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מדינת ישראל
רשות הפטנטים

חוק הפטנטים, התשכ"ז- 1967
Patents Law, 5727 - 1967

תעודת פטנט

CERTIFICATE OF PATENT

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זאת לתעודה כי הפרטים דלהלן נרשמו בפנקס הפטנטים

Patent No: **243159** **מס' הפטנט:**

Date of Application: 23/12/2015 תאריך הבקשה:

Title of Invention: שם האמצאה:

METHOD FOR CONSTRUCTING VENTILATED EXTERIOR WALLS OF BUILDINGS

שיטה לבניית קירות חיצוניים מאווררים למבנים

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Date of Publication: 30/04/2018 תאריך פרסום קיבול הבקשה:

Date of Grant: 31/07/2018 תאריך מתן פטנט:

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לבני מהנדסים
פתרונות יצירתיים למבנים מורכבים

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30/03/2022

חיפוי קירות מאווררים בשיטת לבני

1. <u>מערכת חיפוי מאווררת</u>

מערכת חיפוי זו הינה שיטה של קיבוע חיפוי לקיר הרקע מבטון מזוין יצוק באתר או טרום היצוק במפעל.
בין קיר הרקע לחיפוי נותר חלל ריק , מאוורר .
הרחקת אלמנטי החיפוי מקיר הרקע יוצר חלל מאוורר המאפשר התקנת בידוד טרמי קשיח וזרימת אויר .
עובי המערכת כ-9 ס"מ . העובי תלוי בעובי אריחי החיפוי , עובי הבידוד הטרמי והחלל המשמש לזרימת אויר .
מערכות מאווררות לחזיתות חוץ של מבנים VENTILATED FACADES מבוססות על אריחי חיפוי בדוגמת : קרמיקה , קלינקר , פורצלן , טרקוטה , אבן טבעית , שיש , לוחות HPL ולוחות עמידים אחרים .
קיבוע אריחי החיפוי לקיר הרקע נעשה תוך שימוש באביזרים נושאי עומס וכאוחזים .
אביזרי קיבוע האריחים , עוגני פלב"ם המעוגנים בקיר הרקע ומקובעים בגב האריחים .
מערכת החיפוי נותנת מענה גם למבנים אשר גובה החיפוי גדול מ-32 מטר מפני הקרקע הסופיים , פתרון שלא ניתן לקבל בקיבוע ברטוב ע"פ תקן ישראלי 2378 חלק 2 כאמור בפרק 3– תכנון סעיף 4.1 .

2. <u>יתרונות החזית המאווררת בחיפוי באריחים מתועשים – פורצלן</u>

2.1. יצור חרושתי של אריחי החיפוי מחומר הומוגני לא סופג בעל חוזק אחיד וידוע. האריחים עמידים כנגד ספיגה , הכתמה ומליחות בסביבה ימית .
2.2. משקל עצמי אריחי החיפוי נמוך בהתייחס לחיפוי באבן טבעית או שיש . היתרון בהפחתת התסבולת הנדרשת לכוחות אופקיים ברעידות אדמה והקטנת העומס הקבוע על אלמנטי שלד נושאים .
2.3. המרווח שבין אריחי החיפוי לקיר הרקע מאפשר התקנת לוחות מבודדים , ללא גשרים טרמים בקירות המעטפת המפרידים בין פנים הבניין אל החוץ . דהיינו הגנה על המסה הטרמית .
בהשוואה לבידוד פנימי שגוזל משטח פנים המבנה ואינו מאפשר פתרון אופטימלי לטיפול בגשרי קור בעובי התקרות . המשמעות חסכון באנרגיה .
2.4. אריחי החיפוי סופגים קרינת השמש במקום קיר הרקע .
2.5. המערכת המאווררת מרחיקה חדירת רסיסי מים ע"י זרימת האויר שבגב האריחים ומפזרת אדי המים מבפנים החוצה .
היתרון – חסכון בצורך לאטום קיר הרקע כמותר בתקינה הזרה .
2.6. מערכת החיפוי משפרת הבידוד האקוסטי של הקיר ומורידה מפלס הרעש ב- 10 db.

3. <u>חזית מאווררת בשיטת לבני</u>

פתרון מוצע לביצוע חזית מאווררת הכוללת : יציקת קיר מבטון מזוין , התקנת לוחות הבידוד, יצירת חלל לאיוורור והתקנת אריחים בשלב אחד .
השיטה מתאימה לביצוע קירות מבטון מזוין יצוקים באתר ו/או קירות מתועשים המיוצרים במפעל ומורכבים בבניין .

4. <u>מרכיבי המערכת</u>

4.1. טפסנות – תבניות פלדה חלקות בגובה קומה . בתבנית החיצונית חורי קיבוע לשומרי מרחק ונעילת האריחים לתבנית .
4.2. אריחי חיפוי .
4.3. שומרי מרחק מחומר פלסטי , לשמירת מרווחים אחידים בין האריחים .
4.4. כפתורי נעילת האריחים אל תבנית הפלדה לייצובם לשלב ההרכבה . הכפתורים מחומר פלסטי .
4.5. לוח מבודד קשיח שטוח או משונן ליצירת חלל מאוורר .
4.6. שומרי מרחק ללוח המבודד לשמירת חלל מאוורר מחומר פלסטי , למקרה שימוש בלוח מבודד קשיח שטוח .
4.7. אביזרי נעילת הלוחות המבודדים הקשיחים השטוחים מחומר פלסטי , לקיבועם לעוגני הפלב"ם .
4.8. עוגני פלב"ם לקיבוע האריחים לקיר הרקע .

4.9. קיר הרקע יצוק מבטון מזוין בעובי ע"פ תכנון והנחיות מתכנן השלד .

5. <u>שלבי הביצוע</u>

5.1. התקנת תבנית פלדה חיצונית .
5.2. קיבוע לדופן תבנית הפלדה שומרי מרחק לסידור האריחים .
5.3. הרכבת אריחי החיפוי ונעילתם בעזרת אביזרי נעילה .
5.4. התקנת עוגני הפלב"ם יעודיים (בטרם הרכבת האריחים בתבנית).
5.5. התקנת לוחות מבודדים וקיבועם עם אביזר נעילה מפלסטיק .
5.6. סידור הזיון לרבות שומרי מרחק לכיסוי הבטון על הזיון לפי תוכנית מתכנן השלד .
5.7. הרכבת תבנית פנימית ונעילתה אל התבנית החיצונית .
5.8. יציקת הקיר בתערובת בטון ע"פ הנחיות מתכנן השלד .
5.9. חיתוך ראשי אביזרי שומרי מרחק ונעילה , הבולטים מתבנית הפלדה החיצונית .
5.10 פרוק תבנית פנימית וחיצונית .

בכבוד רב ,

יעקב לבני

METHOD FOR CONSTRUCTING VENTILATED EXTERIOR WALLS OF BUILDINGS

FIELD OF THE INVENTION

The present invention relates to systems and methodologies for constructing exterior walls of buildings and more particularly to systems and methodologies for constructing exterior walls including tiles.

BACKGROUND OF THE INVENTION

Various types of exterior wall construction systems and methods are known in the art.

WO 2009/154561 discloses a construction panel having two substantially parallel surfaces, which are each located in a plane, and at least two edges. The construction panel has on each surface at least one projecting portion with at least one boundary surface facing away from the construction panel, which boundary surface, together with at least the respective plane, forms at least one cavity along each surface, said cavities extending in a continuous manner from the first of said edges to the second of said edges. The present invention further relates to a building construction system comprising the construction panel and to the use of a construction panel in a wet room.

SUMMARY OF THE INVENTION

The present invention seeks to provide an improved methodology for constructing exterior walls of buildings.

There is thus provided in accordance with a preferred embodiment of the present invention a method for constructing ventilated exterior walls of buildings including the steps of mounting tiles having exterior surfaces and interior surfaces in a desired mutual spatial relationship onto an exterior frame, such that the exterior surfaces

of the tiles faces the exterior frame, mounting thermal insulation panels having air flow passageway defining protrusions over the interior surfaces of the tiles such that the protrusions in the thermal insulation panels define air flow passageways between the thermal insulation panels and the interior surfaces of the tiles, positioning reinforcement elements between the thermal insulation panels and an interior frame and pouring concrete over the reinforcement elements and between the thermal insulation panels and the interior frame.

Preferably, the mounting tiles includes attaching to apertures in the exterior frame, tile placement positioners and mounting onto the exterior frame, at locations defined by the tile placement positioners, tile assemblies including the tiles and tile mounting shafts attached thereto. Additionally, the mounting tiles also includes temporarily retaining the tile assemblies onto the exterior frame by means of tile placement retainers cooperating with the tile placement positioners. Additionally or alternatively, the mounting thermal insulation panels includes mounting the thermal insulation panels over the tiles by bolting them onto the tile mounting shafts.

In accordance with a preferred embodiment of the present invention the method for constructing ventilated exterior walls of buildings also includes sealing joints between adjacent ones of the thermal insulation panels prior to the positioning reinforcement elements. Additionally or alternatively, the exterior frame includes a flexible resilient tile surface protection layer adhered to an interior-facing surface thereof.

Preferably, the thermal insulation panels have first and second adjacent undercut edges and third and fourth adjacent overcut edges so as to fit together in a mutually tucked arrangement.

In accordance with a preferred embodiment of the present invention the method for constructing ventilated exterior walls of buildings also includes removing the exterior frame and the interior frame.

There is also provided in accordance with another preferred embodiment of the present invention a building having at least one ventilated exterior tiled wall, the wall including at least one wall portion including an array of tiles, having exterior surfaces and interior surfaces, arranged in a desired mutual spatial relationship, thermal insulation panels joined to the array of tiles and having air flow passageway defining

protrusions, mounted adjacent the interior surfaces of the tiles such that the protrusions in the thermal insulation panels define air flow passageways between the thermal insulation panels and the interior surfaces of the tiles and poured reinforced concrete interior of the thermal insulation panels and joined to the array of tiles and the thermal insulation panels.

Preferably, the thermal insulation panels have first and second adjacent undercut edges and third and fourth adjacent overcut edges so as to fit together in a mutually tucked arrangement.

In accordance with a preferred embodiment of the present invention the wall also includes tape sealing joints between adjacent ones of the thermal insulation panels.

Preferably, the array of tiles includes tiles including at least one of ceramic elements, klinker elements, porcelain elements, terra cotta elements, natural stone elements, artificial stone elements, marble elements, HPL elements and metal elements.

There is further provided in accordance with yet another preferred embodiment of the present invention a tile placement positioner including a planar portion including at least two mutually perpendicular arms defining a plurality of tile edge engagement surfaces, a pin portion integrally formed with the planar portion and including an undercut retaining configuration suitable for snap-fit engagement with apertures in a frame assembly and an undercut socket suitable for receiving a corresponding tile placement retainer.

Preferably, the tile placement positioner also includes a tile placement retainer arranged for engagement with the undercut socket of the tile placement positioner and including a retaining portion being configured for retaining edges of adjacent tiles between the tile placement positioner and the tile placement retainer.

There is yet further provided in accordance with still another preferred embodiment of the present invention an insulation panel including a first planar surface and a second planar surface facing oppositely to the first planar surface, at least one of the first and second planar surfaces being formed with an array of mutually spaced protrusions which are suitable to define air-flow pathways.

Preferably, the array of mutually spaced protrusions are mutually spaced along mutually perpendicular directions thereby being suitable to define air-flow pathways extending in mutually perpendicular directions.

It is appreciated that the methodology, apparatus and systems of the present invention are suitable for both in-situ and precast wall construction.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description in which:

Fig. 1 is a simplified illustration of a frame assembly useful in constructing exterior walls of buildings in accordance with a preferred embodiment of the present invention;

Fig. 2 is a simplified illustration of the frame assembly of Fig. 1 having tile placement retainers mounted therein in accordance with a preferred embodiment of the present invention;

Figs. 3A, 3B & 3C are simplified illustrations of three stages in preparation of a typical tile assembly useful in a preferred embodiment of the present invention and having anchors and support bolts mounted thereon;

Figs. 4A and 4B are simplified illustrations of mounting of the tiles of Figs. 3A – 3C onto the frame assembly of Figs. 1 & 2 in accordance with a preferred embodiment of the present invention;

Fig. 5 is a simplified front and sectional illustration of one embodiment of a thermal insulation panel useful in a preferred embodiment of the present invention;

Fig. 6 is a simplified front and sectional illustration of another embodiment of a thermal insulation panel useful in a preferred embodiment of the present invention;

Figs. 7A, 7B, 7C, 7D, 7E, 7F, 7G, 7H and 7I are simplified illustrations of further stages in the construction of exterior walls of buildings in accordance with a preferred embodiment of the present invention and employing the elements illustrated in Figs. 1 - 6B;

Fig. 8 is a simplified sectional illustration of a multi-level building including exterior walls in accordance with a preferred embodiment of the present invention showing air flows therethrough; and

Fig. 9 is a simplified front view of a multi-level building, similar to the multilevel building of Fig. 8 showing air flows through a front wall of a building constructed and operative in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Reference is now made to Fig. 1, which is a simplified illustration of an exterior frame assembly 100 useful in constructing exterior walls of buildings in accordance with a preferred embodiment of the present invention. The present invention relates to construction of building facade walls, both in pre-fabricated construction and in on-site construction. Embodiments of the present invention are suitable for use with various types of facade elements, here termed "tiles". Tiles, as defined herein may include any suitable facade element, such as, for example, ceramic elements, klinker elements, porcelain elements, terra cotta elements, natural stone elements, artificial stone elements, marble elements, HPL elements and metal elements.

As seen in Fig. 1, the frame assembly 100 typically comprises a generally planar element 101 having an interior-facing surface 102 and an array of reinforcement beams 104 on an exterior-facing surface thereof. It is appreciated than non-planar frame assemblies may alternatively be provided.

Preferably, there are provided a flexible resilient tile surface protection layer 106, adhered to the interior-facing surface 102. Layer 106 is preferably formed of NEOPRENE®. A multiplicity of pre-drilled holes 108 are preferably formed in the interior-facing surface 102 at locations intermediate strips 106 and preferably include holes 108, which are positioned so as to lie at the corners of tiles forming part of the desired pattern of tiles to be mounted on layer 106 adhered to interior-facing surface 102.

The frame assembly 100 is preferably positioned as by a crane (not shown) at one side of a proposed vertical wall on a building and is preferably fixed to a previously constructed floor structure 110 of the building, as seen in Fig. 1.

Reference is now made to Fig. 2, which a simplified illustration of the frame assembly of Fig. 1 having tile placement positioners 120 mounted therein in holes 108 accordance with a preferred embodiment of the present invention. As seen in Fig. 2, the tile placement positioners 120 are preferably of generally cruciform shape and are each formed at their center with an undercut retaining pin portion 122 for snap-fit engagement with frame assembly 100 at holes 108. Tile placement positioners 120 are

preferably each formed with an undercut socket 124 for receiving corresponding tile placement retainers (not shown). Tile placement positioners 120 each preferably define a total of eight tile edge engagement surfaces 126.

Reference is now made to Figs. 3A, 3B & 3C, which are simplified illustrations of three stages in preparation of a typical tile assembly 128 useful in a preferred embodiment of the present invention and having anchors and support bolts mounted thereon.

Fig. 3A illustrates optional drilling of an undercut socket 130 at the back surface 132 of a conventional tile 134. Alternatively, tiles 134 may be provided with pre-formed sockets 130. Fig. 3B shows an internally threaded anchor 136 mounted within each of a plurality of undercut sockets 130 on a tile 134. A preferred embodiment of anchor 136 is a plug in anchor CA 555 commercially available from KEIL Befestigungstechnik GmbH, Engelskirchen, Germany. Fig. 3C illustrates a threaded tile mounting shaft 138 threadably engaged with each of typically four anchors 136 on a tile 134. As seen in Figs. 3A - 3C, each tile 134 has an exterior-facing surface 142, an interior-facing surface 144 and peripheral edges 146 meeting at corners 148. Each threaded tile mounting shaft 138 extends outwardly from interior-facing surface 144.

Reference is now made to Figs. 4A and 4B, which are simplified illustrations of mounting of the tile assemblies 128 of Figs. 3A – 3C onto the frame assembly 100 of Figs. 1 & 2 in accordance with a preferred embodiment of the present invention. Preferably, the outer surfaces of the tiles 134 are sprayed with a suitable silicone spray which is intended to reduce or eliminate the need to clean the tiles after the frame is removed.

As seen in Figs. 4A and 4B, each tile assembly 128 is placed onto frame assembly 100 such that each corner 148 of each tile 134 lies at the intersection of two tile edge engagement surfaces 126 of a tile placement positioner 120. Once four adjacent tile assemblies 128 are so placed, they are preferably retained in position by snap-fit insertion of a tile placement retainer 150, into tile assembly retaining engagement with a corresponding tile placement positioner 120.

As seen most clearly in Fig. 4B, tile placement retainers 150 include a planar portion 152, having at its center on one side of planar portion 152 an undercut

retaining pin 154, which is arranged for snap fit engagement with undercut socket 124 of each tile placement positioner 120.

Reference is now made to Figs. 5 and 6, which are simplified front and sectional illustrations of two examples of a thermal insulation panel 160, useful in a preferred embodiment of the present invention.

As seen in Figs. 5 & 6, the thermal insulation panel 160 preferably is a fire-resistant planar panel, typically formed of coated foamed polystyrene. A preferred example is POLYESH, commercially available from Polybid of Kibbutz Mishmar Hanegev, Israel and having first and second adjacent undercut edges 162 and 164 and third and fourth adjacent overcut edges 166 and 168 so as to fit together with similar panels 160 in a mutually tucked arrangement defining a joint 169 (Fig. 7A). Thermal insulation panel 160 preferably includes an inward-facing surface 170 and an outward-facing surface 172. In accordance with a preferred embodiment of the present invention, outward-facing surface 172 is formed with an array of mutually spaced protrusions which define air-flow pathways therebetween. Preferably, the air-flow passageways provided extend both vertically and horizontally. In the example of Fig. 5, circular protrusions 174 are provided and in the example of Fig. 6, elongate protrusions 175 are provided.

It is a particular feature of an embodiment of the present invention that the protrusions define air flow passages which provide an air flow, preferably vertical, through the walls of a building constructed in accordance with a preferred embodiment of the present invention. These pathways are indicated by arrows 176 in the embodiment of Fig. 5 and by arrows 178 in the embodiment of Fig. 6. Preferably a plurality of pre-drilled holes 180, positioned and sized to accommodate threaded tile mounting shafts 138, extend through each thermal insulation panel 160.

Reference is now made to Figs. 7A, 7B, 7C, 7D, 7E, 7F, 7G, 7H and 7I, which are simplified illustrations of further stages in the construction of exterior walls of buildings in accordance with a preferred embodiment of the present invention and employing the elements illustrated in Figs. 1 - 6B.

As seen in Fig. 7A, the thermal insulation panels 160 are mounted over the tile assemblies 128, with outward-facing surfaces 172 facing tile assemblies 128, such that the threaded tile mounting shafts 138 extend through pre-drilled holes 180 in

each thermal insulation panel 160. Fig. 7B illustrates threaded engagement of threaded retaining nuts 182 with each of threaded tile mounting shafts 138 for retaining the thermal insulation panels 160 in position behind the tile assemblies 128. Alternatively, tile mounting shafts 138 are non-threaded and non-threaded retaining caps are provided and sealingly positioned onto tile mounting shafts for retaining the thermal insulation panels 160 in position behind the tile assemblies 128.

Fig. 7C illustrates tape sealing of the joints 169 between adjacent thermal insulation panels 160 by tape 184. Fig. 7D illustrates threaded engagement of exterior reinforcement bar engagement elements 186 at selected locations on the backs of some of the thermal insulation panels 160.

Fig. 7E illustrates engagement of exterior reinforcement bars 188 with exterior reinforcement bar engagement elements 186. Fig. 7F illustrates tied engagement of a reinforcement bar grid 190 onto exterior reinforcement bars 188, preferably using a wire 192. Alternatively, any other suitable attachment method may be used to attach reinforcement bar grid 190 onto exterior reinforcement bar engagement elements 186.

Fig. 7G illustrates positioning of an interior frame assembly 200 interiorly of the arrangement of Fig. 7F. It is seen that interior frame assembly 200 includes interior reinforcement bar spacer elements 202, extending outwardly from an outwardly facing surface 204 of interior frame assembly. Exterior reinforcement bars 206, which preferably form part of an interior reinforcement bar grid, are engaged by spacer elements 202 and are also attached to reinforcement bar grid 190.

Fig. 7H shows concrete poured between the backs of thermal insulation panels 160 and outwardly facing surface 204 of interior frame assembly 200. Fig. 7I shows a wall portion 210 produced in accordance with a preferred embodiment of the present invention following removal of the exterior and interior frame assemblies 100 and 200 respectively.

Reference is now made to Fig. 8, which is a simplified sectional illustration of a multi-level building including exterior walls in accordance with a preferred embodiment of the present invention showing air flows therethrough.

As seen in Fig. 8, vertical air flow passageways 300 are defined in an exterior wall 310 which includes multiple wall portions 210 (Fig. 7I). It is appreciated

that preferably a wall top cap strip 320 is attached, typically as shown as by bolts 324, on the top of exterior wall 310 and it is noted that an air passageway, shown by an arrow 326, is provided to allow air which rises along air flow passageways 300, preferably defined by the protrusions of the thermal insulation panels 160, to escape to the outside of the building.

It is further appreciated that a wall bottom strip 330 is attached, typically as shown by bolts 334, at the bottom of exterior wall 310 and it is noted that an air passageway, shown by an arrow 336, is provided to allow air from the outside of the building to enter the air flow passageways 300.

Reference is now made to Fig. 9, which a simplified front view of the multi-level building of Fig. 8 showing air flows through side wall 400 thereof. As seen in Fig. 9, air enters wall 400 through air flows 402 at the bottom of wall 400, such as an air flow through an air flow passageway defined by a wall bottom portion, such as air flow passageway 336 (Fig. 8) defined by bottom strip 330 (Fig. 8), as well as through horizontal air flows 404 which enter through side ends of wall 400. Air preferably flows upwardly via air flows 406 and exits wall 400, via air flows 408, from a top portion of wall 400, typically by exiting through an air flow passageway defined by a cap portion, such as through air flow passageway 326 (Fig. 8) defined by cap strip 320 (Fig. 8). Air also preferably flows horizontally between the inner-facing surfaces of the tiles and the insulation panels.

It is appreciated that the tiles are preferably spaced from each other both vertically and horizontally, thereby to allow air flows in both directions between the outside and the passageways defined between the inner-facing surfaces of the tiles and the insulation panels.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described herein. Rather the scope of the present invention includes both combinations and sub-combinations of the various features described hereinabove as well as modifications and variations which would occur to persons skilled in the art upon reading the foregoing description and which are not in the prior art.

CLAIMS:

1. A ventilated exterior wall structure for a building having a structural wall and comprising:

an array of exterior tiles arranged in a first plane;

an array of insulation panels arranged in a second plane, parallel to said first plane and spaced therefrom by an air flow space, each of said insulation panels having a plurality of throughgoing apertures; and

connecting elements extending through said plurality of throughgoing apertures and connecting said array of exterior tiles to a structural wall.

2. A ventilated exterior wall structure for a building according to claim 1 and wherein said exterior tiles in said array of exterior tiles are mutually spaced.

3. A ventilated exterior wall structure for a building according to claim 1 or claim 2 and wherein said insulation panels in said array of insulation panels are not mutually spaced.

4. A ventilated exterior wall structure for a building according to any of claims 1 – 3 and wherein said air flow space is defined by a plurality of protrusions.

5. A ventilated exterior wall structure for a building according to claim 4 and wherein said plurality of protrusions are integrally formed with said insulation panels.

6. A ventilated exterior wall structure for a building according to any of claims 1 – 5 and wherein said connecting elements each include at least one threaded element.

7. A ventilated exterior wall structure for a building according to any of claims 1 – 5 and wherein said at least one threaded element includes first and second mutually threadable threaded elements.

8. A ventilated exterior wall structure for a building according to any of claims 1 – 7 and wherein structural wall comprises a concrete wall.

9. A ventilated exterior wall structure for a building according to any of claims 1 – 7 and wherein structural wall comprises a reinforced concrete wall.

10. A ventilated exterior wall structure for a building according to any of claims 1 – 9 and wherein each of said exterior tiles is mutually spaced from each adjacent exterior tiles in said array of exterior tiles.

11. A method for creating a ventilated exterior wall structure for a building having a structural wall and comprising the steps of:

arranging an array of exterior tiles in a first plane;

arranging an array of insulation panels in a second plane, parallel to said first plane and spaced therefrom by an air flow space, each of said insulation panels having a plurality of throughgoing apertures; and

connecting said array of exterior tiles to a structural wall using connecting elements extending through said plurality of throughgoing apertures.

12. A method according to claim 11 and wherein said exterior tiles in said array of exterior tiles are mutually spaced.

13. A method according to claim 11 or claim 12 and wherein said insulation panels in said array of insulation panels are not mutually spaced.

14. A method according to any of claims 11 – 13 and wherein said air flow space is defined by a plurality of protrusions.

15. A method according to claim 14 and wherein said plurality of protrusions are integrally formed with said insulation panels.

16. A method according to any of claims 11 – 15 and wherein said connecting elements each include at least one threaded element.

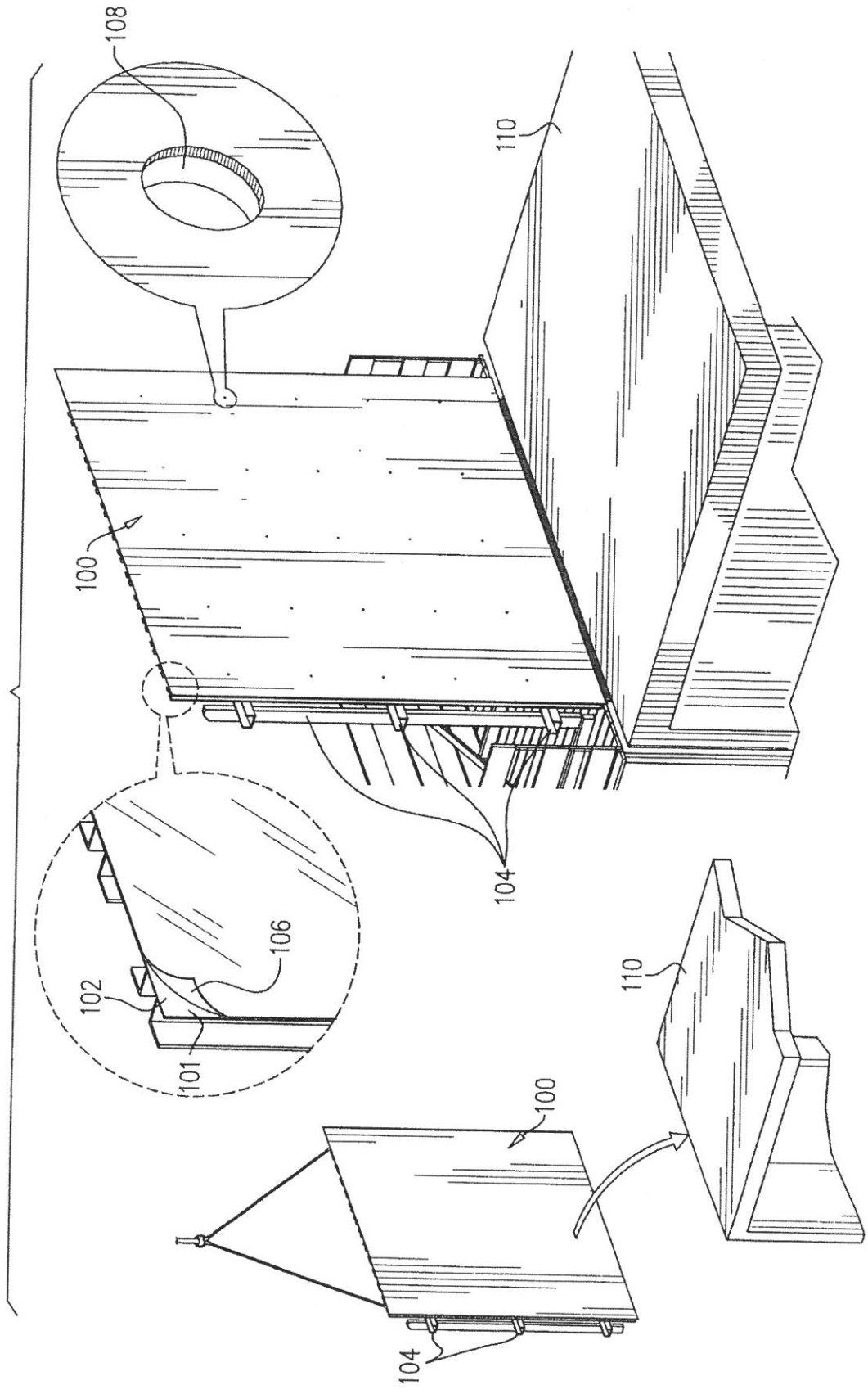
17. A method according to any of claims 11 – 15 and wherein said at least one threaded element includes first and second mutually threadable threaded elements.

18. A method according to any of claims 11 – 17 and wherein structural wall comprises a concrete wall.

19. A method according to any of claims 11 – 17 and wherein structural wall comprises a reinforced concrete wall.

20. A method according to any of claims 11 –1 9 and wherein each of said exterior tiles is mutually spaced from each adjacent exterior tiles in said array of exterior tiles.

FIG. 1



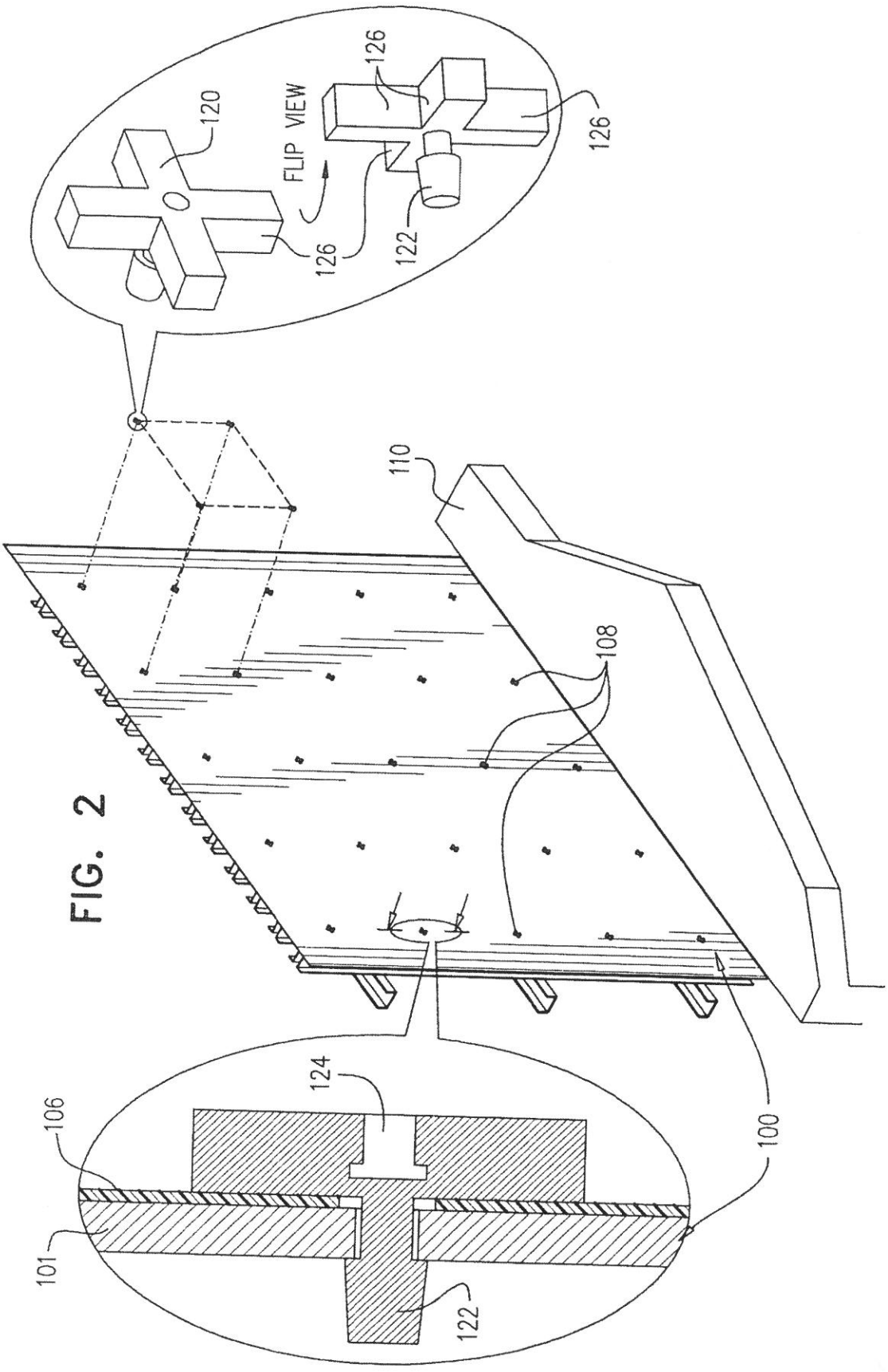


FIG. 2

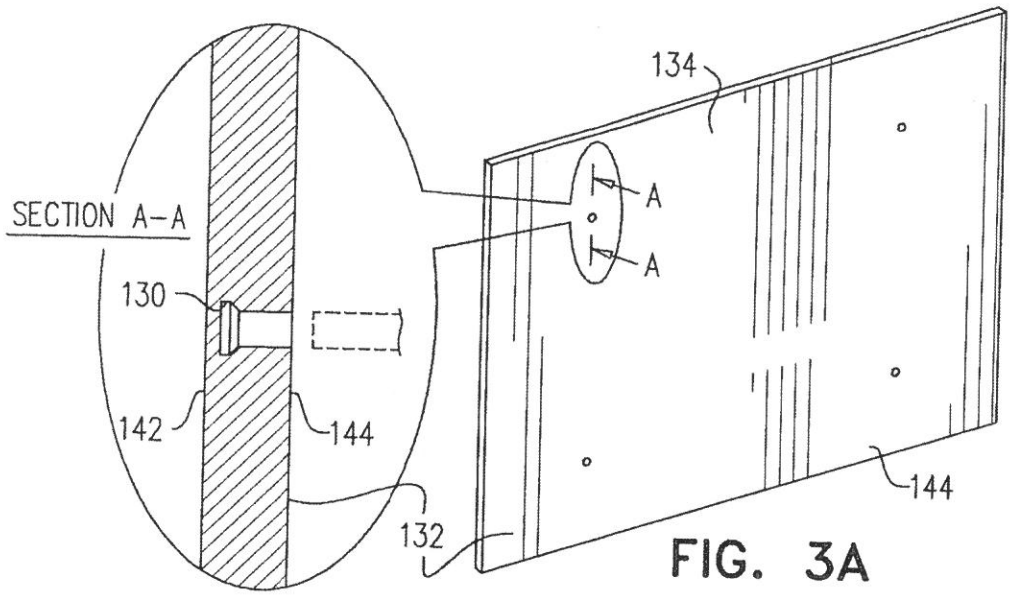


FIG. 3A

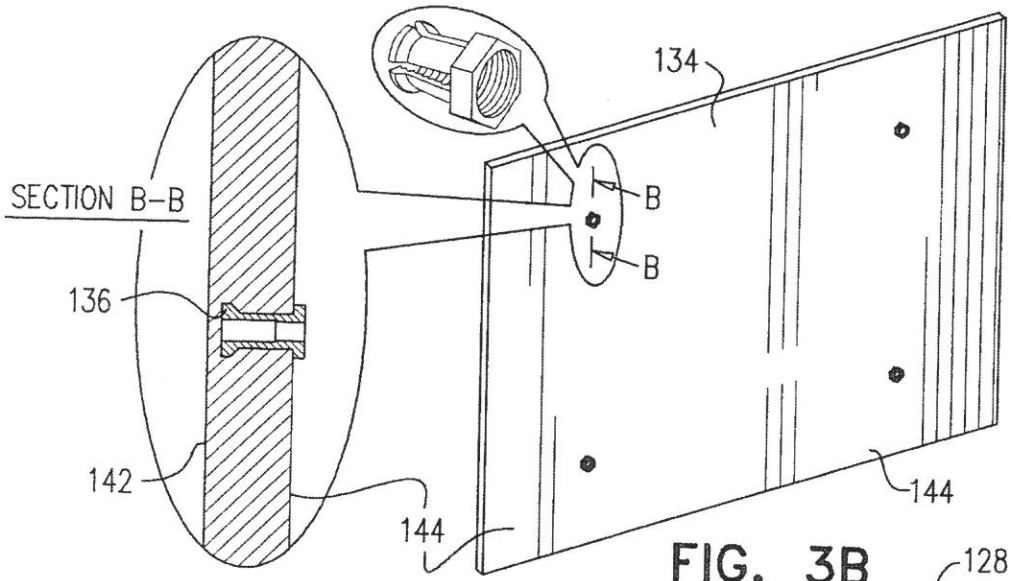


FIG. 3B

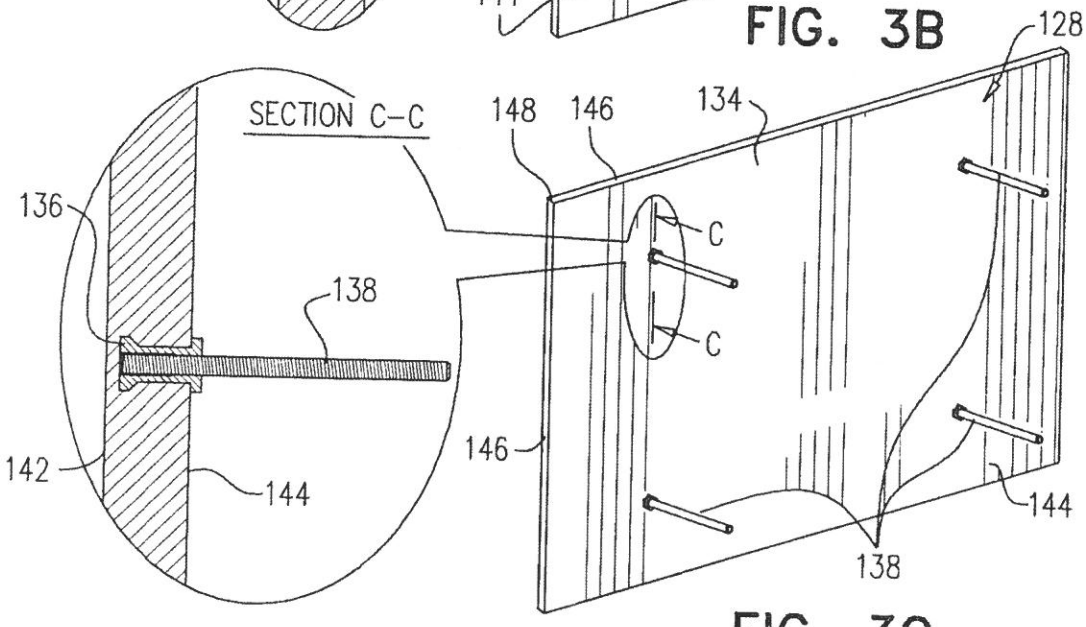
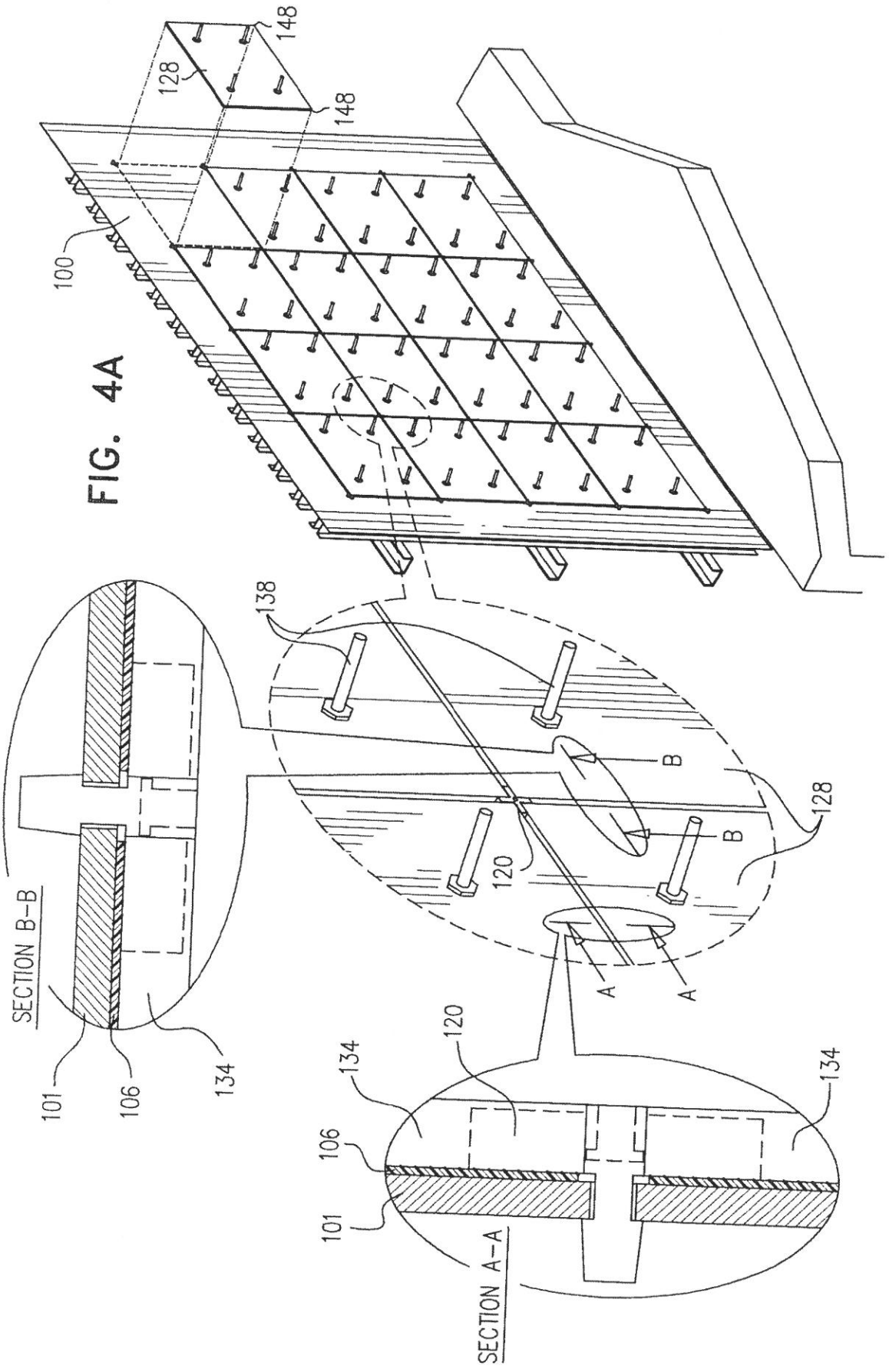


FIG. 3C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A
A
SECTION B–B
101
106
134
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134
106
134
101
SECTION A–A

FIG. 4A

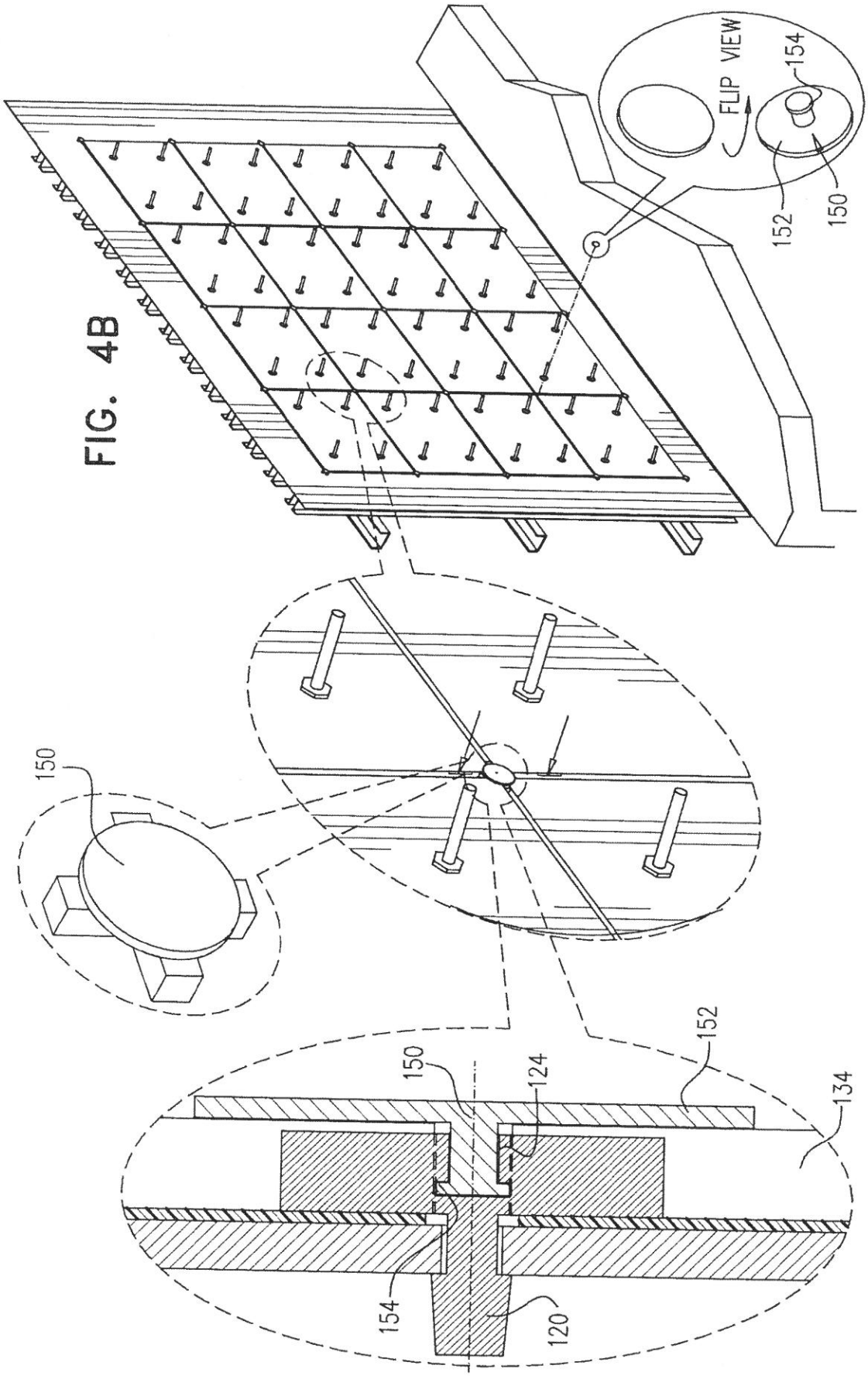

FIG. 4B

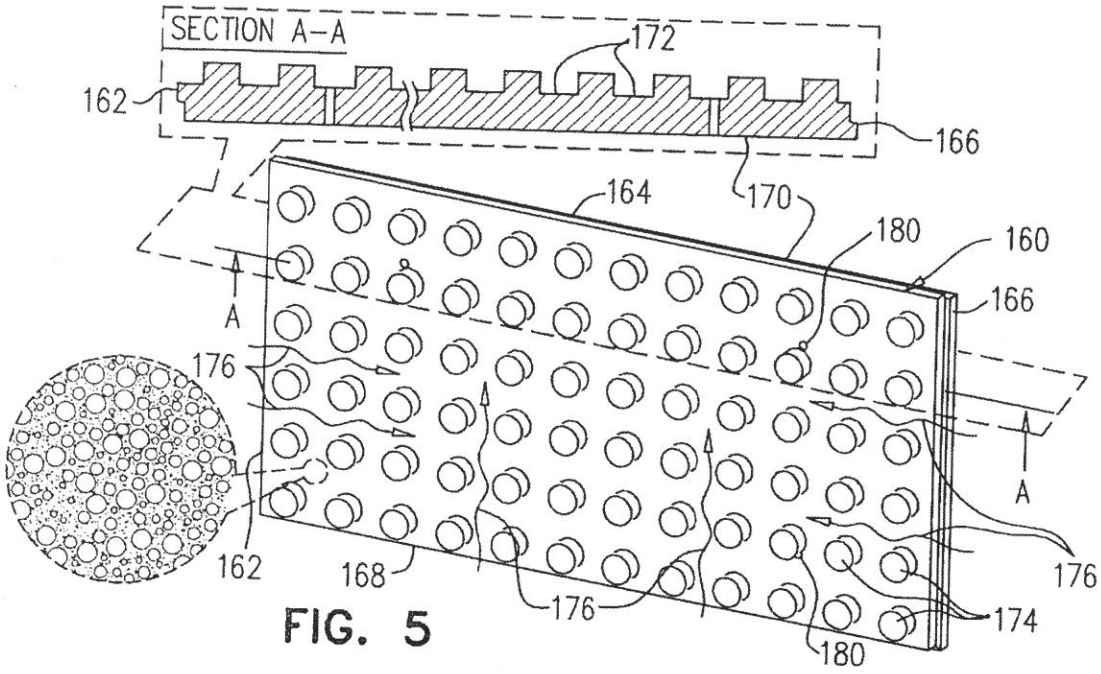
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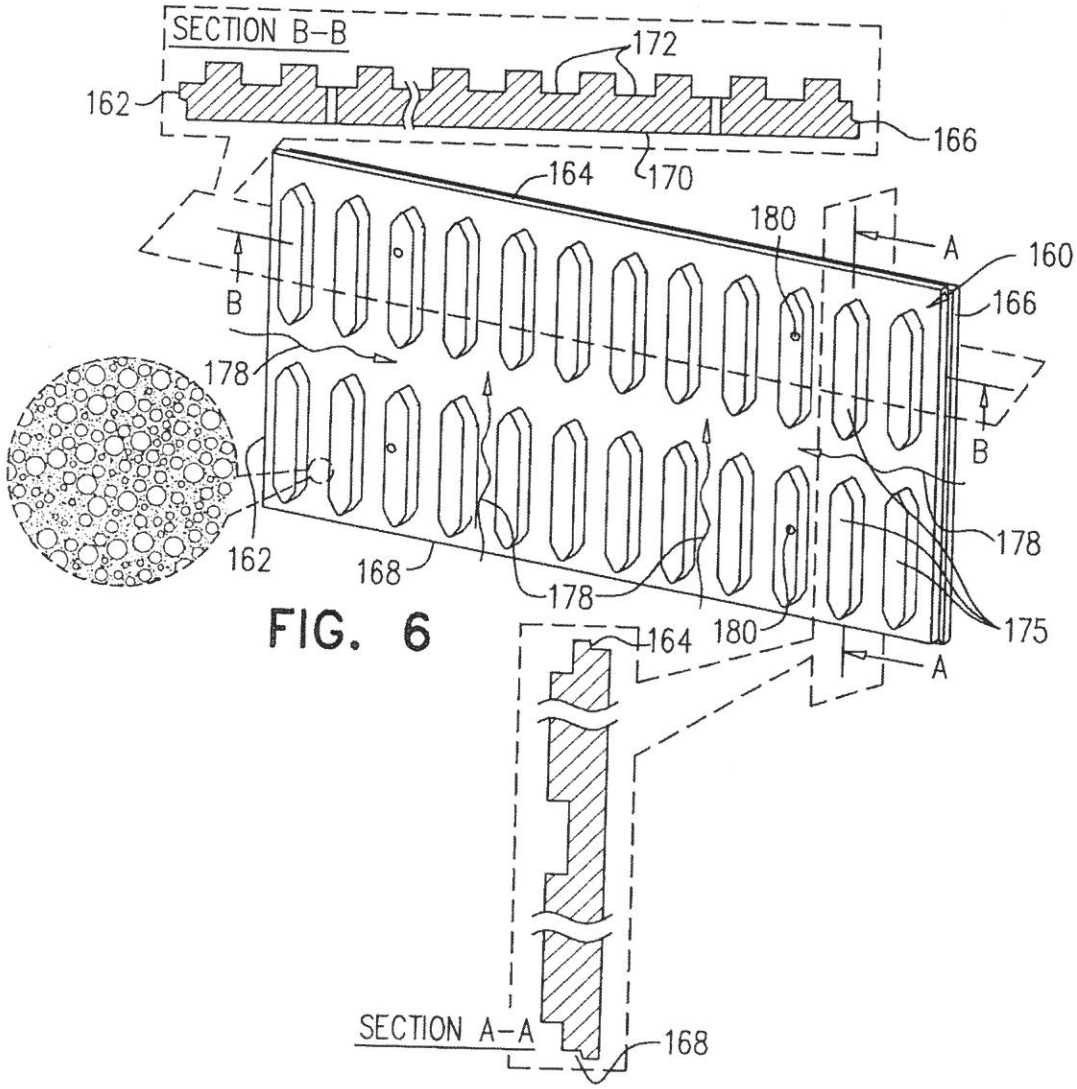
FIG. 5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SECTION A–A
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FIG. 6

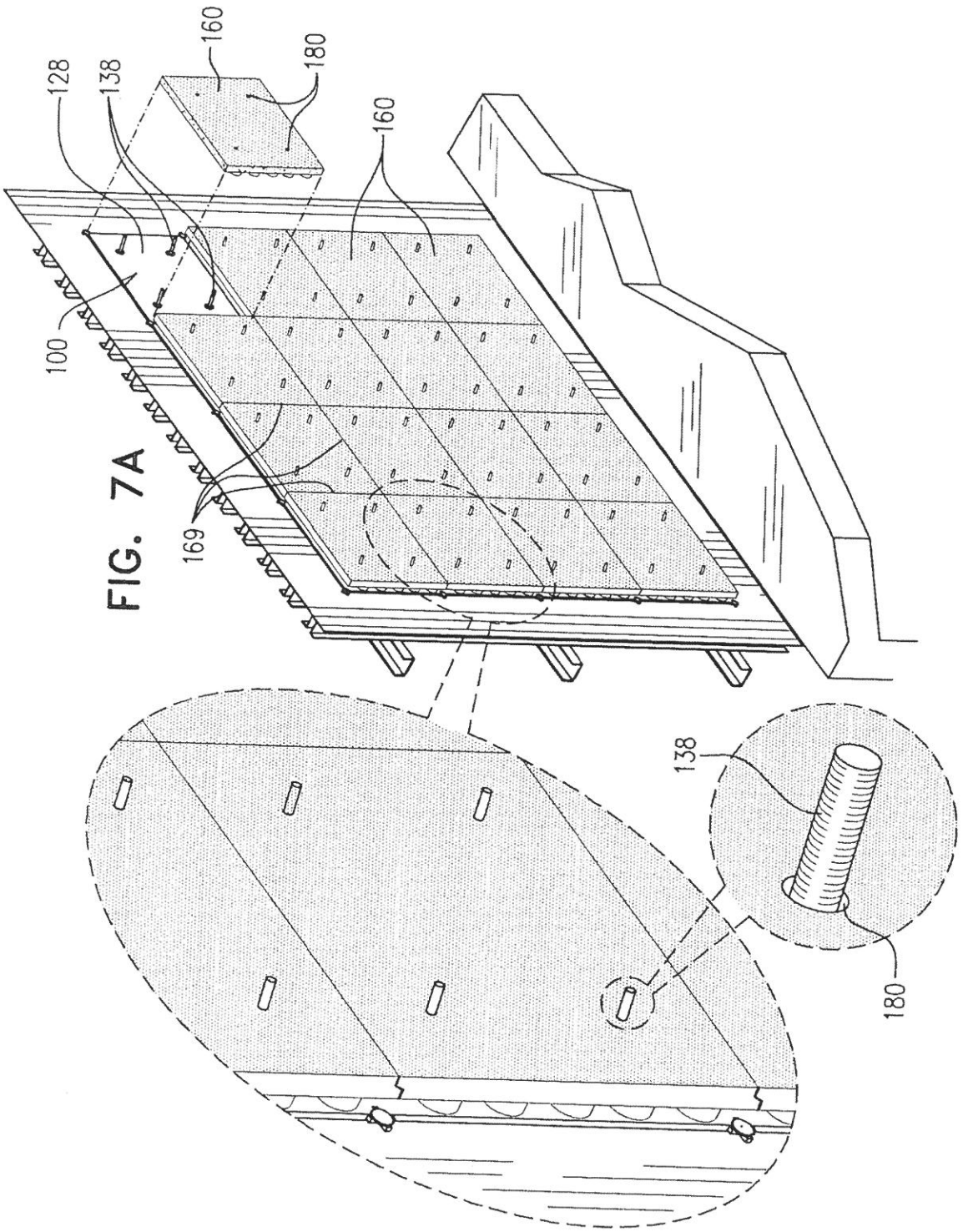


FIG. 7A

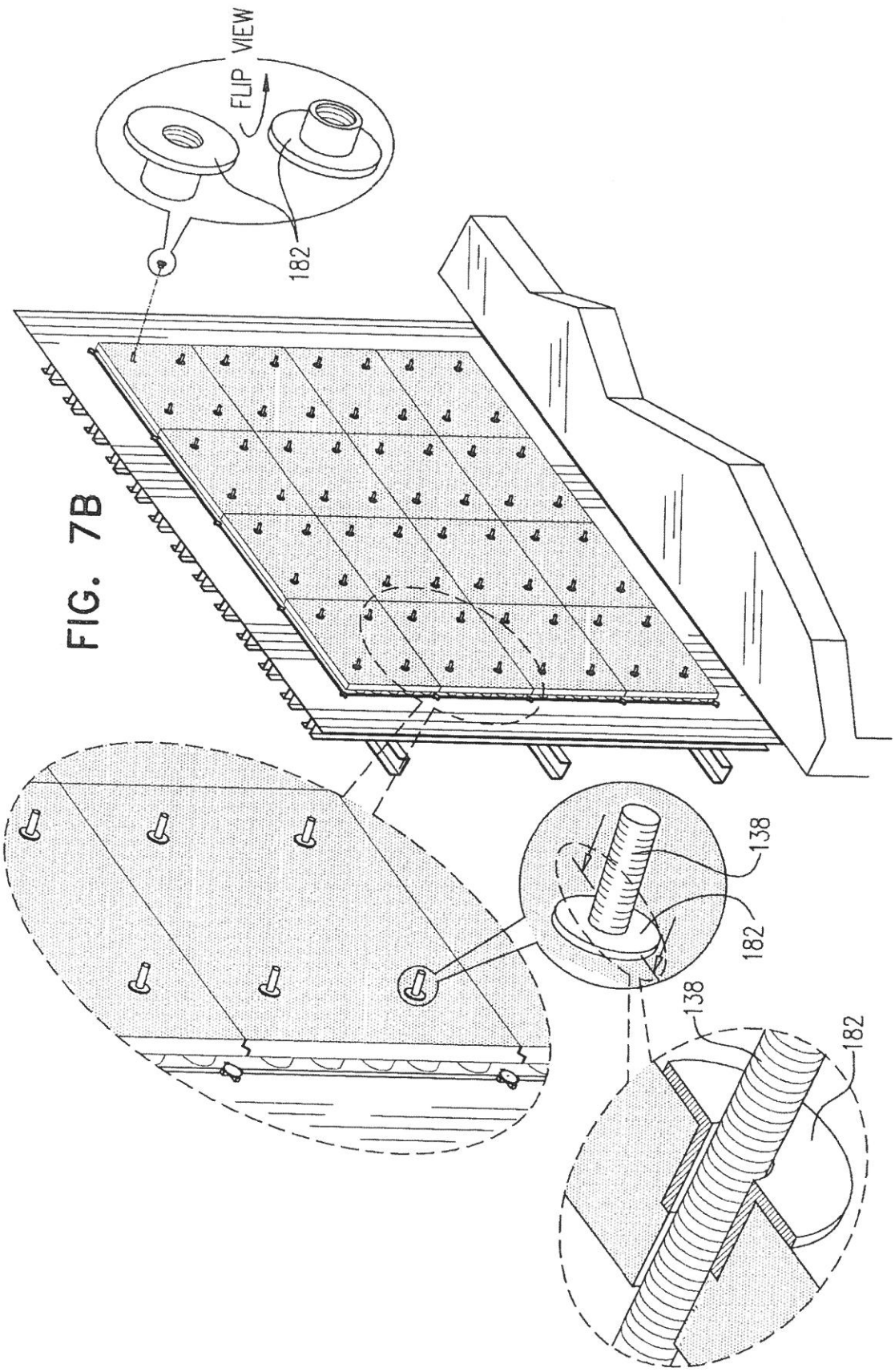


FIG. 7B

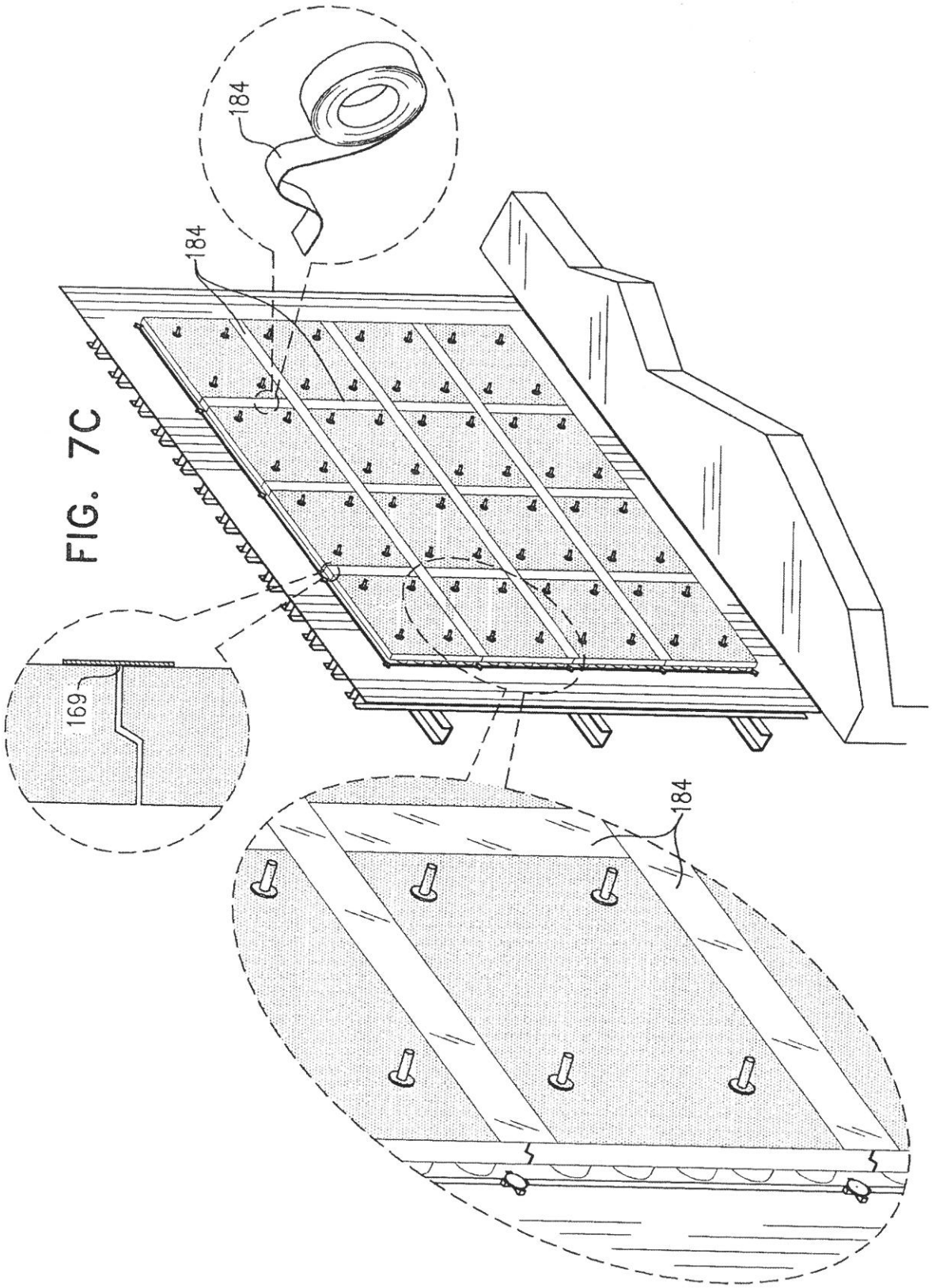


FIG. 7C

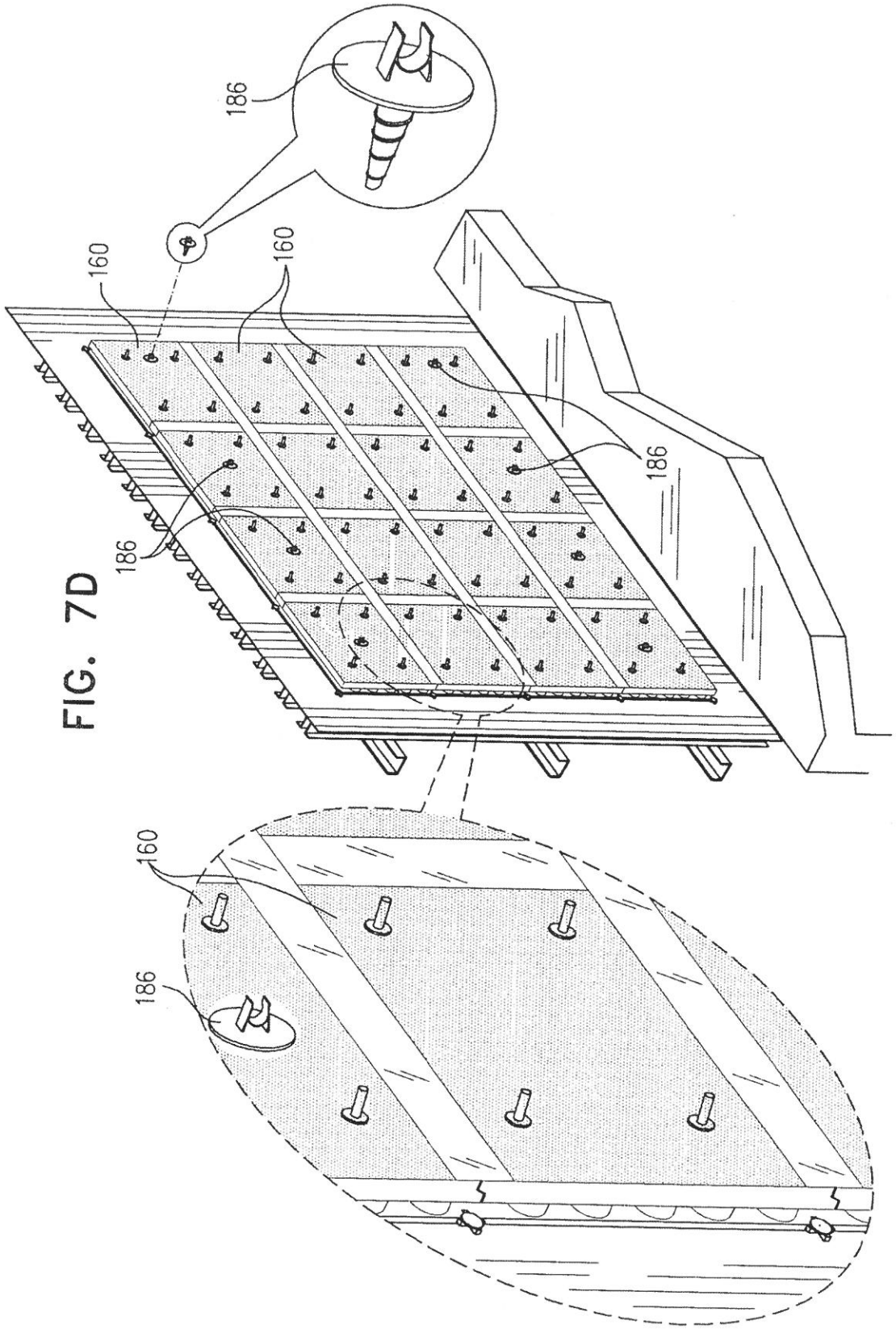


FIG. 7D

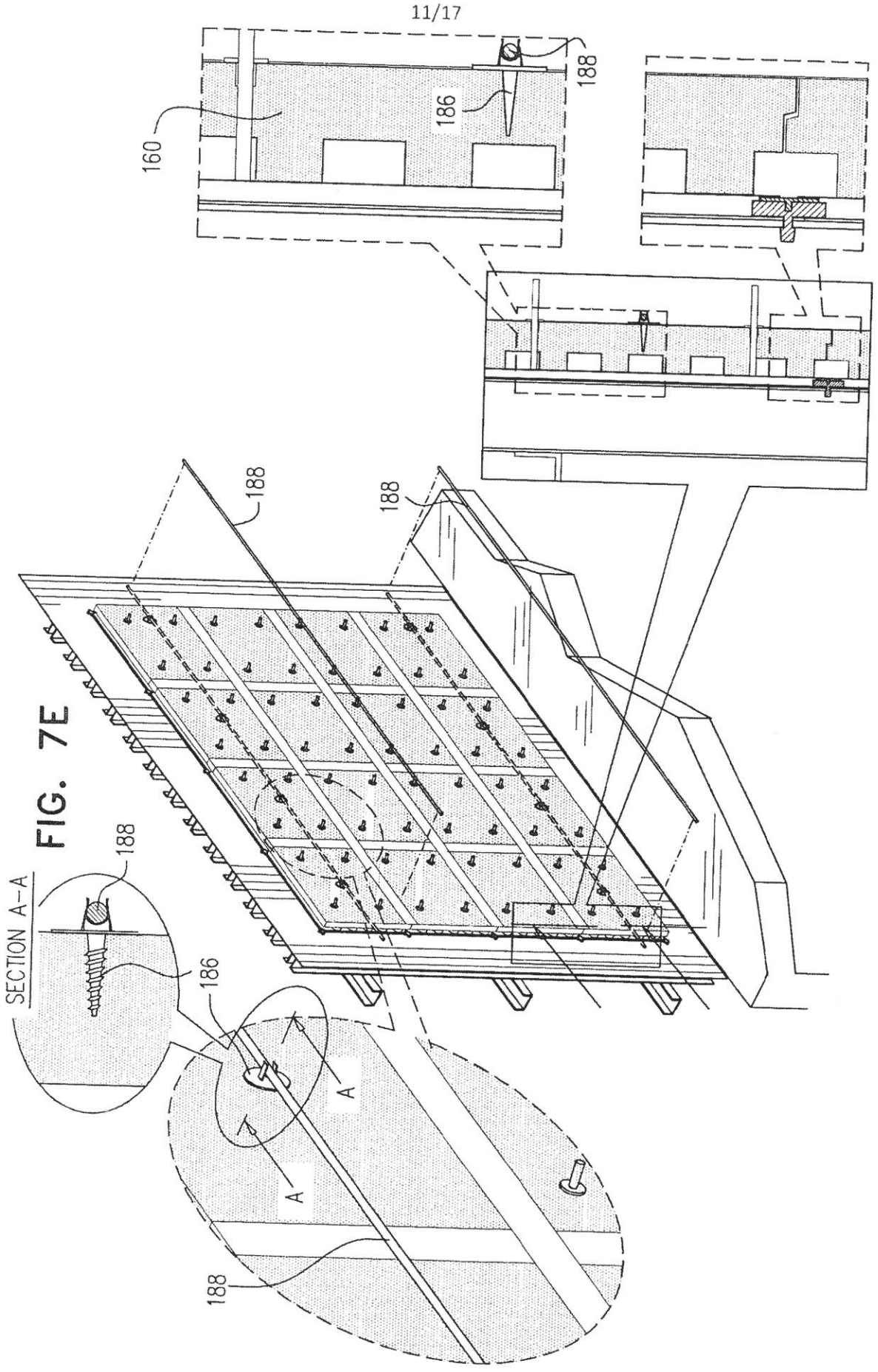


FIG. 7E

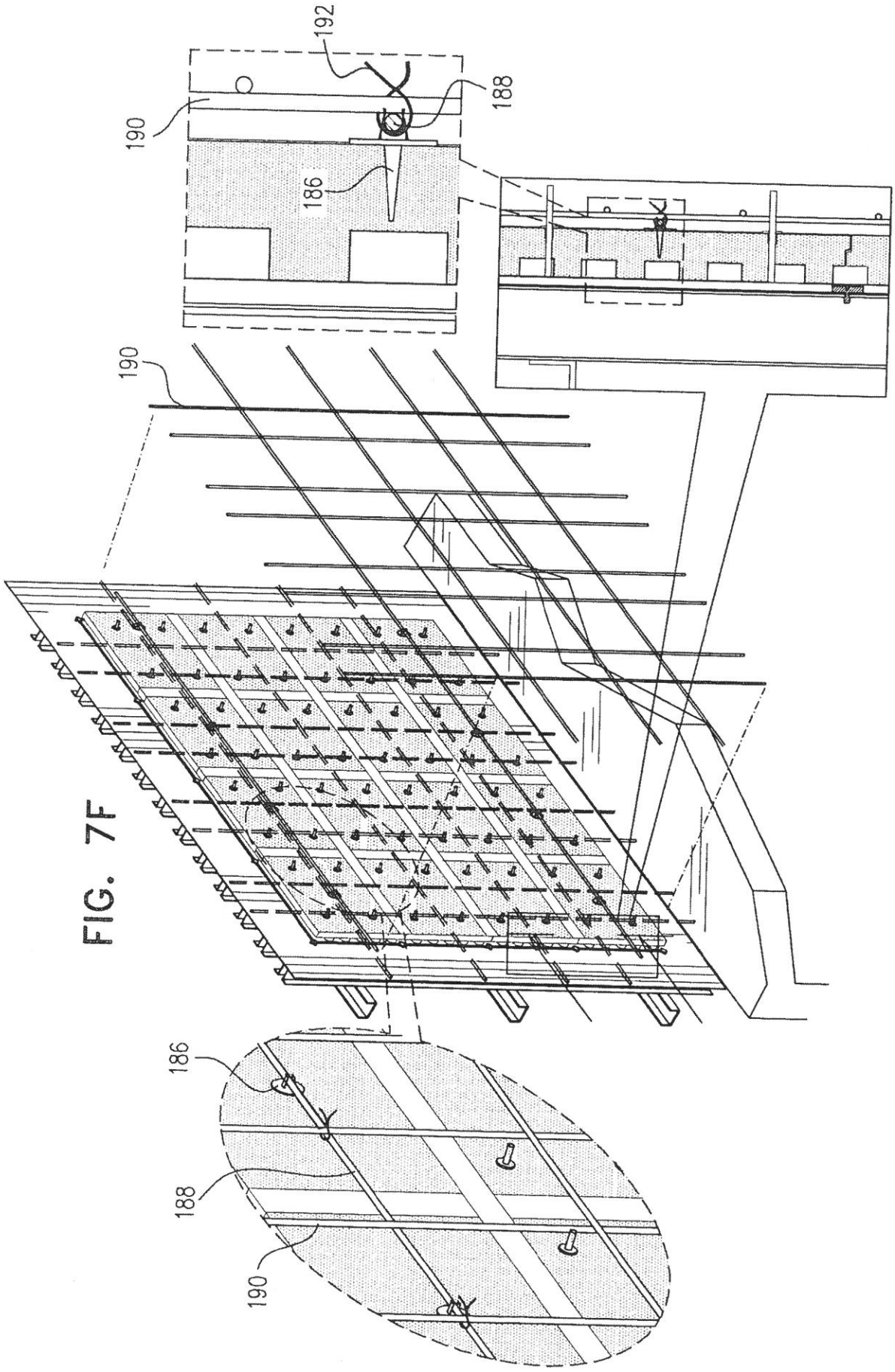


FIG. 7F

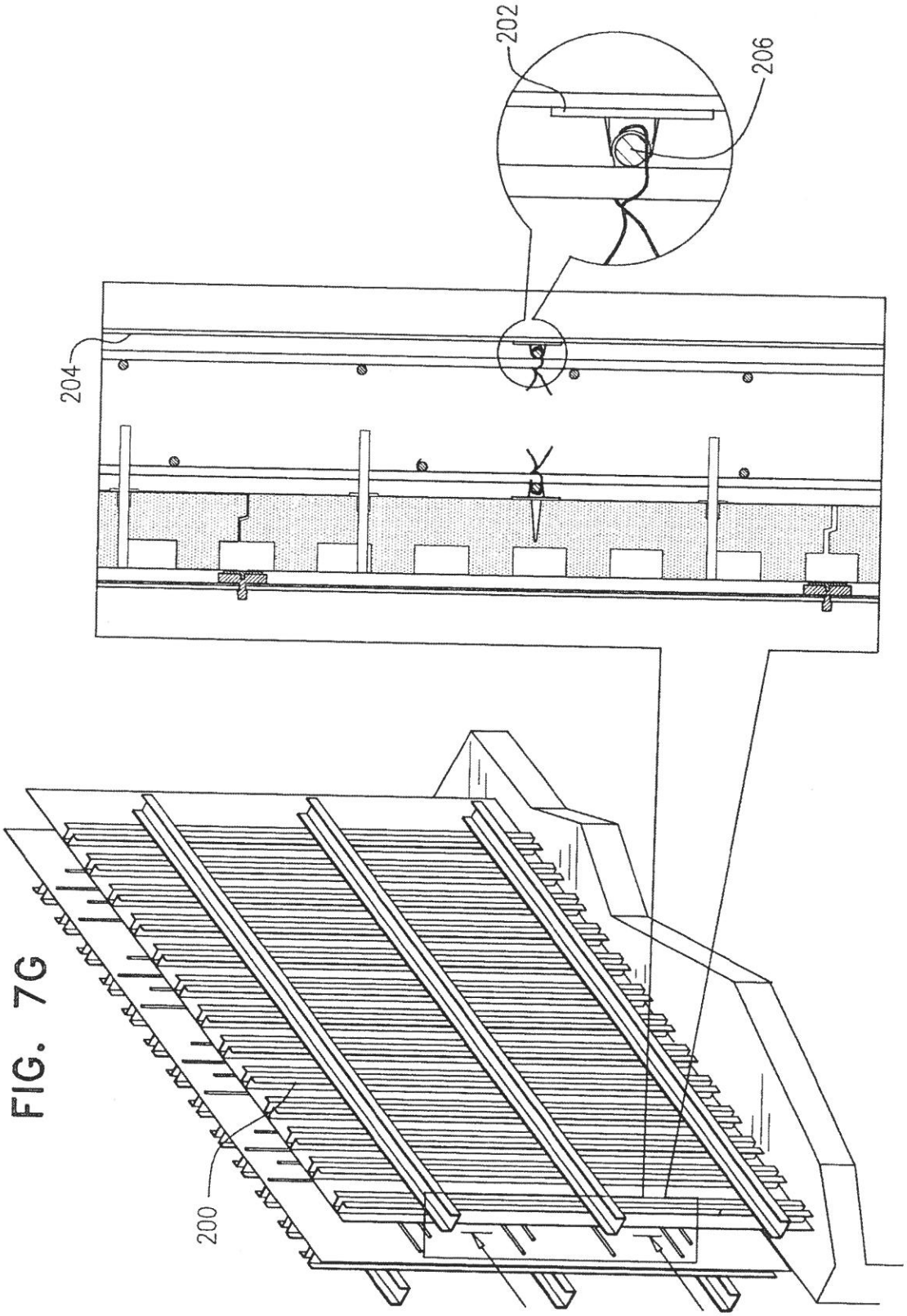


FIG. 7G

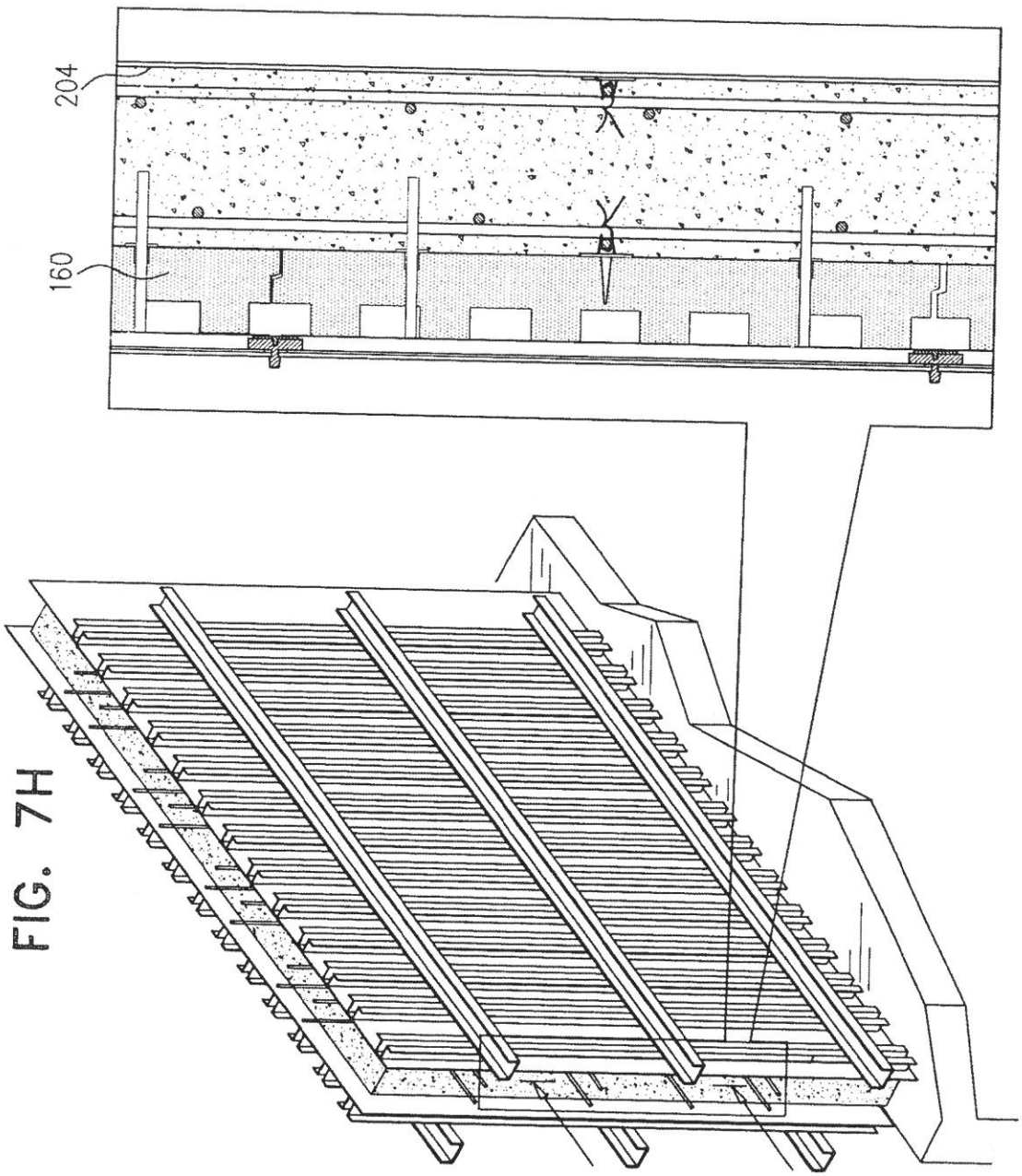


FIG. 7H

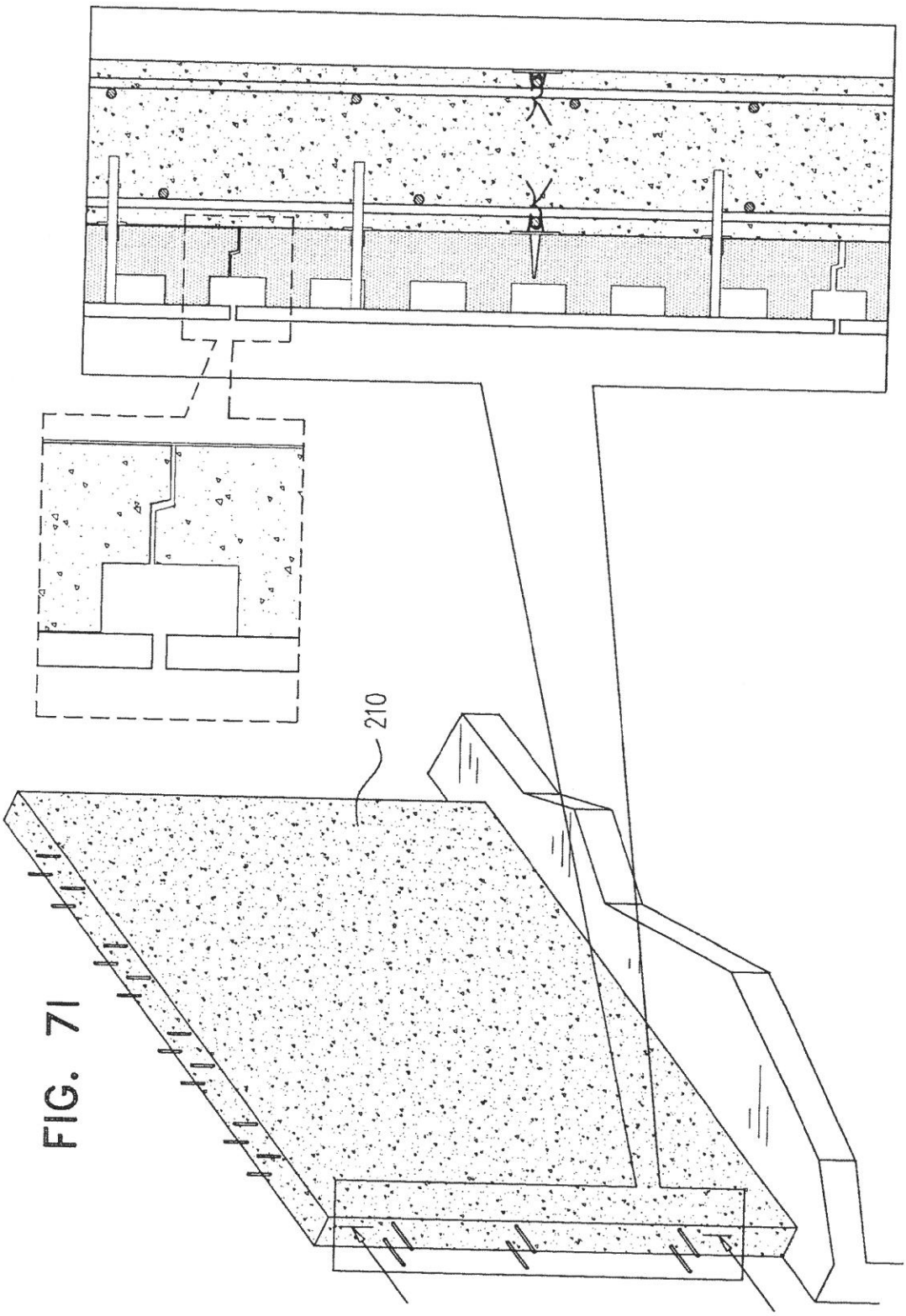


FIG. 7I

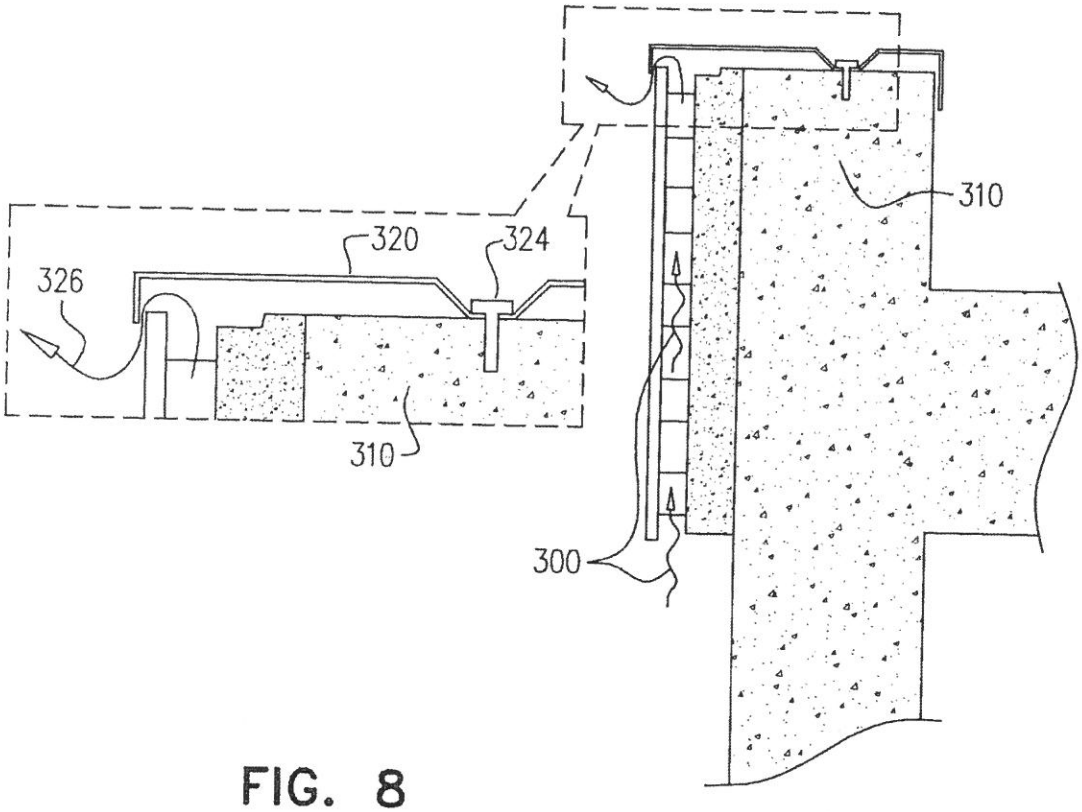


FIG. 8

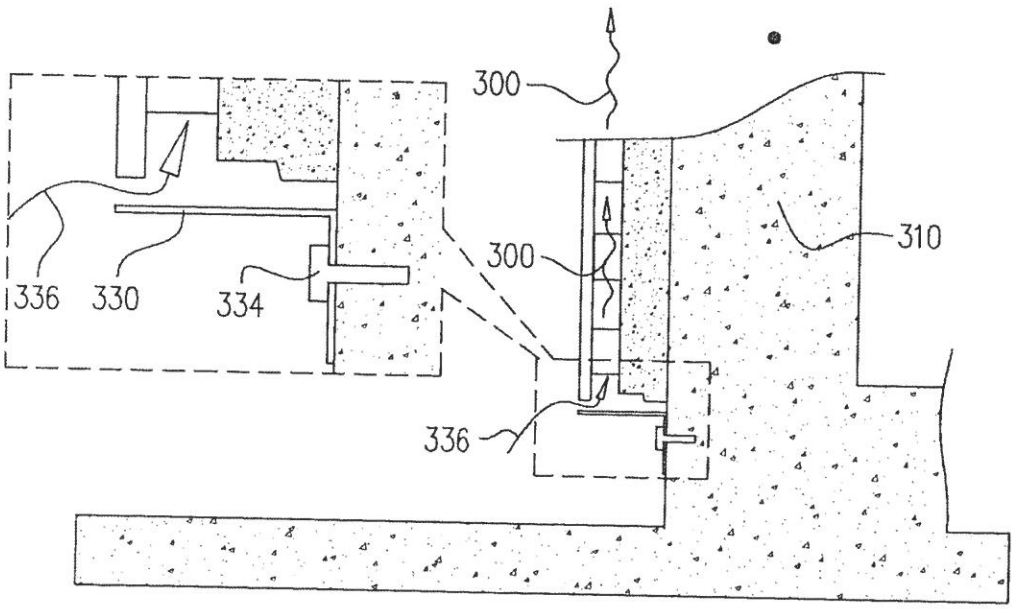
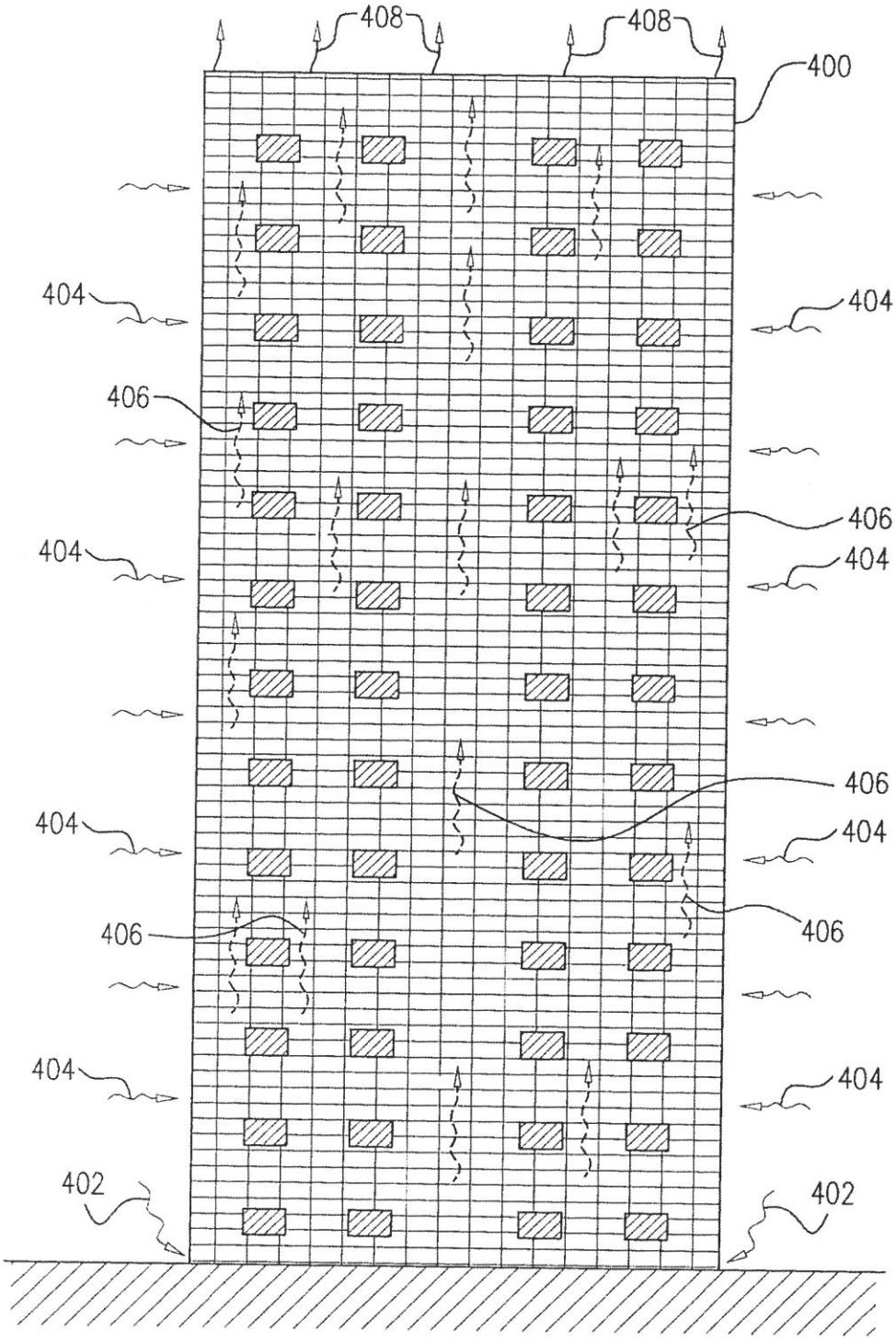


FIG. 9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