each panel 302, 402 is interlocked with the intermediate structure 90 in a similar way they would directly interlock to one another, which is essentially the same interlocking system as hereinabove described for the first two embodiments 100, 200. The intermediate structure 90 is typically formed of a plurality of vertical members 92 with corresponding vertical rods 304', 404', each member 92 defining a plurality of securing brackets 312', 412' having similar characteristics (first rod opening, second rod abutting region, etc.) than the second ends 118, 218 of the above-described brackets 112, 212.

In the third embodiment 300, a plastic type material plate 314 forms a plurality of registered securing brackets 312 in which the first end 316 substantially has a T-shape for slidably engaging a corresponding T-shape channel 328 extending along the panel 302 or along a side surface thereof, similar to the above second embodiment 200.

In the fourth embodiment 400, the preferably plastic type material plate 414 forming a plurality of registered securing brackets 412 includes a shoulder 430 formed at the first end 416 to be in abutment contact with an edge 432 of the surface 403 of the corresponding panel 402 facing the intermediate structure 90. Although not shown, the panel 402 is temporarily secured to the plate 414

for easy removal after the concrete has dried (typically facilitated using known in the art release agent covering the surface of the removable panel facing the concrete), and replacement by another wall finish (not shown).

It is noted that in both embodiments 300, 400, each bracket 312, 412 has the second end 318, 418 and the first rod opening 320, 420 and the second rod abutting region 322 are also similar to the above second embodiment 200.

Now referring more specifically to Figures 7 to 9, another embodiment 500 of the panel interlocking system in accordance with the present invention has its panel 502 interlocked to a second embodiment 90a of an intermediate panel structure. In the fifth embodiment 500, the body 514 is made out of a rigid wire shaped to form a plurality of V-shape brackets 512, similar to those 112 of above first embodiment 100, positioned in a side-by-side configuration with two adjacent V-shape brackets being spaced apart from one another by a respective wire spacing segment 534 (shown in dotted lines in Figure 8). The wire 514 forms a plurality of second rod abutting regions 522 for being in abutment contact with a common horizontal rod 506, and each first rod opening 520 slidably receives a respective vertical rod 504 therein. The spacing segments 534 of the wire 514 are securable to the panel 502, and are preferably embedded within the panel 502, such that only the V-shape brackets 512 protrude out of the panel 502 for connection to the rods 504, 506.

The system 500 typically includes a plurality of folded rigid wire 514 positioned in a side-by-side configuration with each V-shape bracket 512 being in register with a corresponding V-shape bracket 512 of each wire 514 such that all registered second end openings 520 are adapted to slidably receive a respective vertical rod 504 therein. The plurality of rigid wires 514 are typically secured to each other via a plurality of cross bars 536 spaced apart from one another, with the rigid wires 514 and the cross bars 536 forming a folded wire mesh 538 together.

As better shown in Figure 8, at least one, preferably two cross bars 536 are located adjacent each bracket closed second end 518 of registered V-shape brackets 512 to being in abutment contact with corresponding horizontal rods

506 when they are in abutment contact with the vertical rods 504 positioned through corresponding first rod openings 520, and typically form the back ridges 526.

In Figures 7 to 9, the intermediate structure 90a is a similar folded wire mesh than the above fifth embodiment 500 with accordion type shape horizontal wires 94 positioned in a side-by-side configuration and attached to each other via vertical cross bars 96. The accordion type shape wires 94 form alternating second end openings 98 to receive respective vertical bars 504', with the cross bars 96 typically forming corresponding back ridges 99 to abut the respective horizontal rods 506, 506'.

Now referring more specifically to Figures 10 to 12, another embodiment 600 of the panel interlocking system in accordance with the present invention is shown. This sixth system 600 includes a plurality of independent brackets 612 each having a generally T-shaped first end 616 adapted to slidably engage corresponding T-shape channel 628 formed along the panel 602. Each bracket 612 is typically spaced from the adjacent two brackets 612 engaged into the same channel 628 by generally elongated corresponding bracket spacers 640 located therebetween and, preferably, also slidably engaging the same channel 628.

The abutting region 622 of the bracket 612 forms a recessed seat 642 that essentially helps positioning and prevents sliding of the horizontal rod 606 thereon, which proves useful when the horizontal rods 606 are installed prior to the vertical rods 604.

Typically, the bracket 612 further includes a top portion of the vertical rod opening 620 that is a countersunk through hole 644 quite helpful for guiding the corresponding vertical rod 604 when slidably inserting the vertical rod 604 therein, usually from the top toward the bottom.

Optionally, the bracket 612 includes a channel 646 extending transversally through the body 614 and located between the first 616 and second 618 ends to guide and position a generally horizontal elongated member 648, such as a

plumbing pipe, an electrical conduit or wire(s), a hollow pipe or the like, that is abuttingly supported therein.

Referring more specifically to Figure 12a, the abutting region 622 of the bracket 612 alternatively includes a generally angled segment 641 relative to a direction perpendicular to the panel plane and downwardly toward the bracket first end 616 for abuttingly receiving the horizontal rod 606 thereagainst. The angled segment 641 also essentially helps the positioning of the horizontal rod 606 thereon against the back ridge 626 and prevents sliding of the rod 606, which proves useful when the horizontal rods 606 are installed prior to the vertical rods 604.

Now referring more specifically to Figures 13 to 15, other embodiments 700, 800 of the panel interlocking system in accordance with the present invention are shown. This seventh system 700 includes a plurality of independent brackets 712 each a first end 716 with a first end surface 750 facing substantially away from the second end 718 for being in abutment contact with a surface 703 of the panel 702 facing the brackets 712 and the rods 704, 706.

The first end 716 typically includes at least one, preferably two bracket through openings 752 extending through said first end surface for receiving a fastener 754 therethrough for connection to the panel 702. To this end, as shown in Figures 16 and 17, the system 700 further includes the generally cylindrical fastener 754 that extends through a through bore 756 of the panel 702 and has a protrusion 758 extending out of the panel surface 703. The protrusion 758 generally defines a circumferential groove 760 adjacent the panel surface 703 such that the through opening 752 slidably engages the circumferential groove 760 via an opening mouth 752' for securing the bracket 712 to the panel 702.

In Figure 16, the fastener 754 typically includes a head 762 adapted to be in abutment contact with the opposite surface 705 of the panel 702 facing generally away from the bracket 712. Alternatively, the head 762 adapted to engage a counter bore 756' of the panel through bore 756 on the panel second surface 705 to allow the fastener head 762 to rest below, and preferably in register with, the panel second surface 705, as shown in Figure 17, such that

the surface 705 and heads 762 are then coverable by a fiberglass skin or the like.

Referring back to Figures 13 to 15, the bracket second end 718 has a U-shape with the base wall of the U-shape forming the back ridge 726 abuttingly receiving the horizontal rod 706, and one of the two, generally parallel, side walls of the U-shape forming the rod abutting region 722. At least one, preferably both side walls of the U-shape having the first rod openings 720 of the brackets 712 extending there through.

Furthermore, when a plurality of panels 702 are positioned side by side, a series of brackets 712 preferably secure to two adjacent panels 702, with each one of the bracket through openings 752 slidably engaging a fastener 754 of a respective adjacent panel 702, to retain the panels adjacent to one another. Such an interlocking system is essentially used on one side of the wall only since the assembly of brackets 712 on a second facing panel is more complex.

This eighth system 800 includes a plurality of independent plates 814 each including a plurality registered brackets 812. All bracket first ends 816 of a common plate 814 have an H-shape with each open cavity 864 of the H-shape being adapted to slidably receive a panel side edge. As illustrated, the panels 802, preferably forming an internal side of the concrete wall, are typically corrugated with horizontal corrugations (see Figure 13) to allow a thinner concrete wall for a same resistance and inwardly or internally curved (see Figure 14) to provide for empty spaces between the panels 802 and internal boards (such as plasterboards (known as Gyproc™ panel) or the like - not shown) to extend power grid wirings, plumbing hardware or the like (not shown) therein. The inward curve of the panels 802 allow to transfer the outward load from the concrete to the plates 814 that are retained to the horizontal rods 706 and the back panels 702 via vertical rods 804.

Figure 18 shows an alternate embodiment 754' of a fastener used with an intermediate panel structure (90d as shown in Figure 23) or panel and having one protrusion 758 with corresponding circumferential groove 760 extending from a respective surface of the panel structure 90d.

Now referring more specifically to Figures 19 and 20, another embodiment 700a of a panel interlocking system in accordance with the present invention is shown, which is similar to the seventh embodiment 700. The main difference is that the bracket 712a has a generally cylindrical-shaped body 714a with first end 716a that directly extends through the panel bore 756 and includes a head 762' to abut the panel opposite surface 705. Similarly to the fastener 754, the bracket 712a includes a circumferential groove 760a adjacent the panel surface 703 to allow a panel link (between adjacent bores 756 of adjacent panels 702) /stiffener bar 766 (between adjacent bores 756 of a same panel 702). Although not shown, such panel bar 766 could be angled to connect adjacent panels angled relative to one another. Each bracket second end 718a includes a diametric transversal channel 768 adapted to receive the horizontal rod 706a therein, and a first rod through opening 720a extending generally orthogonally to the channel 768 to slidably receive the vertical rod 704a therein.

Now referring more specifically to Figures 21 and 22, alternate embodiments 700b, 700c of the panel interlocking system 700 in accordance with the present invention are shown, in which the respective brackets 712b, 712c essentially differ from bracket 712 and are secured to corresponding vertical rods 704b, 704c and horizontal rod 706. Brackets 712b, 712c each are of a generally L-shape with the base wall of the L-shape forming the bracket first end 716b, 716c, and the free end of the elongated wall of the L-shape having the first rod opening 720 extending there through and the adjacent second rod abutment region 722 (bracket 712c only in this case) to form the bracket second end 718. The first end of the bracket 712b has an opening 752 with a mouth 752' to slidably engage the corresponding fastener 754 protruding from the panel 702b, similar to bracket 712. On the other side, the bracket 712c simply includes a through closed opening 752c adapted to be engaged by a screw-type fastener 754c or the like when the securing is done onto an existing wall 702c or the like (not accessible from both sides or simply too thick).

Now referring more specifically to Figures 23 and 24, another embodiment 90d of an intermediate panel structure using vertical members 92d similar to the members 92 of Figures 4 to 6 but having opposed longitudinal side channels 93

adapted to be engaged by a respective edge wall 42 of an adjacent intermediate panel 40. The intermediate panel 40 typically includes fasteners 754' slidably receiving brackets 712b (with a squared second end 718b), 712d on back and front side of Figure 23 respectively (or top and bottom side of Figure 24 respectively). Brackets 712d, of panel interlocking system 700d in accordance with the present invention, have a generally U-shape with the base wall of the U-shape forming the bracket first end 716d and having a through opening (not shown) with a side mouth (not shown) to engage the corresponding protrusion 758 of the fastener 754'. The brackets 712b, 712d and the vertical members 92d are in register with each other to connect to respective horizontal 706b, 706d and vertical 704b, 704d rods. This embodiment is the most suitable to use when shotcrete (concrete shot under pressure using a gun or the like) is considered, to form an insulated sandwich panel (not shown).

Depending on the type and material of the panel that is considered, the different components of the present panel interlocking system could be made out of numerous materials such as metal, plastic, or the like type materials using a wide variety of manufacturing processes.

All plates described hereinabove are typically weight relieved mainly to allow a better flow of concrete when poured thereon as well as a better adherence of the concrete onto the plate to preserve a unitary strong concrete wall.

Although the present invention has been described with a certain degree of particularity, it is to be understood that the disclosure has been made by way of example only and that the present invention is not limited to the features of the embodiments described and illustrated herein, but includes all variations and modifications within the scope and spirit of the invention as hereinafter claimed.

CLAIMS

1. A panel interlocking system (100) for locking a panel (102) to an opposite panel structure (202), said system (100) being adapted to connect to substantially orthogonal first (104) and second (106) rods positioned generally parallel to a plane defined by the panel (102), and to be embedded therewith within a filler material poured adjacent the panel (102) in a direction toward the panel structure (202), said system (100) comprising:

- at least one panel securing bracket (112) having a body (114) with a first end (116) for connecting to the panel (102) and a generally opposite second end (118) for connecting to the orthogonal rods (104,106), the second end (118) having at least one first rod opening (120) extending therethrough for slidably receiving the first rod (104) therein, the second end (118) defining a second rod abutting region (122) adjacent the at least one first rod opening (120) in a direction toward the first end (116) for being in abutment contact with the second rod (106), whereby said second rod (106) being adapted to be in abutment contact to and between the first rod (104) and a structure rod (204) so as to be interlocked therebetween for locking the panel (102) to the panel structure (202).

2. The system of claim 1, wherein said first end (716) includes a first end surface (750) facing substantially away from said second end (718) for being in abutment contact with a surface (703) of the panel (702).

3. The system of claim 2, wherein said first end (716) includes a through opening (752) extending through said first end surface (750) for receiving a fastener (754) therethrough for connection to the panel (702).

4. The system of claim 2, further including a generally cylindrical fastener (754) extending through a through bore (756) of the panel (702) and having a protrusion (758) extending out of said panel surface (703), said protrusion (758) defining a circumferential groove (760) adjacent the panel surface (703), wherein said first end (716) includes a through opening (752) slidably engaging said circumferential groove (760) via an opening mouth (752') for securing the bracket (712) to the panel (702).

5. The system of claim 4, wherein said cylindrical fastener (754) includes a head (762) adapted to be in abutment contact with a panel second surface (705) facing generally away from the bracket (712).

6. The system of claim 4, wherein said cylindrical fastener (754) includes a head (762) adapted to engage a counter bore (756') of the panel through bore (756) on a panel second surface (705) facing generally away from the bracket (712) so as to allow the fastener head (762) to rest below the panel second surface (705).

7. The system of claim 2, wherein said first end (712a) includes a generally cylindrical extension extending through a through bore (756) of the panel (702).

8. The system of claim 7, wherein said body (714a) is generally cylindrical in shape and includes said cylindrical extension, said first end (716a) including a head (762') adapted to be in abutment contact with a panel second surface (705) facing generally away from the bracket (712a).

9. The system of anyone of claim 7 or 8, wherein said cylindrical extension includes a circumferential groove (760a) adjacent a panel surface (703) facing toward said bracket second end (718a) for slidably receiving a reinforcing bar (766) therein.

10. The system of claim 1, wherein said body (114) has a generally V-shape defining an open end and an opposite closed end forming said first end (116) and said second end (118) respectively, said open end (116) being securable to the panel (102), said closed end (118) being rounded so as to form said first rod opening (120).

11. The system of claim 10, wherein said body (114) is made out of a plate folded to form the V-shape.

12. The system of claim 11, wherein said folded plate (114) defines a plurality of said bracket (112) being positioned in an end-to-end configuration with all said first rod openings (120) being in register with each other for slidably receiving the first rod (104) therein, said closed end (118) including a plurality of cutouts (124) extending from the second end (118) toward the first end (116), each said cutout (124) defining a respective said second rod abutting region (122) for being in abutment contact with a respective said second rod (106).

13. The system of claim 10, wherein said body (514) is made out of a rigid wire folded to form a plurality of said V-shape of said brackets (512) positioned in a side-by-side configuration with two adjacent said V-shapes (512) being spaced apart from one another by a respective wire spacing segment (534), the wire forming a plurality of said second rod abutting region (522) for being in abutment contact with the second rod (506), each said first rod opening (520)

being for slidably receiving a respective said first rod (504) therein, said spacing segments (534) of the wire (514) being securable to the panel (502).

14. The system of claim 13, wherein said spacing segments (534) of the wire are embedded within the panel (502), whereby said V-shapes (512) protrude out of said panel (502) for connecting to the first (504) and second (506) rods.

15. The system of claim 13, including a plurality of said folded rigid wire (514) positioned in a side-by-side configuration with each said V-shape (512) being in register with a corresponding said V-shape of each said rigid wire (514), whereby all registered second end openings (520) being adapted for slidably receiving a respective said first rod (504) therein, said plurality of rigid wires (514) being secured to each other via a plurality of cross bars (536) spaced apart from one another, whereby said rigid wires (514) and said cross bars (536) forming a folded wire mesh (538).

16. The system of claim 15, wherein at least one said cross bar (536) is located adjacent each said bracket closed second end (518) of registered V-shapes (512) for being in abutment contact with corresponding said second rods (506) when corresponding said second rods (506) are in abutment contact with said first rods (504) positioned through corresponding said first rod openings (520).

17. The system of claim 1, wherein said body (214) is made out of a plate having said first end (216) being folded substantially orthogonally relative to the plate (214) for securing to the panel (202), said plate (214) having said second end (218) being arcuately folded to form a saddle facing toward the first end

(216) and defining said first rod opening (220) for slidably receiving the first rod (204) therein.

18. The system of claim 17, wherein said saddle (220) extends over at least an angle of about 270 degrees for defining said first rod opening.

19. The system of claim 17, wherein said plate (214) defines a plurality of said bracket (212) being positioned in an end-to-end configuration with all said first rod openings (220) being in register with each other for slidably receiving the first rod (204) therein, said plate (214) including a plurality of cutouts (224) extending from the second end (218) toward the first end (216) defining adjacent said first rod openings (220), each said cutout (224) defining a respective said second rod abutting region (222) for being in abutment contact with a respective said second rod (106).

20. The system of claim 19, wherein said first ends (216) of said plate (214) are folded orthogonally relative to the plate (214) in an alternating configuration in opposite directions.

21. The system of claim 1, wherein said first end (616) substantially forms a T-shape for slidably engaging a corresponding T-shape channel (628) extending along the panel (602), said channel (628) allowing the first rod opening (620) to be in register with said first rod opening (620) of respective each adjacent said brackets (612) slidably engaging the channel (628).

22. The system of claim 21, wherein said bracket (612) is spaced from adjacent said bracket (612) along said channel (628) by a corresponding

bracket spacer (640) located therebetween, said bracket spacer (640) being slidably engageable into the channel (628).

23. The system of claim 1, wherein said first end (416) substantially forms a shoulder (430) for being in abutment contact with an edge (432) of at least one said panel (402).

24. The system of claim 1, wherein a plurality of said bracket (712) being positioned in an end-to-end configuration with all said first rod openings (720) being in register with each other to slidably receive the first rod (704) therein.

25. The system of claim 1, wherein said abutting region (622) includes a segment (641) generally angled relative to a direction perpendicular to the panel plane for abuttingly receiving the second rod (606) thereagainst.

26. The system of claim 1, wherein said abutting region (622) forms a recessed seat (642) for abuttingly receiving the second rod (606) thereagainst.

27. The system of claim 1, wherein said rod opening (620) is a countersunk through hole (644) for guidingly and slidably receiving the first rod (604) therein.

28. The system of claim 1, wherein said abutting region (622) includes a ridge (626) extending substantially perpendicularly to the direction extending between the first (616) and second (618) ends and facing toward said second end (618), said ridge (626) being for abuttingly receiving the second rod (606)

thereagainst when the second rod (606) is in abutment contact with the first rod (604) positioned through said first rod opening (620).

29. The system of claim 1, wherein said bracket (612) includes a channel (646) extending transversally through the body (614) and located between said first (616) and second (618) ends for abutingly and locally supporting an elongated member (648) therein.

30. A panel interlocking system (100) for attachment to an opposite panel structure (202), said system comprising:

- a panel (102) for locking to the panel structure (202);
- at least one first rod (104) and at least one second rod (106), substantially orthogonal to each other, positioned generally parallel to a plane defined by the panel (102); and
- at least one bracket (112) having a body (114) with a first end (116) connecting to the panel (102) and a generally opposite second end (118) connecting to the orthogonal rods (104,106), the second end (118) having at least one first rod opening (120) extending therethrough for slidably receiving the first rod (104) therein, the second end (118) defining a second rod abutting region (122) adjacent the at least one first rod opening (120) in a direction toward the first end (116) for being in abutment contact with the second rod (106), said second rod (106) being adapted to be in abutment contact to and between the first rod (104) and a structure rod (204) so as to be interlocked therebetween for locking the panel (102) to the panel structure (202), whereby said at least one bracket (112), said first (104) and second (106) rods and the structure rod (204) being adapted to be embedded within a filler material poured adjacent the panel (102) in a direction toward the panel structure (202).

31. A method for interlocking a panel (102) to an opposite panel structure (202), said panel (102) connecting to a first end (116) of a body (114) of at least one bracket (112), the bracket (112) having a generally opposite free second end (118), said method comprising the steps of:

- positioning the panel (102) in a face-to-face configuration with the structure panel (202), with the at least one bracket (112) extending toward the panel structure (202);
- slidably engaging, in a first direction generally parallel to a plane defined by the panel (102), a first rod (104) into at least one first rod opening (120) extending through the second end (118);
- engaging, in a second direction substantially perpendicular to the first direction and generally parallel to the panel plane, a second rod (106) in abutment contact with a second rod abutting region (122) adjacent the at least one first rod opening (120), said second rod (106) being located adjacent said first rod (104) between said first rod (104) and said panel (102); and
- slidably engaging, in a direction substantially parallel to the first direction, a structure rod (204) into at least one rod receiving structure bracket (212), said second rod (106) being adapted to be in abutment contact to and between the first rod (104) and the structure rod (204) so as to be interlocked therebetween for locking the panel (102) to the panel structure (202).

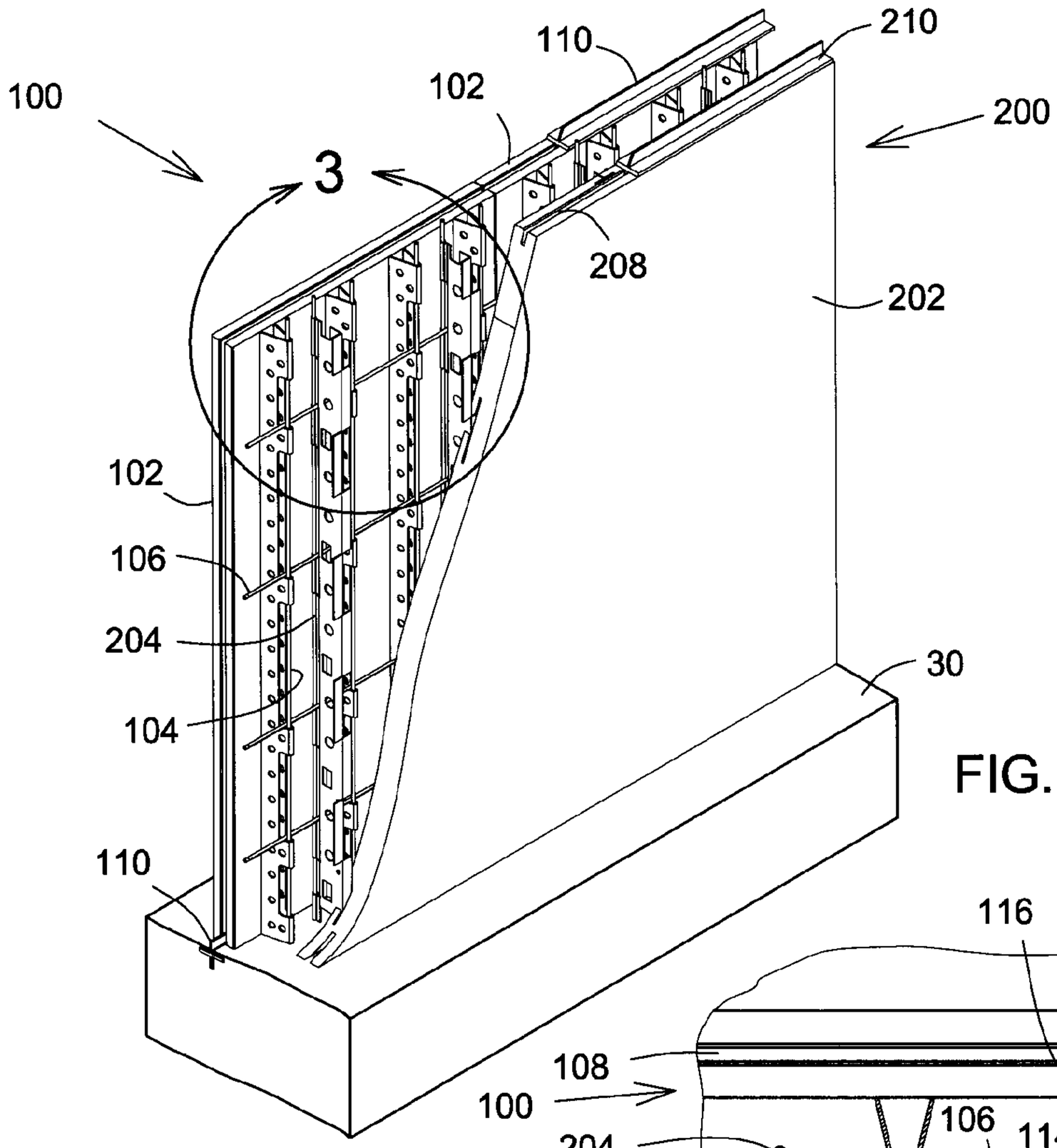

FIG.1

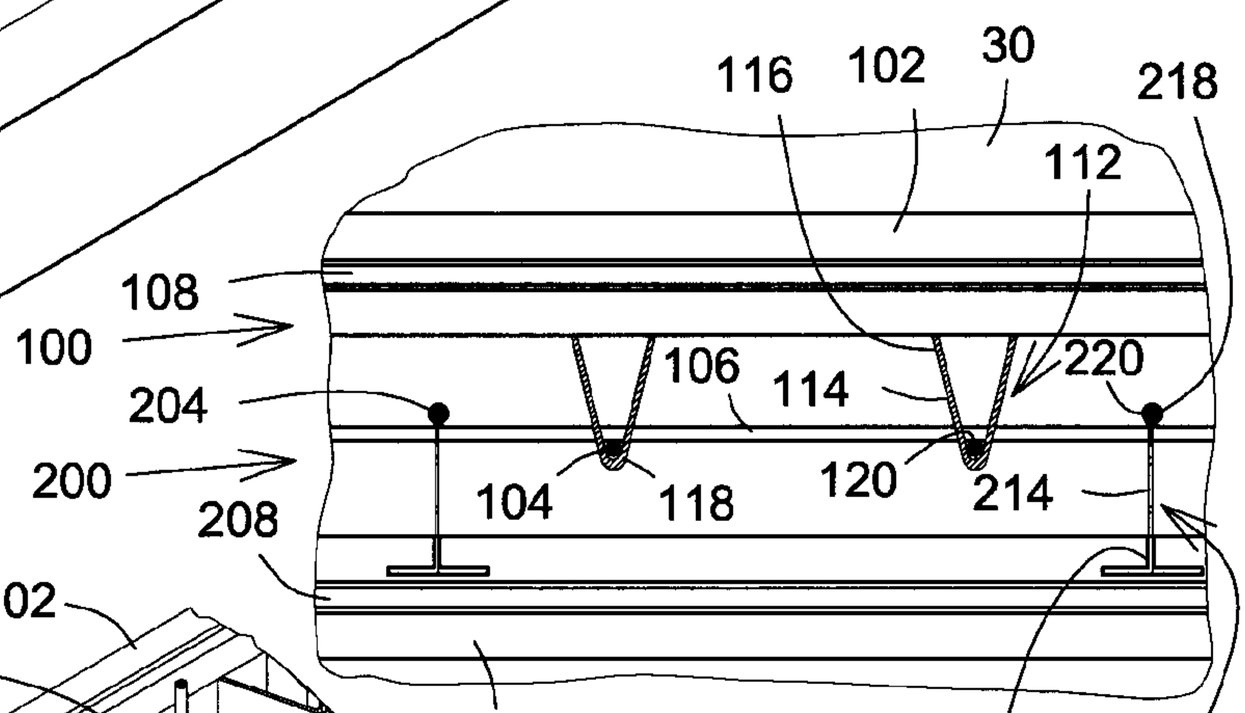

FIG.2

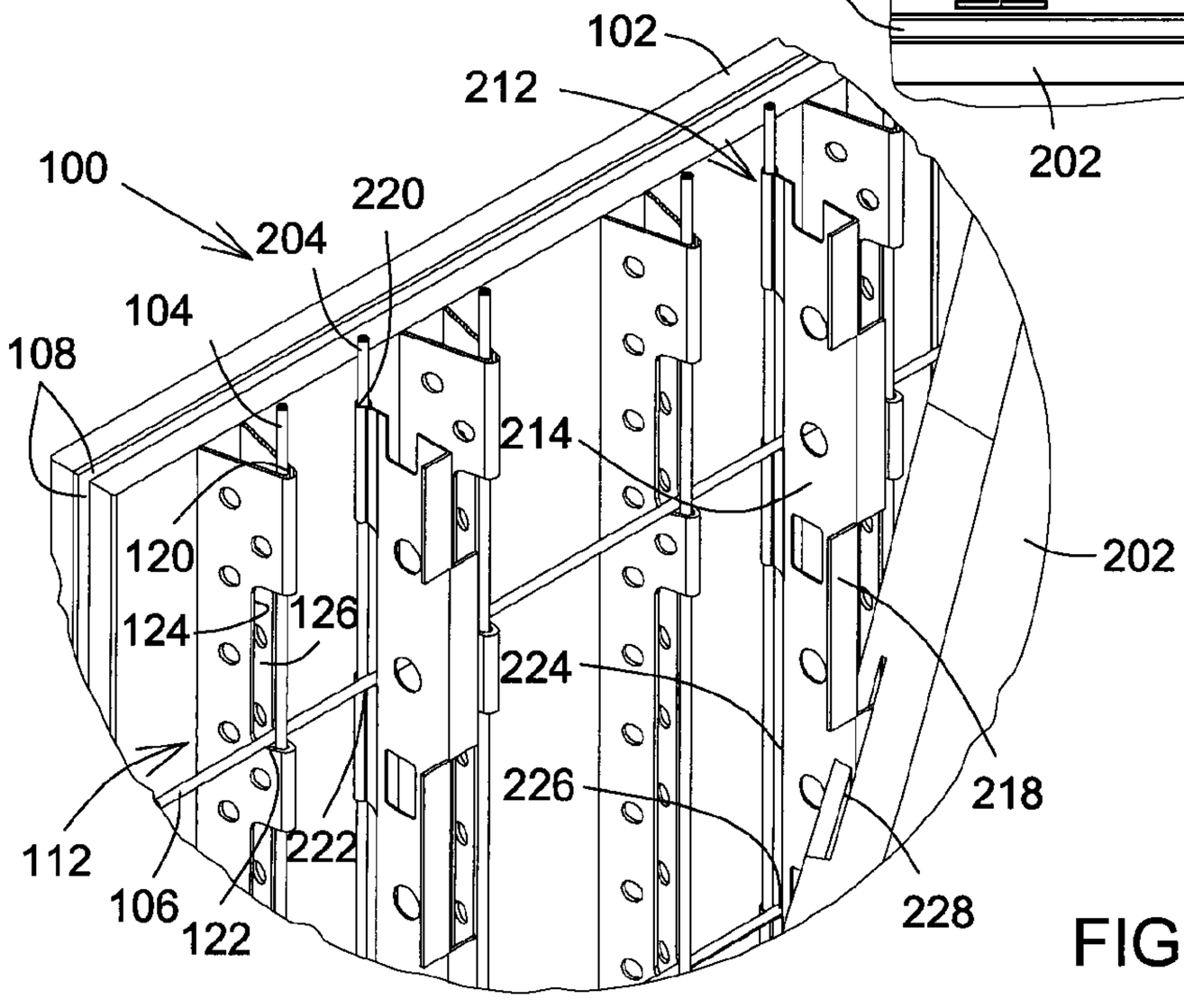

FIG.3

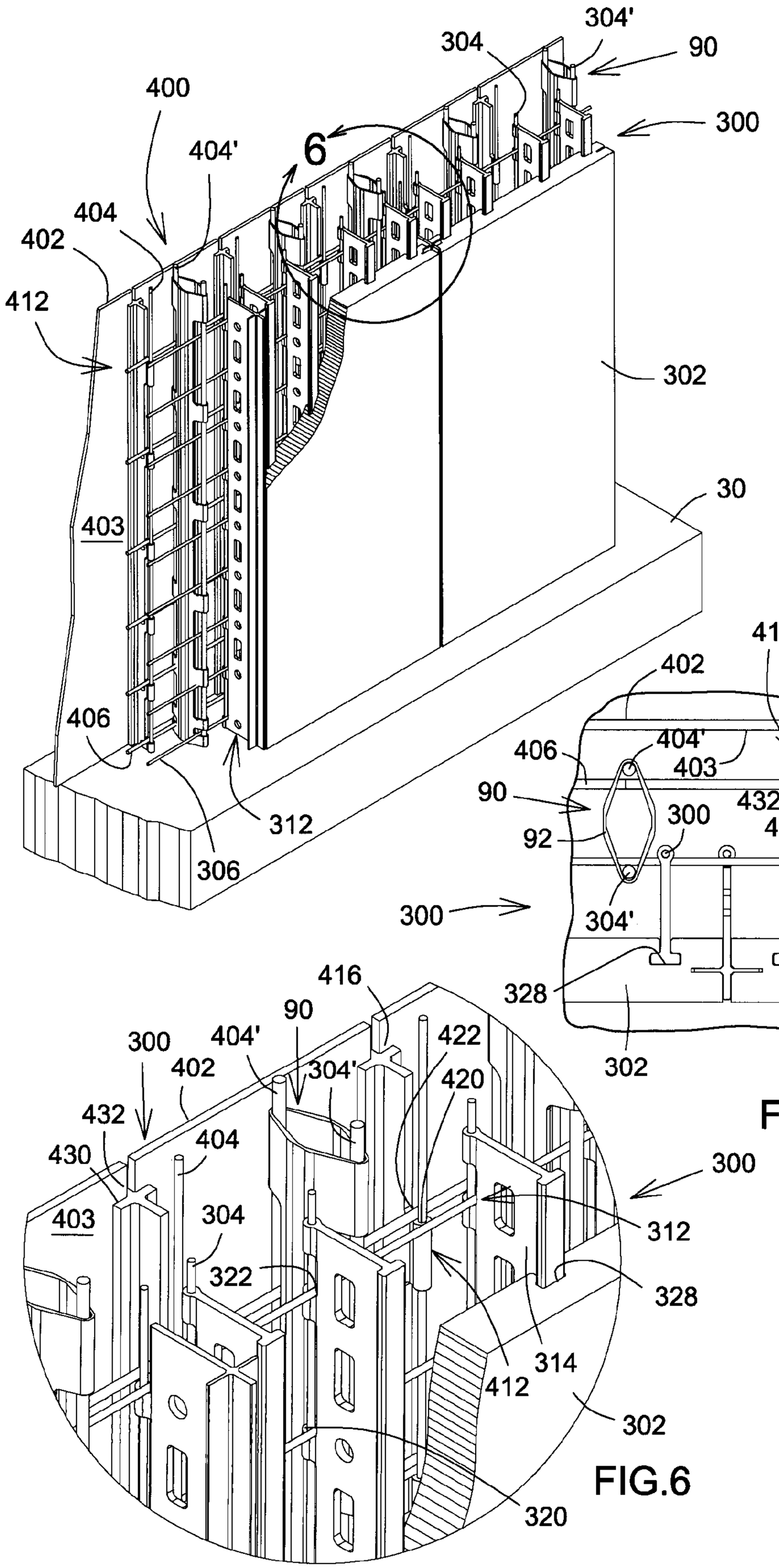

FIG.4

FIG.5

FIG.6

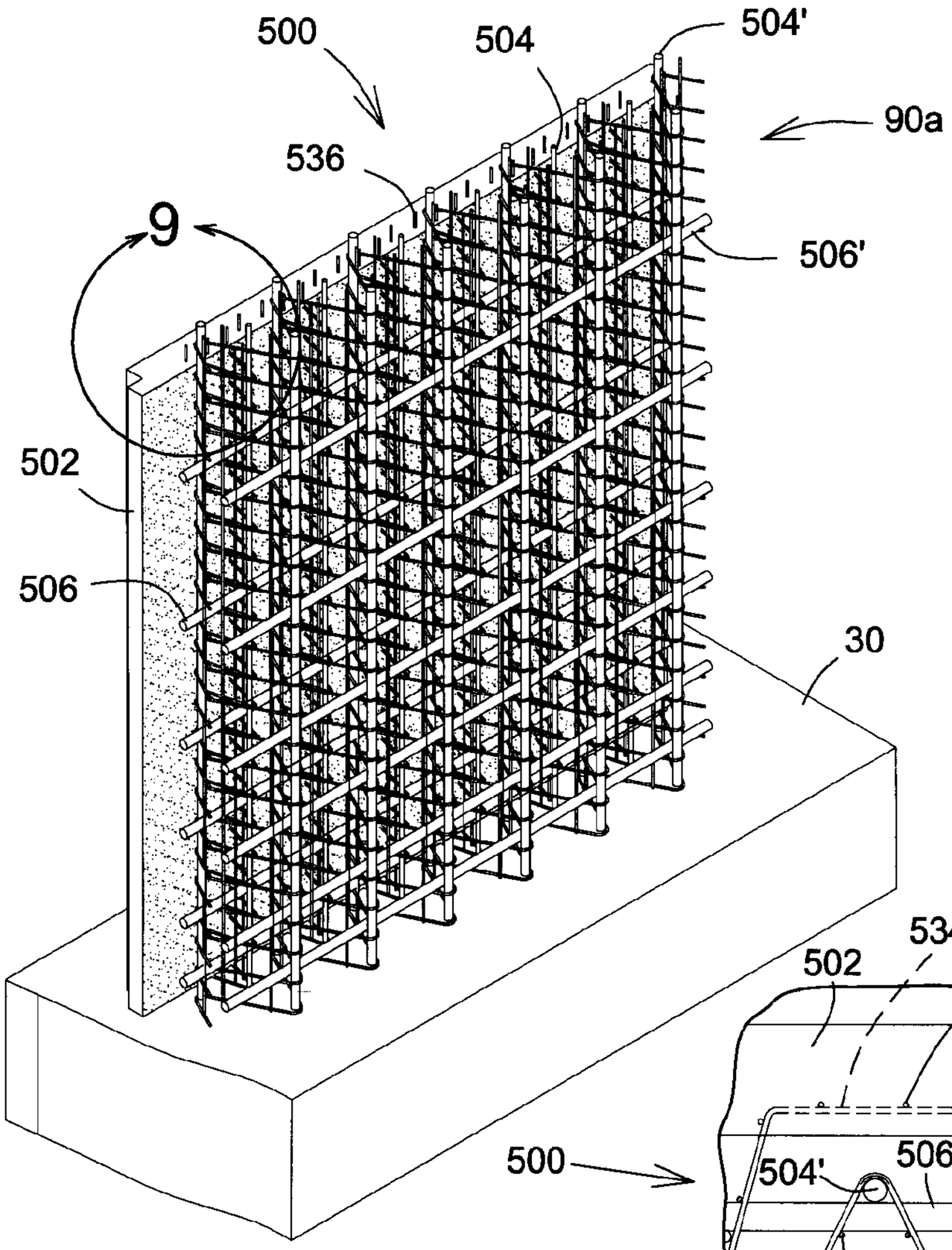

FIG.7

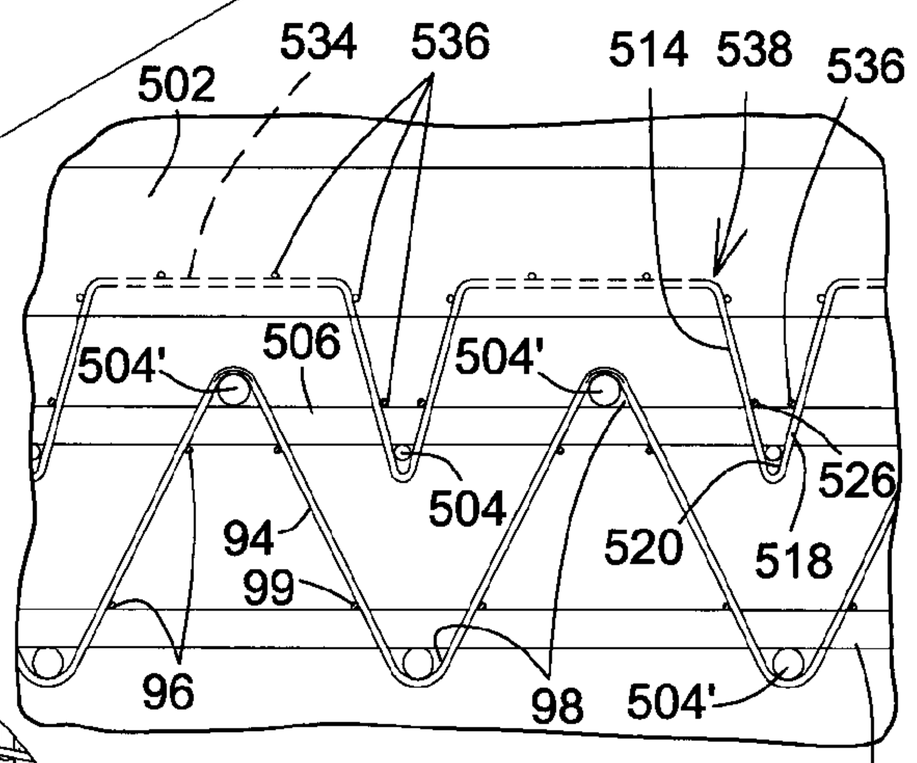

FIG.8

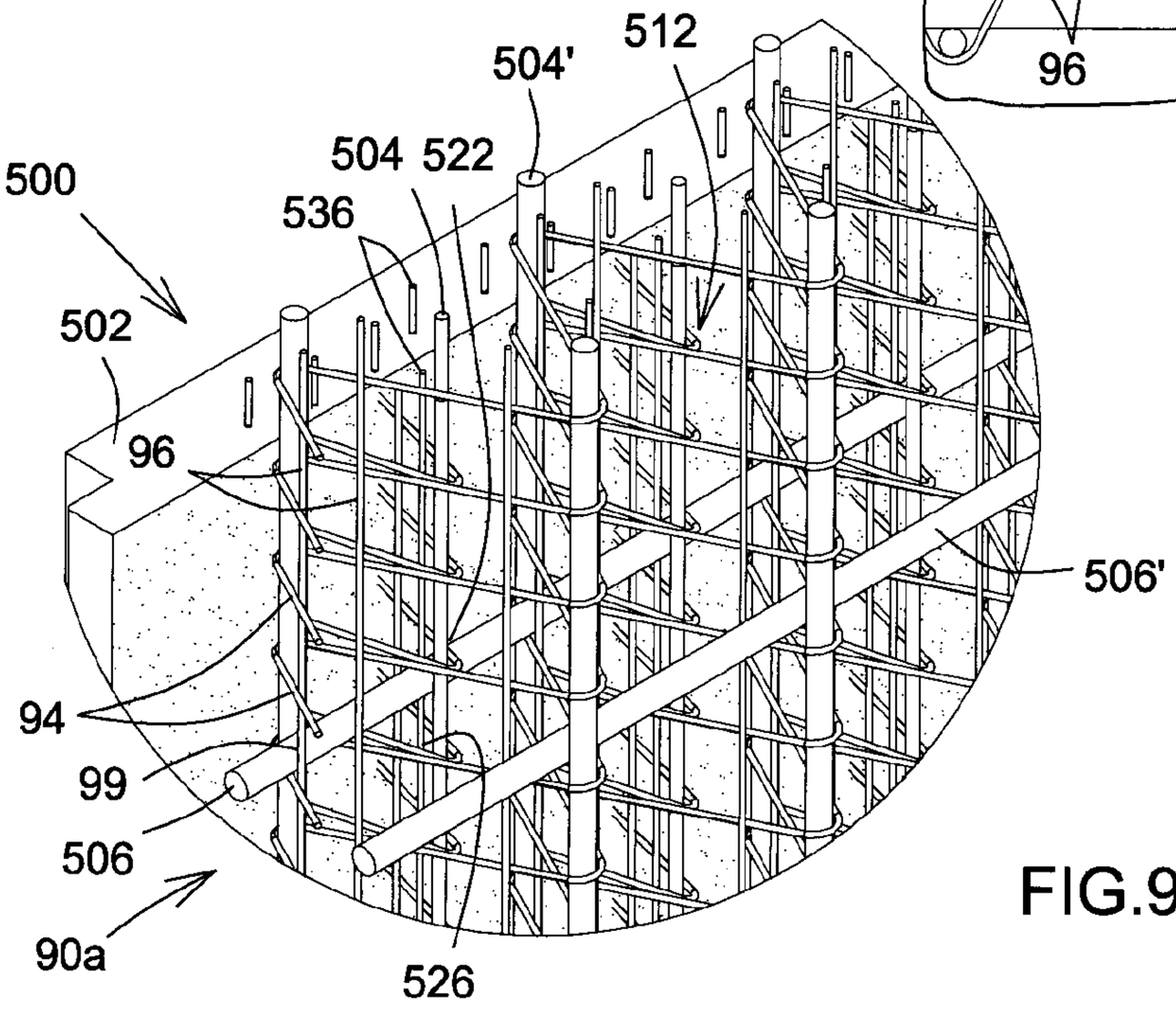

FIG.9

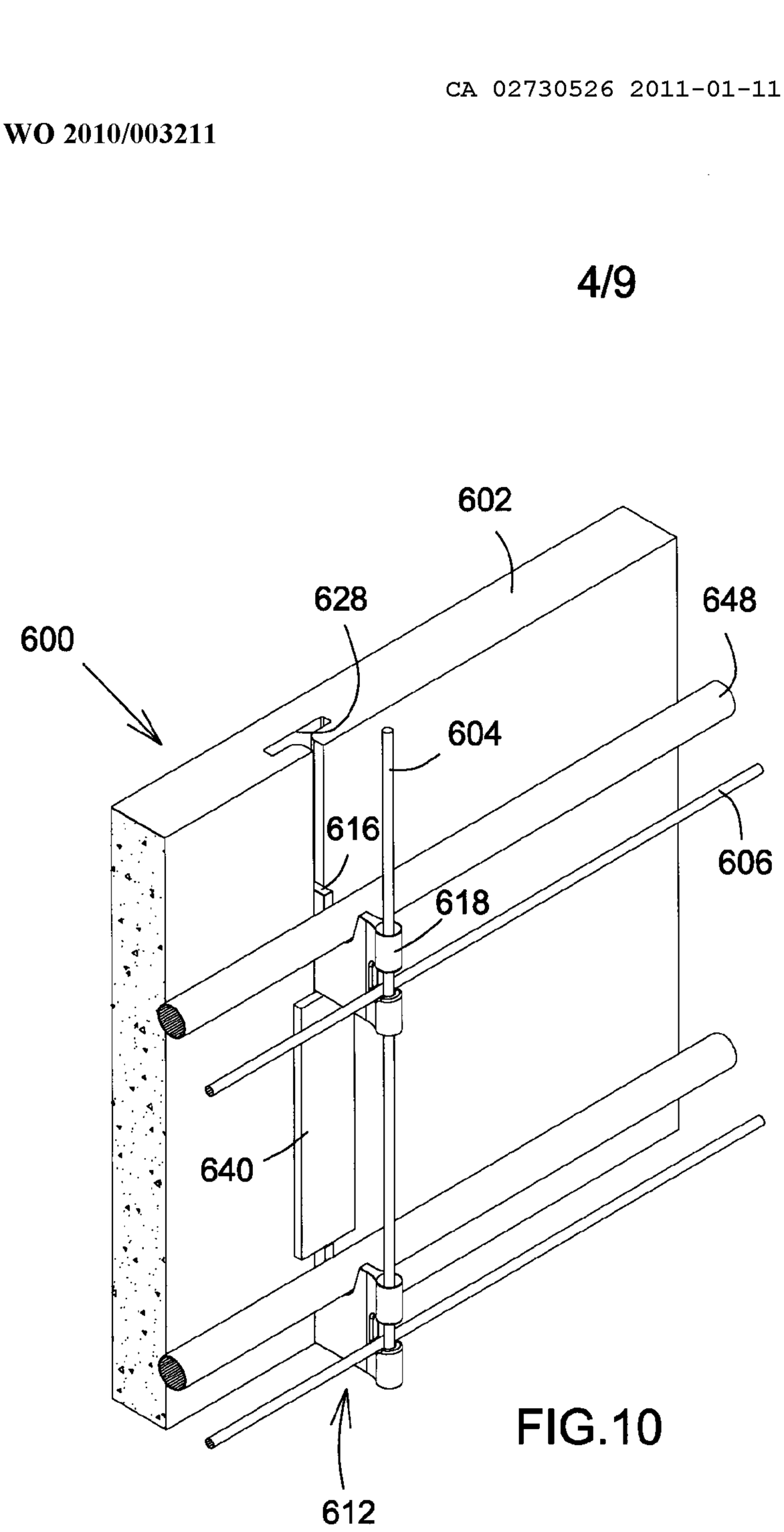

FIG.10

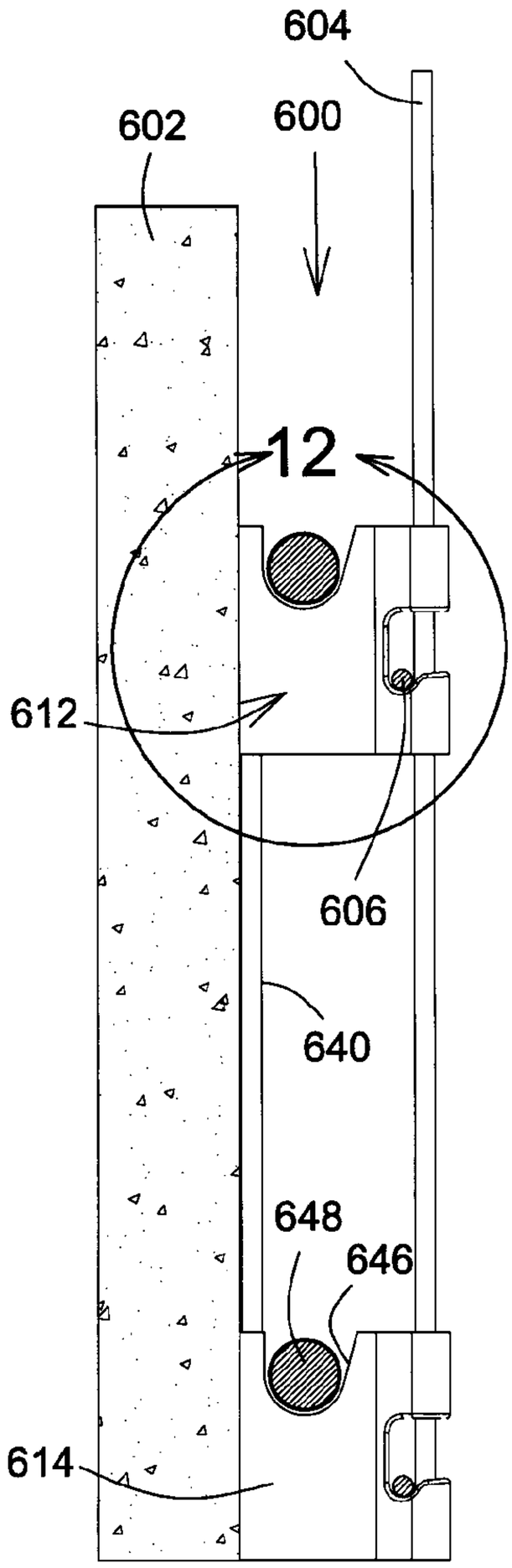

FIG.11

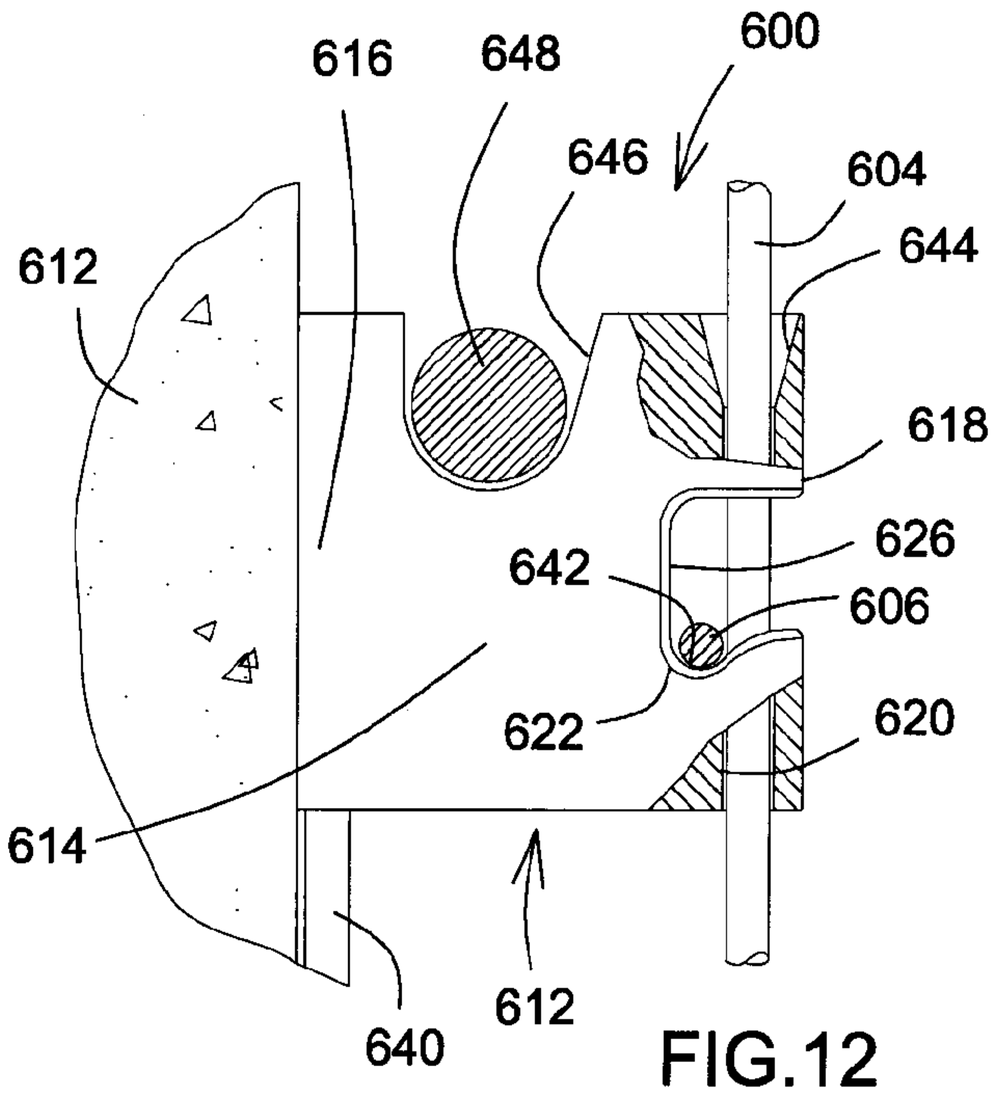

FIG.12

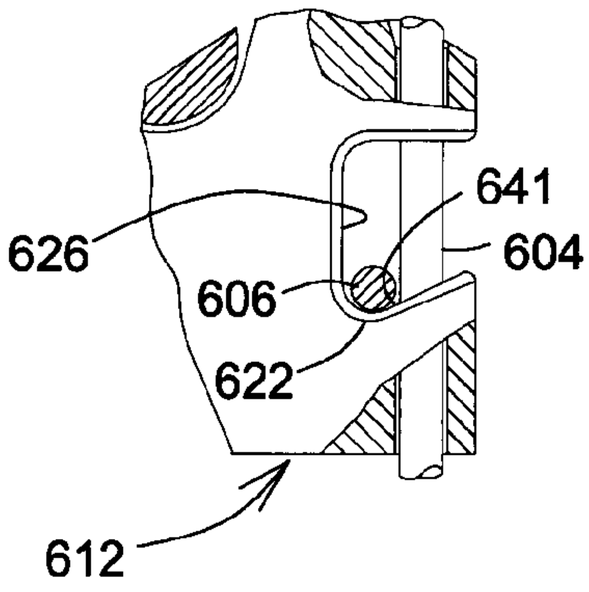

FIG.12a

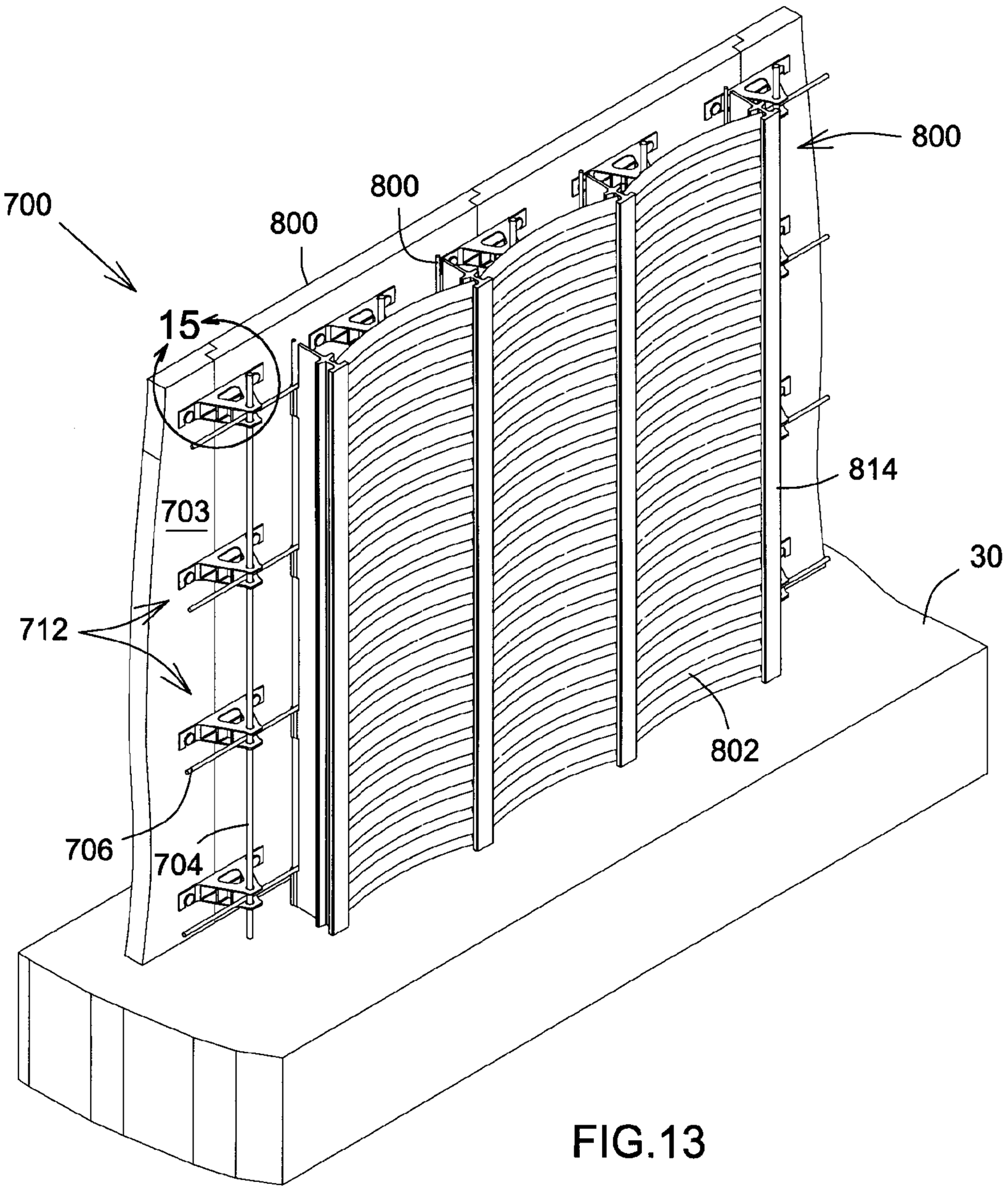
700
800
800
800
15
703
712
706
704
814
30
802

FIG.13

700
705
702
30
750
762
754
716
712
703
706
804
718
704
814
800
802
812
864
864
802
816

FIG.14

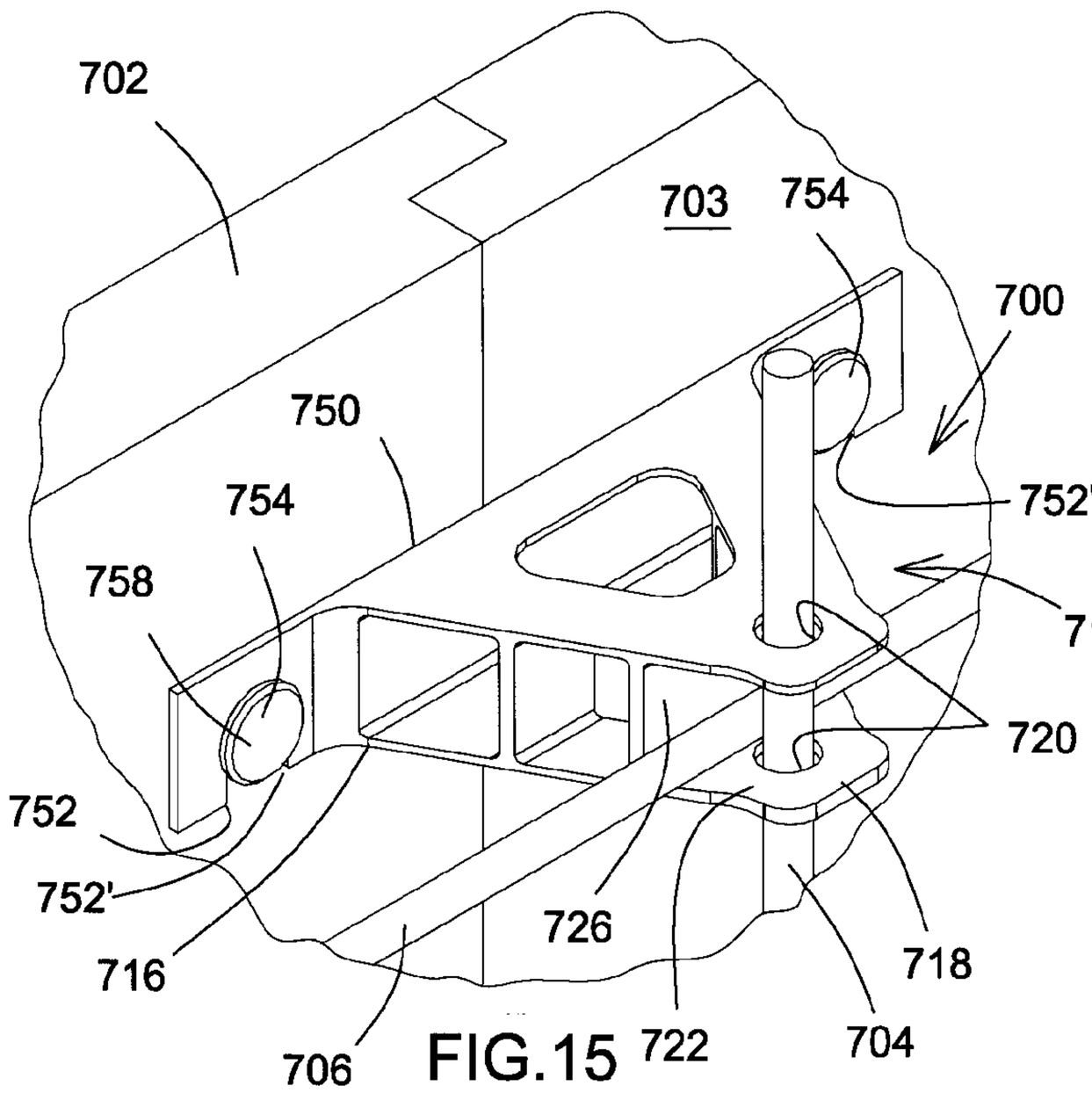

FIG.15

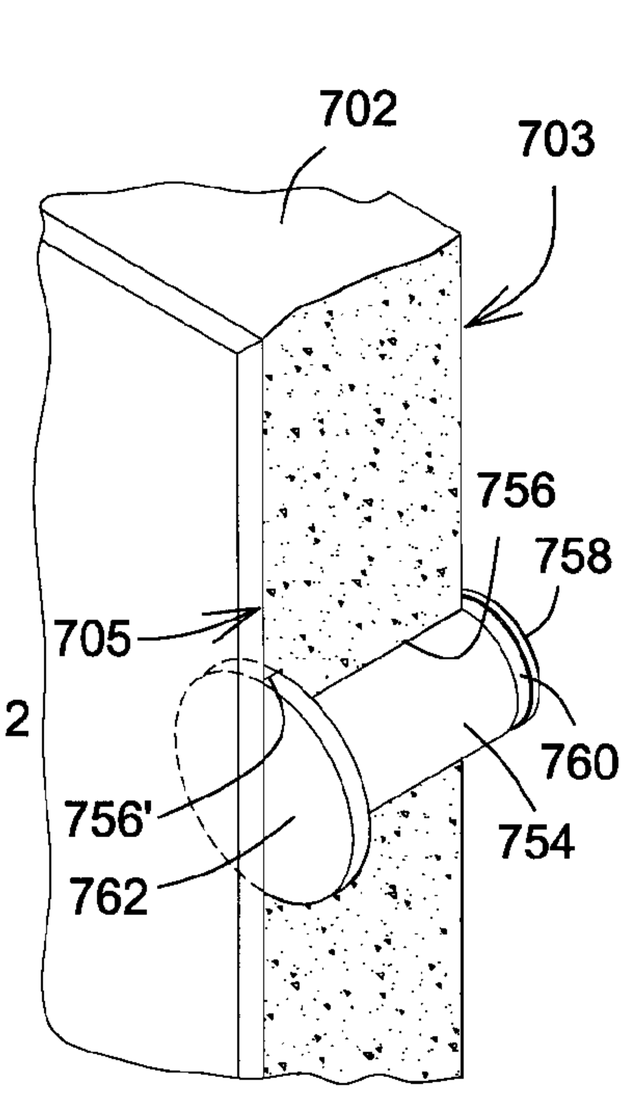

FIG. 17

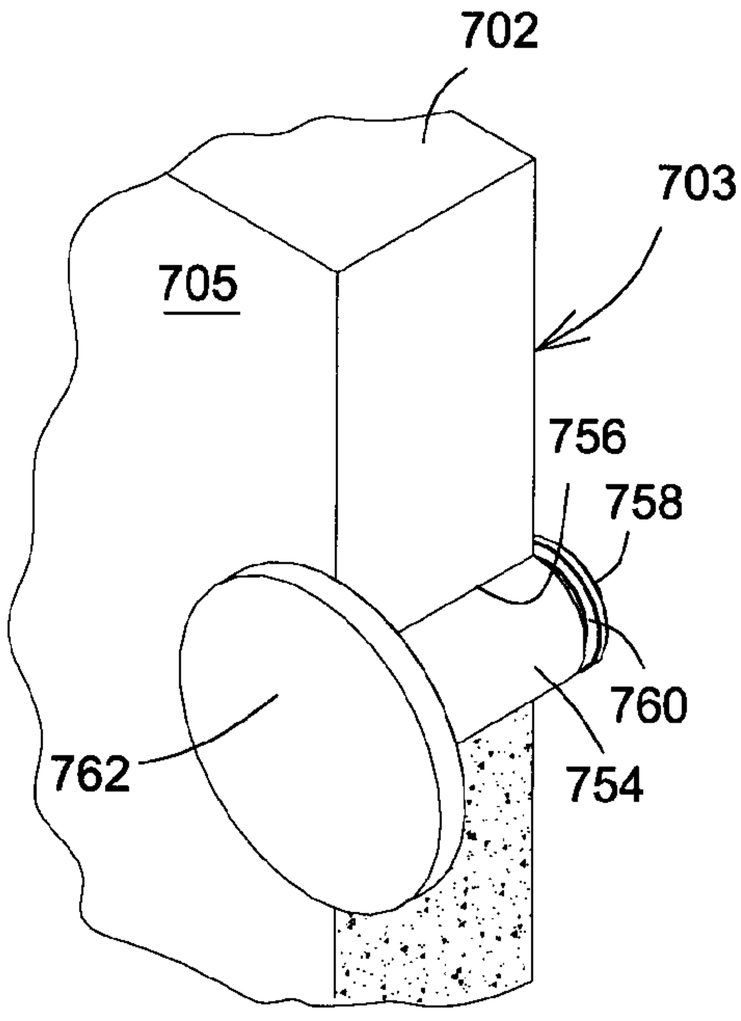

FIG.16

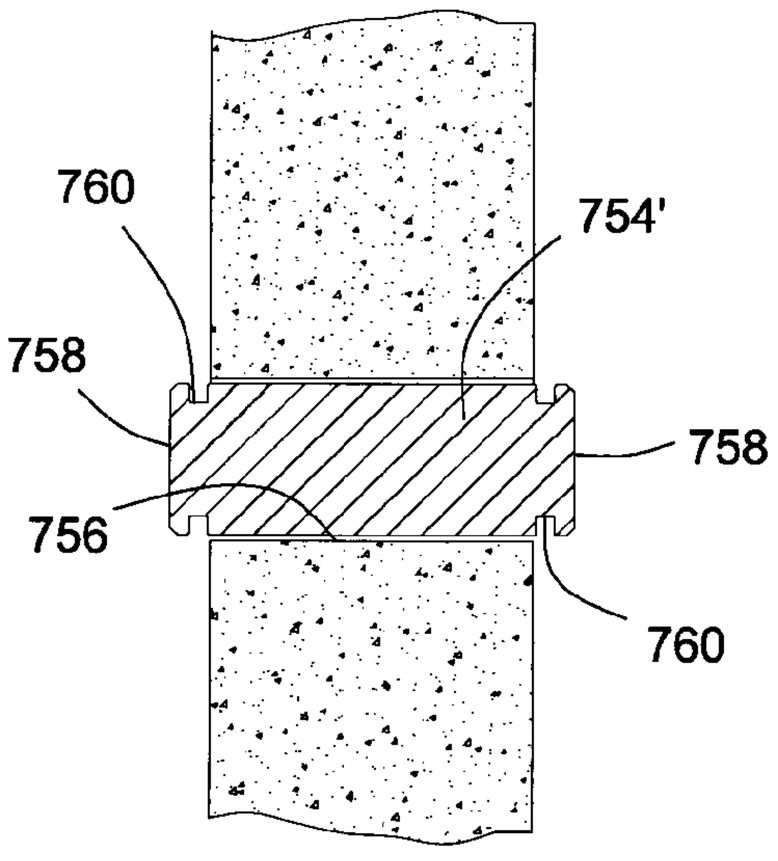

FIG. 18

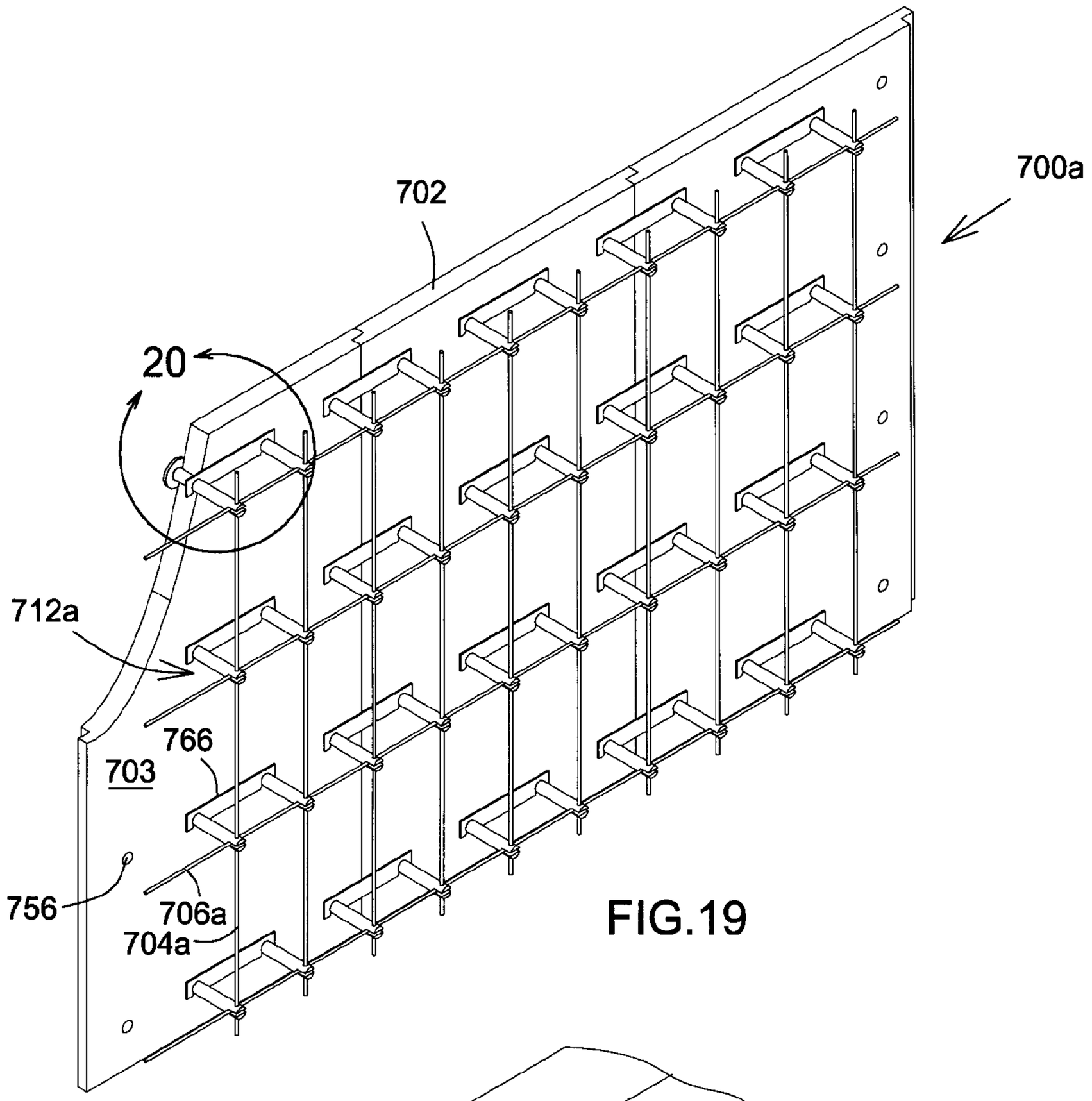
700a
702
20
712a
766
703
756
706a
704a

FIG.19

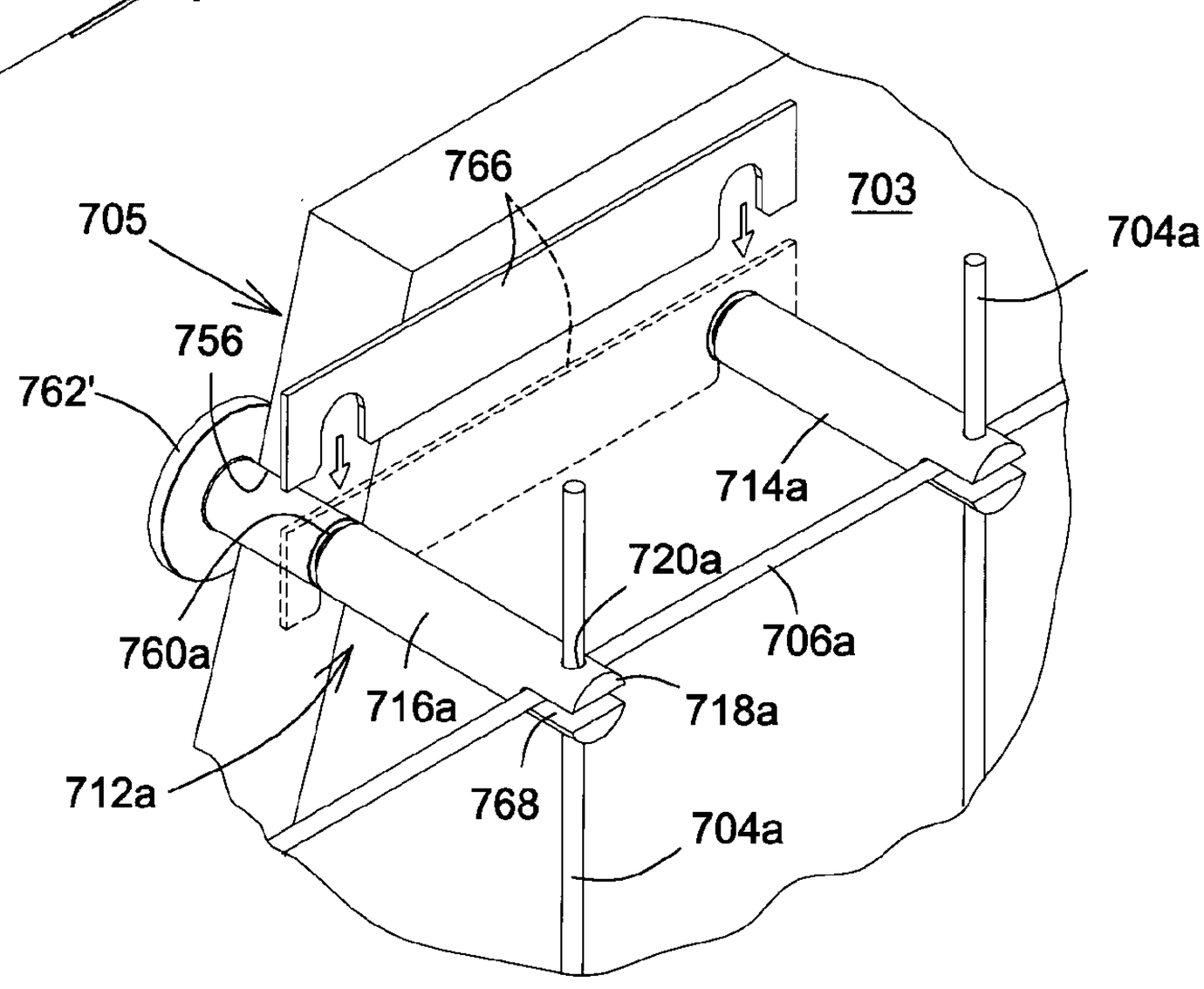
766
703
705
704a
756
762'
714a
720a
706a
760a
716a
718a
712a
768
704a

FIG.20

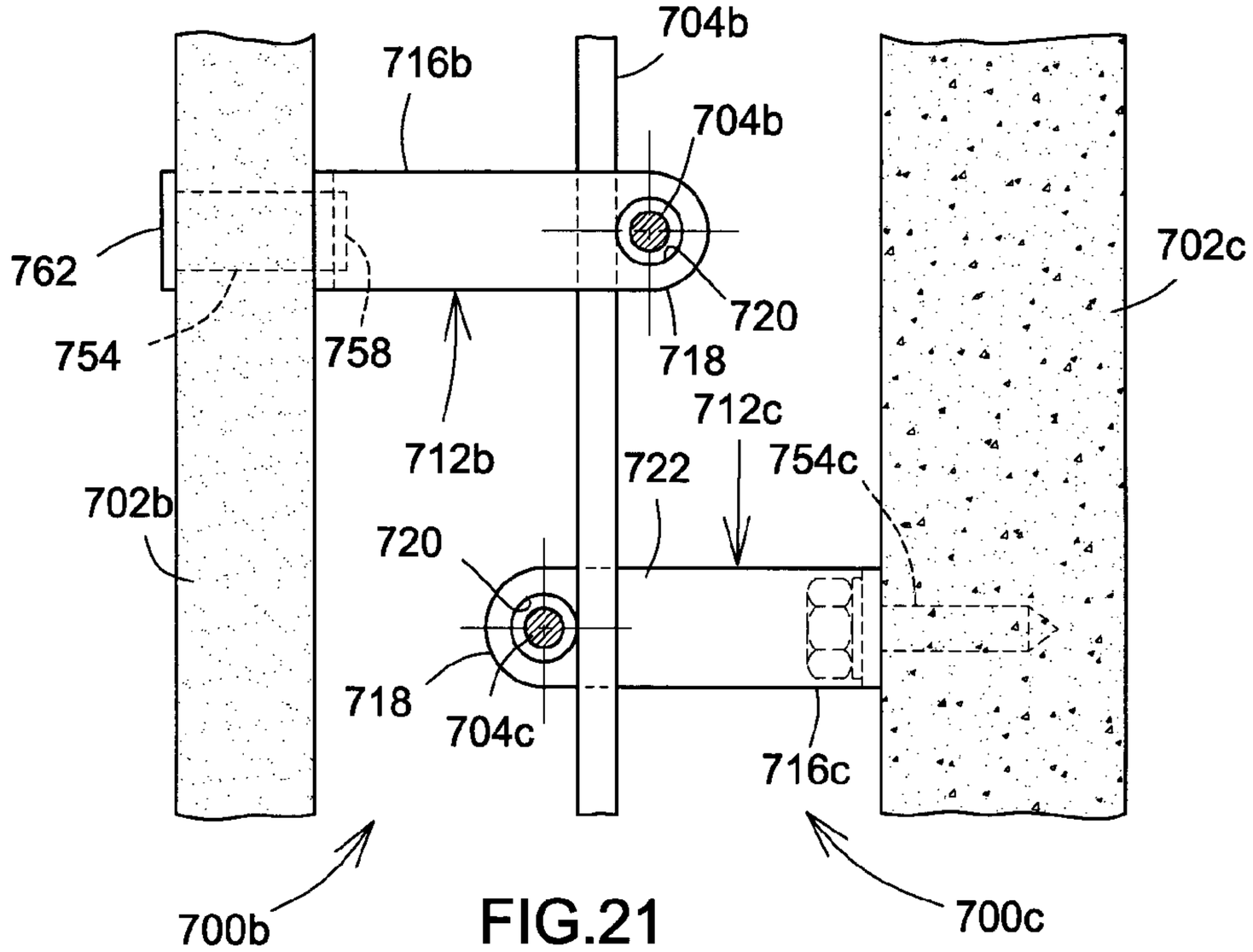
704b
716b
704b
762
720
754
758
718
702c
712b
712c
722
754c
702b
720
718
704c
716c
700b
700c

FIG.21

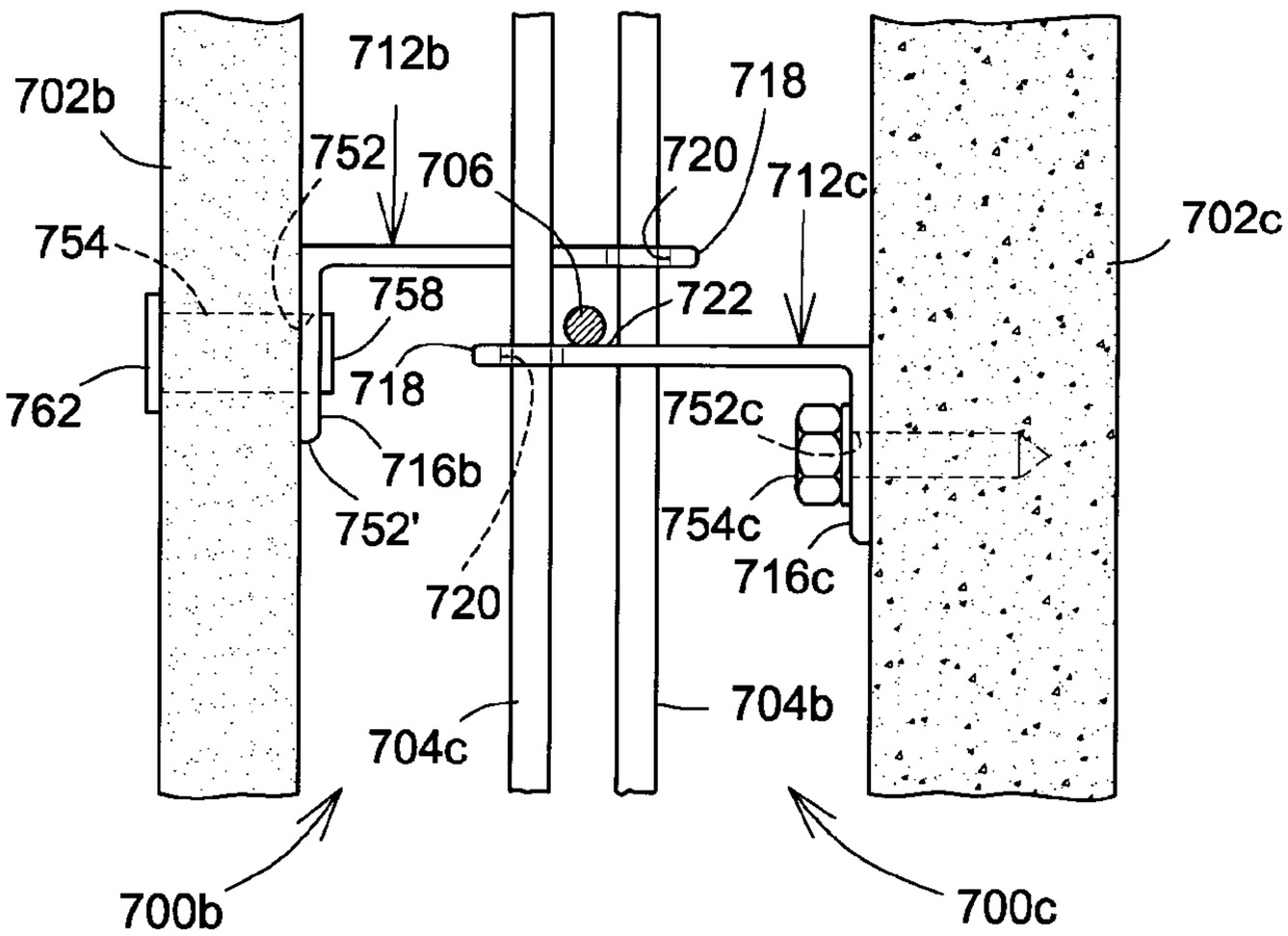
712b
718
702b
752
706
720
712c
702c
754
758
722
762
718
752c
716b
752'
754c
720
716c
704b
704c
700b
700c

FIG.22

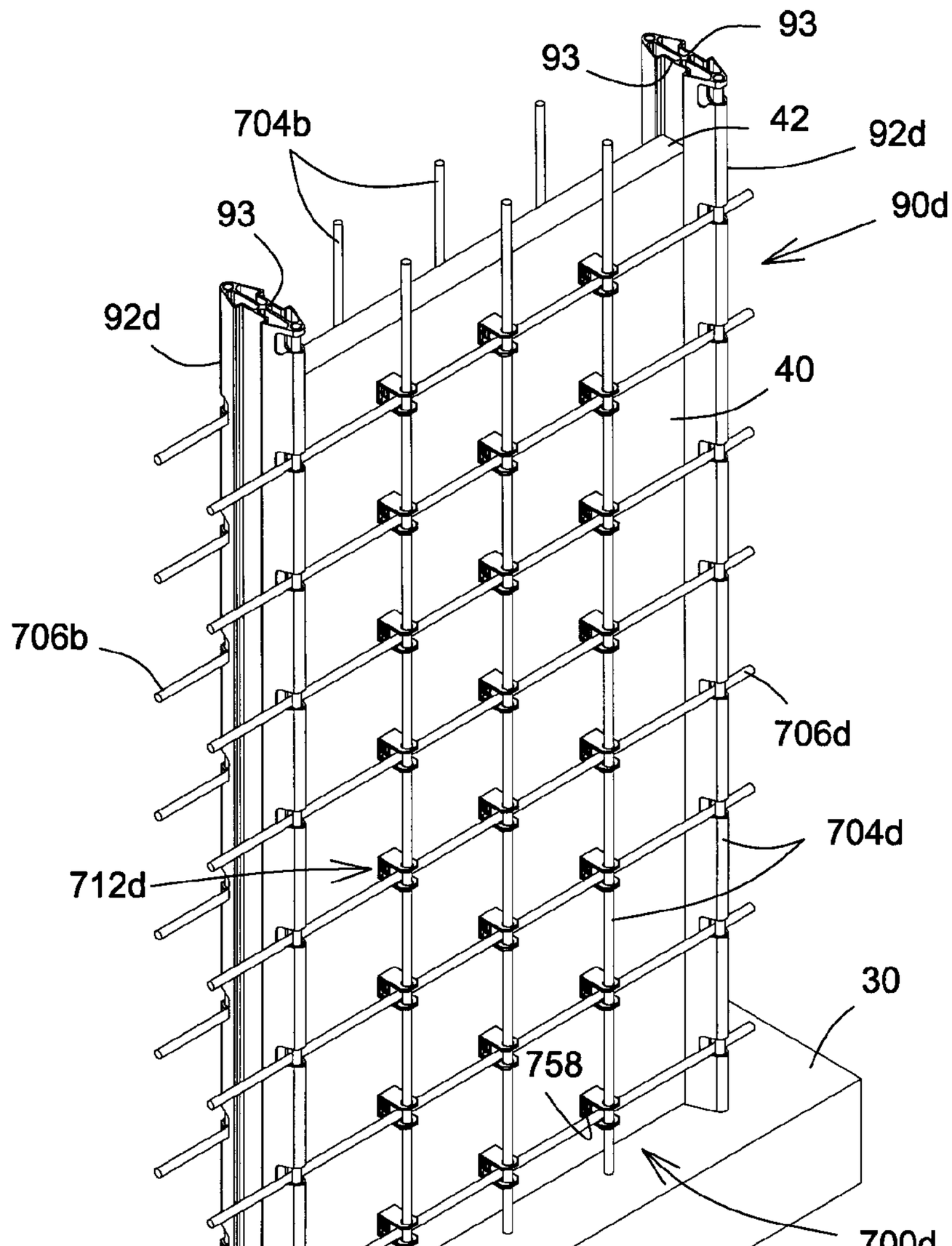
93
93
704b
42
92d
90d
93
92d
40
706b
706d
712d
704d
30
758
700d

FIG.23

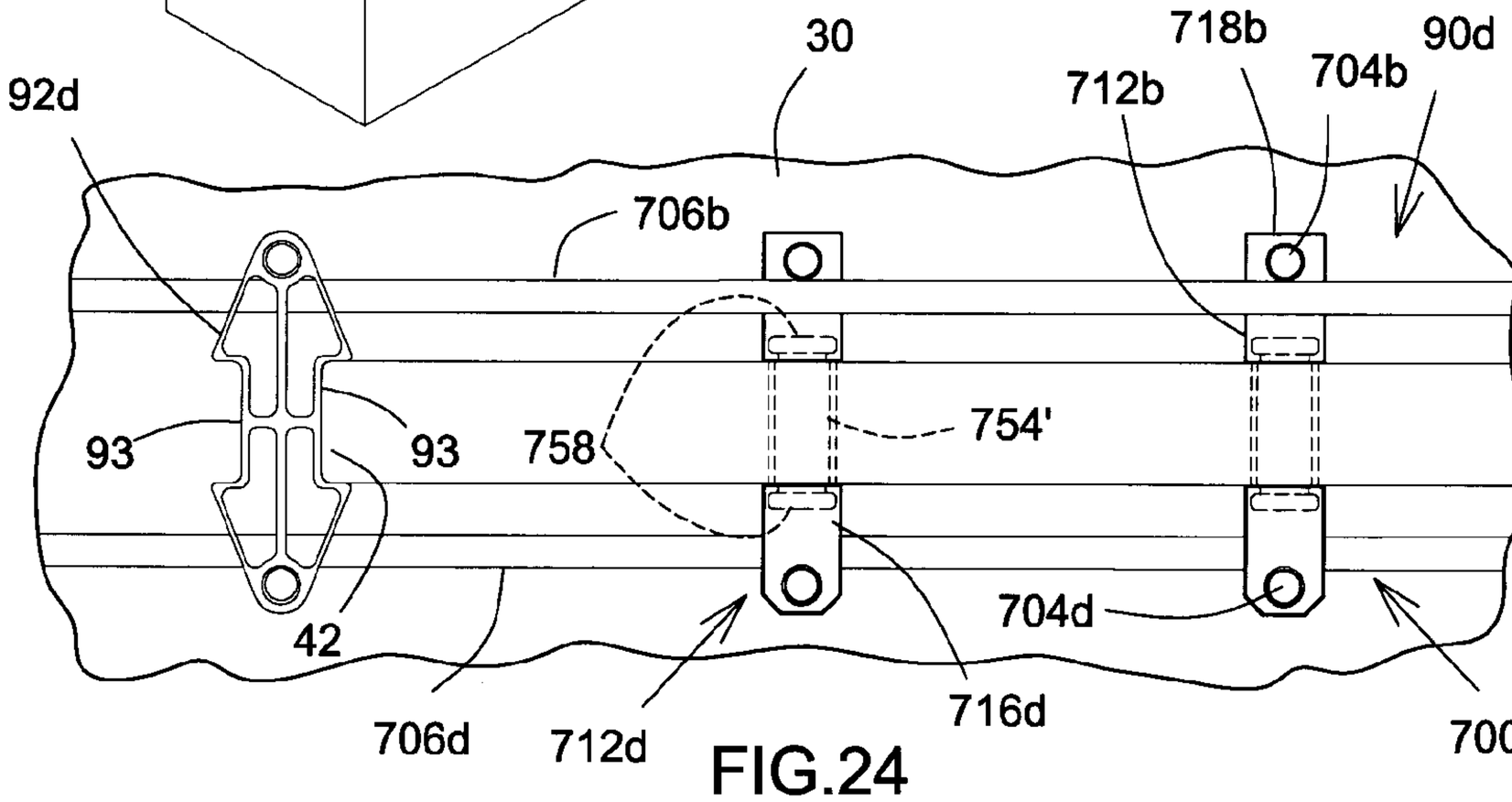
30
718b
90d
704b
712b
92d
706b
93
93
758
754'
42
704d
706d
712d
716d
700d

FIG.24

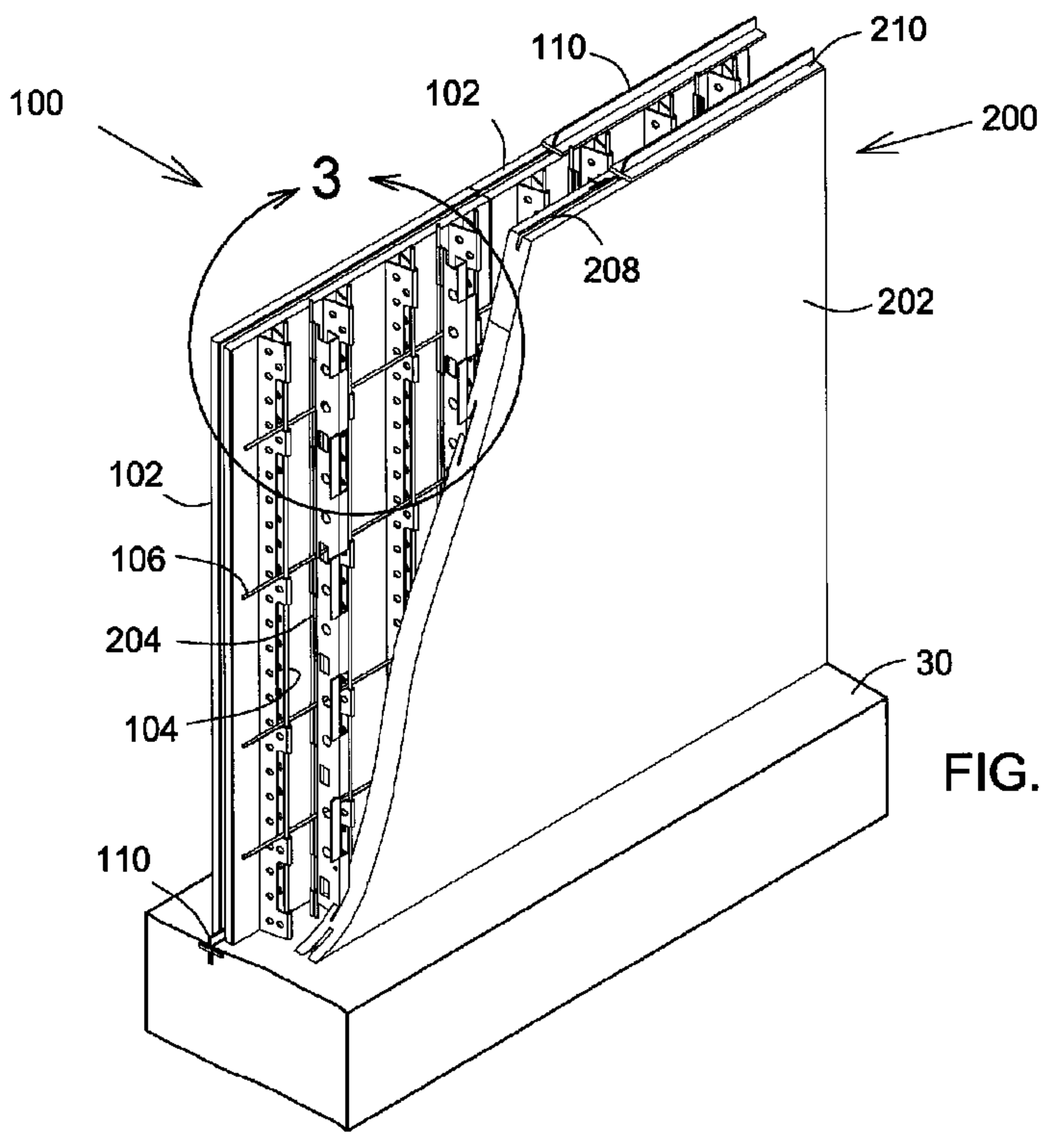

FIG.1