



## (51) International Patent Classification:

*E04F 13/08* (2006.01) *E04B 1/76* (2006.01)  
*E04B 1/41* (2006.01)

## (21) International Application Number:

PCT/US2015/066097

## (22) International Filing Date:

16 December 2015 (16.12.2015)

## (25) Filing Language:

English

## (26) Publication Language:

English

## (30) Priority Data:

62/093,032 17 December 2014 (17.12.2014) US

(71) Applicant: **DOW CORNING CORPORATION**  
[US/US]; 2200 West Salzburg Road, Midland, MI 48686-0994 (US).(72) Inventors: **CARBARY, Lawrence Donald**; 3960 E. Johns Lane, Midland, MI 48642 (US). **JENSEN, Jary D**; 1969 Pinesboro, Sanford, MI 48657 (US).(74) Agents: **LAPRAIRIE, David M.** et al.; Howard & Howard Attorneys PLLC, 450 West Fourth Street, Royal Oak, MI 48067 (US).

## (81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

## Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))
- of inventorship (Rule 4.17(iv))

[Continued on next page]

## (54) Title: THERMALLY BROKEN ANCHOR AND ASSEMBLY INCLUDING THE SAME

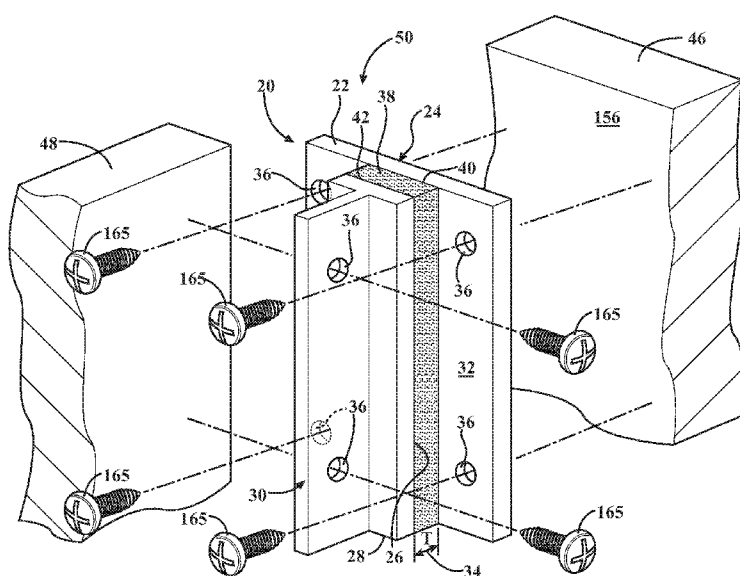


FIG. 4

(57) Abstract: An anchor 20 for securing together interior 48 and exterior building components 46 includes a first end 22 having an outer side 24 for engaging the interior building component and an inner side 26 opposite the outer side 24. The anchor further includes a second end 28 having an outer side 30 and an inner side 32 opposite the outer side of the second end for engaging the exterior building component. A thermal break 38 for reducing thermal bridging between the exterior and interior building components is disposed in a space 34 between the inner sides of the ends and has a first coupling surface 40 bonded to the inner side of the first end and a second coupling surface 42 bonded to the inner side of the second end. An assembly 50 includes the anchor 20 for securing together the interior and exterior building components 46, 48.

**WO 2016/100514 A1**



---

**Published:**

— *with international search report (Art. 21(3))*

## **THERMALLY BROKEN ANCHOR AND ASSEMBLY INCLUDING THE SAME**

### **CROSS-REFERENCE TO RELATED APPLICATIONS**

[0001] This application claims priority to U.S. Provisional Application No. 62/093,032, filed December 17, 2014, the content of which is incorporated herein by reference.

### **FIELD OF THE INVENTION**

[0002] The present invention generally relates to an anchor and to an assembly for a structure, more specifically to an anchor and to an assembly comprising interior and exterior building components, with the anchor disposed between the building components and having a thermal break for reducing thermal bridging between the building components while the building components are subject to a temperature difference between the building components.

### **DESCRIPTION OF THE RELATED ART**

[0003] In many commercial or industrial buildings, L- or Z-brackets are used to mechanically attach external building components (e.g. cladding) to internal building components (e.g. structural walls or sub-frames). A continuous span of insulation is often in contact with at least the internal building component. The brackets pass through seams in the insulation so that the external component can be attached to the brackets, which were previously attached to the interior building component. The brackets transfer climactic loads (e.g. wind loads) of the environment from the external building component to the internal building component. The brackets must be strong enough to support climactic loads and also weight of the external building component(s). Therefore, the brackets are often formed from metal (e.g. steel or aluminum). Unfortunately, since the aforementioned brackets are formed from metal, they act as direct thermal shorts between the exterior and interior building components. Various systems have been proposed in an effort to reduce heat transfer (i.e., heat loss or gain) between building components.

[0004] One system utilizes a ThermaStop™ thermal isolation system, which is commercially available from Knight Wall Systems of Deer Park, WA. The ThermaStop™ system utilizes 55 AL-ZN-coated steel brackets with plastic bases and integral 1/8-inch plastic washers. While the ThermaStop™ system has a relatively

narrow cross-section, the cross-section is formed from steel which passes through insulation and acts as a direct thermal short.

[0005] Another system utilizes a CASCADIA CLIP<sup>®</sup>, which is commercially available from Cascadia Windows Ltd. of Langley, BC, Canada. The CASCADIA CLIP<sup>®</sup> is a fiberglass girt spacer, and is illustrated in U.S. Design Patent No. D666,894 S to Bombino et al. and U.S. Patent Application Publication No. US2013/0174506 A1 to Bombino et al. While formed from fiberglass, the CASCADIA CLIP<sup>®</sup> relies on conventional metal fasteners (e.g. lag screws) that act as direct thermal shorts. In addition, the CASCADIA CLIP<sup>®</sup> can be difficult and time consuming to install.

[0006] Another system utilizes a thermal insulation material (TIM), which is commercially available from FABREEKA<sup>®</sup> of Boston, MA. The TIM is manufactured from a fiberglass-reinforced laminate composite. While formed from fiberglass, the TIM is a merely a pad used between flanged steel connections. The steel connections must be connected via conventional metal fasteners (e.g. bolts) that act as direct thermal shorts. In addition, the TIM can be difficult and time consuming to install.

[0007] Yet another system utilizes a POS-I-TIE<sup>®</sup> ThermalClip<sup>®</sup>, which is commercially available from Heckmann Building Products, Inc. of Melrose Park, IL. The ThermalClip<sup>®</sup> is formed from polyphenylsulfone (PPSU), has a snap on design, and is described in U.S. Patent Application Publication No. US2013/0232909 A1 to Curtis et al. The ThermalClip<sup>®</sup> is used in masonry construction. While formed from PPSU, the ThermalClip<sup>®</sup> relies on conventional metal wire ties that can act as direct thermal shorts. In addition, the ThermalClip<sup>®</sup> can be difficult and time consuming to install.

[0008] In view of the foregoing, there remains an opportunity to provide systems that reduce or negate heat transfer. There also remains an opportunity to provide systems that are easier and less time consuming to install.

### SUMMARY OF THE INVENTION

[0009] An anchor is disclosed. The anchor is useful for securing an exterior building component to an interior building component. The anchor comprises a first end having an outer side for engaging the interior building component. The anchor also comprises an inner side opposite the outer side of the first end. The anchor further comprises a second end having an outer side for engaging the exterior building component. The anchor yet further comprises an inner side opposite the outer side of the second end. The inner sides of the ends face each other. A space is defined between the inner sides of the ends. A thermal break is disposed in the space. The thermal break has a first coupling surface bonded to the inner side of the first end. The thermal break also has a second coupling surface opposite the first coupling surface and bonded to the inner side of the second end. Thermal conductivity of the thermal break is lower than thermal conductivity of at least one of the ends. The thermal break generally reduces thermal bridging between the building components while the building components are subject to a temperature difference between the building components.

[0010] An assembly is also disclosed. The assembly comprises the interior and exterior building components, which are spaced from each other to define the space. The anchor is disposed between the building components. The anchor secures the exterior building component to the interior building component, and generally reduces thermal bridging therebetween. The assembly is useful for a structure, such as for a building.

[0011] A method is also disclosed. The method entails securing the exterior building component to the interior building component. The method comprises the steps of providing the anchor and attaching the anchor to one of the building components to form a sub-assembly. The method further comprises the step of connecting the sub-assembly and the remaining building component to secure the building components.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Other advantages of the disclosure will be readily appreciated, as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

[0013] Figure 1A is a perspective view of an anchor of the disclosure;

[0014] Figure 1B is an exploded perspective view of the anchor in Figure 1A;

[0015] Figure 2 is a perspective view of another anchor of the disclosure;

[0016] Figure 3 is a photograph of a portion of an assembly having exterior and interior building components, clips, and rigid foam insulation; and

[0017] Figure 4 is a side view of an assembly having an exterior building component and interior building components and the anchor according to Figure 2 used for securing the exterior building component to the interior building component;

[0018] Figure 5 is a side section view of an anchor in accordance with another embodiment of the disclosure including a catch structures positioned within a thermal break;

[0019] Figure 6 is a side section view of the anchor of Figure 5 in which the thermal break is removed and wherein the catch structures are interlocked and engaged to one another.

#### DETAILED DESCRIPTION OF THE INVENTION

[0020] Referring to the Figures, wherein like numerals indicate like parts throughout the several views, an anchor is shown generally at **20**. The anchor **20** is useful for securing an exterior building component **46** to an interior building component **48**. The building components **46**, **48** are described further below and illustrated in Figures 3-6.

[0021] The anchor **20** comprises a first end **22** having an outer side **24**. The outer side **24** is useful for engaging the interior building component **46**. The anchor **20** further comprises an inner side **26** opposite the outer side **24** of the first end **22**. The first end **22** can be of various sizes, dimensions, and shapes. Referring to Figure 1, the first end **22** is generally configured as a T-bracket. As shown in Figure 2, the first end **22** is generally configured as a flat-bracket. While the T- and flat-bracket configurations (or designs) are shown, the first end **22** can be of various configurations and is not limited to a particular one.

[0022] The anchor **20** further comprises a second end **28** having an outer side **30**. The outer side **30** is useful for engaging the exterior building component. The anchor **20** yet further comprises an inner side **32** opposite the outer side **30** of the second end **28**. The second end **28** can be of various sizes, dimensions, and shapes. As shown in Figures 1 and 2, the second end **28** is generally configured as a T-bracket. While the

T-bracket configuration is shown, the second end **28** can be of various configurations and is not limited to a particular one. The second end **28** can be the same as or different from the first end **22**. For example, the ends **22, 28** may be mirror images of each other as best shown in Figure 1B, or different from each other as shown in Figure 2.

[0023] The inner sides **26, 32** of the ends **22, 28** generally face each other. Typically, the inner sides **26, 32** are substantially parallel each other; however, this is not required. A space **34** is generally defined between the inner sides **26, 32** of the ends **22, 28**. The space **34** can be of various dimensions.

[0024] Other configurations, designs, or profiles that may be utilized for at least one of the ends **22, 28**, and/or for the anchor itself **20**, include those that mimic conventional L-brackets, Z-brackets, U-brackets, C-brackets, I-brackets, H-brackets, hanging-brackets, hat-brackets, stirrup-brackets, flat-brackets, split-bend-anchors, etc. The anchor **20** can be configured to mimic various types of conventional anchors utilized in construction for securing building components together. The anchor **20** may also be referred to as a tie, clip, or bracket. A person of ordinary skill in the art can select an appropriate configuration of the ends **22, 28**, and/or the anchor **20** based on use, location, load, etc., of the anchor **20**.

[0025] Optionally, the ends **22, 28** can individually define at least one hole **36**. The hole **36** can be of various sizes, dimensions, and shapes. The hole **36** can be used for attaching the first end **22** to the interior building component and/or for attaching the second end **28** to the exterior building component. The hole **36** can be used in combination with a fastener. Examples of suitable fasteners include, but are not limited to, bolts, screws, pins, ties, nails, rivets, adhesives, etc. The disclosure is not limited to a particular type of fastener. The hole(s) **36** can be pre- or post-formed in the end(s) **22, 28**, e.g. by casting, machining, stamping, drilling, etc.

[0026] Typically, each of the ends **22, 28** individually comprise a rigid material. Examples of suitable rigid materials include, but are not limited to, metallic materials, polymeric materials, composite materials, and combinations thereof. In various embodiments, each of the ends **22, 28** comprise a metallic material. In these embodiments, each of the ends **22, 28** can individually comprise an elemental metal or an alloy thereof. Examples of suitable metals include, but are not limited to,

transition and post-transition metals, such as iron, copper, aluminum, zinc, etc. In certain embodiments, each of the ends **22**, **28** comprise iron. In specific embodiments, each of the ends **22**, **28** comprise steel. Various grades of steel (SAE Steel Grades) can be used to form the ends **22**, **28**, such as 200 or 300 series stainless steel. In a specific embodiment, SAE Steel Grade 304 stainless steel is used to form each of the ends **22**, **28**. A person of ordinary skill in the art can select an appropriate material for each of the ends **22**, **28** based on use, location, load, etc., of the anchor **20**.

[0027] A thermal break **38** is disposed in the space **34**. The thermal break **38** has a first coupling surface **40** bonded to the inner side **26** of the first end **22**. The thermal break **38** also has a second coupling surface **42** opposite the first coupling surface **40**. The second coupling surface **42** is bonded to the inner side **32** of the second end **28**.

[0028] Typically, the thermal break **38** adhesively bonds the ends **22**, **28** together. Said another way, the first coupling surface **40** is generally adhered to the inner side **26** of the first end **22**, and the second coupling surface **42** is generally adhered to the inner side **32** of the second end **28** during normal usage. Adhesion is generally the tendency of dissimilar surfaces to cling to one another. In further embodiments, the thermal break **38** exclusively bonds the ends **22**, **28** together. In these embodiments, the anchor **20** is free of supplemental means for connecting the ends **22**, **28** together. In other words, the ends **22**, **28** are attached together exclusively by the thermal break **38** and nothing more. Examples of such supplemental means include, but are not limited to, fasteners such as bolts, pins, screws, etc.

[0029] The thermal break **38** can be of various dimensions. As best shown in Figure 1B, the thermal break **38** generally has a height (**H**), width (**W**), and thickness (**T**). Each of the height (**H**), width (**W**), and thickness (**T**) of the thermal break **38** can be uniform or can vary. A person of ordinary skill in the art can select an appropriate height (**H**), width (**W**), and thickness (**T**) of the thermal break **38** based on use, location, load, etc., of the anchor **20**.

[0030] The thermal break **38** can have various cross-sectional areas, as generally defined by its height (**H**) and width (**W**). In various embodiments, the thermal break **38** has a cross-sectional area (**H\*W**) of from about 1 to about 800, about 1 to about 300, about 1 to about 200, about 5 to about 100, about 5 to about 50, about 10 to about 40, about 20 to about 40, or about 30 square centimeters (cm<sup>2</sup>), or any subrange

between about 1 and about 800 cm<sup>2</sup>. Alternatively, the thermal break **38** can have a cross-sectional area (**H\*W**) of from about 0.5 to about 120 square inches (in<sup>2</sup>) (3.23 – 774 cm<sup>2</sup>), about 0.5 to about 80 in<sup>2</sup> (3.23 – 516 cm<sup>2</sup>), about 2 to about 40 in<sup>2</sup> (12.9 – 258 cm<sup>2</sup>), about 2 to about 20 in<sup>2</sup> (12.9 – 129 cm<sup>2</sup>), about 4 to about 16 in<sup>2</sup> (25.8 – 103.2 cm<sup>2</sup>), about 8 to about 16 in<sup>2</sup> (50.6 – 103.2 cm<sup>2</sup>), or about 12 in<sup>2</sup> (77 cm<sup>2</sup>), or any subrange between about 0.5 and about 120 in<sup>2</sup>, (3.23 – 774 cm<sup>2</sup>). A person of ordinary skill in the art can select an appropriate cross-sectional area (**H\*W**) of the thermal break **38** based on use, location, load, etc., of the anchor **20**.

[0031] The thermal break **38** can have various average thicknesses, as generally defined by its thickness (**T**). In various embodiments, the thermal break **38** has an average thickness (**T**) of from about 1 to about 50, about 1 to about 40, about 1 to about 30, about 1 to about 20, about 2 to about 10, about 4 to about 8, or about 6, millimeters (mm), or any subrange from about 1 to about 40 mm. Alternatively, the thermal break **38** has an average thickness (**T**) of from about 0.05 to about 2 inches (in) (1.27 – 50.8mm), about 0.05 to about 1.5 in (1.27 – 38.1mm), about 0.05 to about 1.25 in (1.27 – 31.75mm), about 0.05 to about 1 in (1.27 – 25.4mm), about 0.1 to about 0.75 in (2.54 – 19.05mm), about 0.25 to about 0.5 in (6.35 – 12.7mm), or about 0.25 in (6.35mm), or any subrange from about 0.05 to about 2 in (1.27 – 50.8mm). A person of ordinary skill in the art can select an appropriate average thickness (**T**) of the thermal break **38** based on use, location, load, thermal performance requirements, etc., of the anchor **20**.

[0032] Optionally, at least a portion of the thermal break **38** can be molded over at least a portion of at least one of the ends **22**, **28**. While not required, it is thought that overmolding may be useful to increase strength (e.g. sheer strength) of the anchor **20**. Optionally, at least one of the inner sides **26**, **32** of the ends **22**, **28** can include one or more surface protrusions. While not required, it is thought that surface protrusions may be useful to increase strength (e.g. sheer strength) of the anchor **20**. Surprisingly, it has been found that strength of the anchor **20** is still adequate even when the inner sides **26**, **32** of the ends **22**, **28** are substantially smooth (e.g. prior to disposing or forming the thermal break **38**). A person of ordinary skill in the art can select an

appropriate option (e.g. overmolding and/or protrusions) based on use, location, load, etc., of the anchor **20**.

[0033] The thermal break **38** typically comprises a rigid, semi-rigid, semi-flexible, or flexible material. It is thought that such a material can allow for varying degrees of movement between the ends **22**, **28** of the anchor **20**. For example, some amount of settling, flexing, expansion, and/or contraction can occur with certain building components. Exterior building components are especially prone to movement when subject to climatic loads (e.g. wind load) and/or variations in temperature (e.g. when exposed to sunlight on a cool/cold day). Other types (or forms) of load include dead, live, building, environmental, and gravity loads, and the disclosure is not limited to a particular one.

[0034] Typically, the thermal break **38** is formed from a material different from at least one of the ends **22**, **28** more typically different from both of the ends **22**, **28**. In various embodiments, the thermal break **38** comprises a polymeric material. Various types of polymer chemistries can be utilized to form the thermal break **38**, including, but not limited to, elastomers (or rubber), silicone or silicone rubber, or rigid materials such as epoxies or epoxy adhesives.

[0035] In various embodiments, the thermal break **38** comprises an elastomer (or rubber). Examples of suitable elastomers include, but are not limited to, thermoplastic elastomers (TPEs), unsaturated rubbers, saturated rubbers, and mixtures thereof.

[0036] Specific examples of suitable TPEs include, but are not limited to, styrenic block copolymers, polyolefins, elastomeric alloys, polyurethanes, copolyesters, and polyamides. Mixtures of TPEs may also be used. In certain embodiments, the thermal break **38** is formed from a polyurethane (e.g. a thermoplastic polyurethane, or TPU).

[0037] Specific examples of suitable unsaturated rubbers include, but are not limited to, those that can be cured by sulfur vulcanization such as polyisoprenes, polybutadienes, chloroprenes, butyl rubbers, styrene-butadienes, and nitrile rubbers. Certain unsaturated rubbers can also be cured by means other than by sulfur vulcanization. Mixtures of unsaturated rubbers may also be used.

[0038] Specific examples of suitable saturated rubbers include, but are not limited to, ethylene propylene rubber (EPM), ethylene propylene diene rubber (EPDM), epichlorohydrin rubber, polyacrylic rubber, silicone rubber, fluorosilicone rubber,

fluoroelastomers, perfluoroelastomers, polyether block amides, chlorosulfonated polyethylene, and ethylene-vinyl acetate. Mixtures of saturated rubbers may also be used. In certain embodiments, the thermal break **38** is formed from EPDM.

[0039] In various embodiments, the thermal break **38** comprises silicone. In further embodiments, the thermal break **38** comprises silicone rubber. The silicone rubber may also be referred to as a silicone elastomer. Various types of silicone rubbers can be used to form the thermal break **38**. The silicone rubber may be cured, for example, by an addition cure system, a condensation cure system, or a peroxide cure system.

[0040] In various embodiments, the silicone rubber is cured by a heat cure system. Heat cure systems typically rely on addition cure mechanisms using platinum-based catalysts or peroxide cure mechanisms to facilitate cure. The curing process can be accelerated by adding heat and/or pressure. Examples of suitable silicone rubbers include those commercially available from Dow Corning Corporation of Midland, MI, such as SILASTIC<sup>®</sup> Silicone Rubbers (e.g. SILASTIC<sup>®</sup> TR-70 Silicone Rubber).

[0041] Alternatively, the thermal break **38** is formed from a condensation cured silicone structural adhesive or condensation cured silicone structural sealant which forms a suitable elastomeric material upon curing. Examples of suitable silicone structural adhesive or condensation cured silicone structural sealant include those commercially available from Dow Corning Corporation of Midland, MI, for example DOW CORNING<sup>®</sup> Silicone Structural Sealants (e.g. DOW CORNING<sup>®</sup> 995 Silicone Structural Sealant).

[0042] In various embodiments, the thermal break **38** comprises an epoxy or an epoxy adhesive. In certain of these embodiments, the epoxy or epoxy adhesive cures to form a rigid material that provides and maintains sufficient adherence and desired adhesive strength to the respective inner sides **26**, **32** of the first and second end **22**, **28** during usage.

[0043] In embodiments where the thermal break **38** comprises a polymeric material, e.g. elastomers, silicone or epoxy, the thermal break **38** generally has a very low thermal conductivity. For example, the thermal break **38** can have a thermal conductivity that is over 2, 5, 10, 25, 50, or 100 times less than that of metallic materials such as steel. The thermal break **38**, and therefore the anchor **20**, can be configured to have a fail safe flame resistance. For example, the anchor **20** can be

configured to have a mechanical catch that will allow the ends 22, 28 to maintain structural engagement in the event a fire burns away the polymeric thermal break 38. This is evaluated by testing to NFPA 285 (National Fire Protection Association Test 285 - Standard First Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components (copies of test available from NFPA of Quincy, Massachusetts)). The anchor 20 can also be configured to be tolerant in “freeze-thaw” conditions, and/or be configured to be tolerant of alkalines in mortar.

[0044] The anchor 20 can be made by various manufacturing methods, and the disclosure is not limited to a particular one. In certain embodiments, the anchor 20 is made by injection molding. In these embodiments, the material utilized to form the thermal break 38 (e.g. a silicone composition) is injected between the ends 22, 28 while in a mold. Heat and/or pressure can be utilized to accelerate cure of certain materials, e.g. silicone rubber. Other molding methods can also be used, such as compression molding. A person of ordinary skill in the art can select an appropriate method of manufacture based on the materials used to form the anchor 20.

[0045] An assembly (shown as 50 in the alternative embodiments of Figures 3-6, respectively). The assembly 50 is useful for a structure, and can be used in the construction industry. The structure is typically a building, and the disclosure is not limited to a particular one. Examples of buildings include, but are not limited to, residential, commercial, and industrial buildings, such as single story, mid-rise, and high-rise buildings.

[0046] The assembly 50 includes an interior building component (shown as 48 in Figures 3-6, respectively). The interior building component 48 can be any type of conventional interior building component, and the disclosure is not limited to a particular one. Examples of suitable interior building components include, but are not limited to, studs, beams, rails, joists, ties, trusses, mounts, braces, frames, walls, and supports. The interior building component can include one or more of the prior examples.

[0047] The assembly 50 further includes an exterior building component (shown as 46 in Figures 3-6, respectively) spaced from the interior building component 48. The exterior building component 46 can be any type of conventional exterior building

component, and the disclosure is not limited to a particular one. Examples of suitable exterior building components include, but are not limited to, rain screens, curtain walls, bricks, masonry, stones, timbers, panels, siding, facades, cladding, girts, rails, walls, sills, lintels, headers, and mullions. The exterior building component can include one or more of the prior examples. The examples listed above for the interior and exterior building components is not an all inclusive list. Further, that which is described as an interior building component may also be used as an exterior building component and vice versa. The disclosure is not limited to a particular designation of the building components.

**[0048]** The assembly **50** further includes the anchor **20** as described in Figures 1-2 above. The anchor **20** is disposed between the interior **48** and exterior building components. The anchor **20** generally secures the exterior building component **46** to the interior building component **48** (or vice versa).

**[0049]** Optionally, the assembly **50** can further include one or more conventional building components. The disclosure is not limited to a particular type or number of conventional building components. In various embodiments, the assembly further comprises at least one fastener. Examples of suitable fasteners include, but are not limited to, bolts, screws, pins, nails, rivets, adhesives, etc. The disclosure is not limited to a particular type of fastener. If used, the fastener is generally used in connection with the hole **36**. Further, if used, the fastener **36** generally does not operatively connect the ends **22**, **28** together, e.g. by spanning between the ends **22**, **28**.

**[0050]** In various embodiments, the assembly **50** further includes insulation. The insulation can be disposed around the anchor **20**, between the anchor **20** and at least one of the building components, and/or between the building components. Examples of suitable types of insulation include, but are not limited to, batts and blankets, loose-fill Insulation, structural insulated panels (SIPs), spray foam, vacuum insulated panels (VIPs), etc. Further examples of suitable types of insulation include, but are not limited to, fiberglass, mineral wool, glass wool, rock wool, cotton, expanded polystyrene (EPS), extruded polystyrene (XPS), polyisocyanurate (“polyiso”), open- or closed-cell polyurethane foam, cellulose, aerogel, etc. Optionally, one or more

fasteners may be used to hold the insulation in place, such as stick pins, clips, etc. The disclosure is not limited to a particular type of insulation or fastener thereof.

**[0051]** Thermal conductivity of the thermal break **38** is lower than thermal conductivity of at least one of the ends **22**, **28**. In certain embodiments, thermal conductivity of the thermal break **38** is lower than the thermal conductivity of each (or both) of the ends **22**, **28**. The thermal break **38** may also be referred to as a thermal barrier. The lower thermal conductivity of the thermal break **38** generally reduces thermal bridging between the building components while the interior and exterior building components are subject to a temperature difference between the building components. In general, the thermal break **38** reduces or prevents the flow of thermal energy between the ends **22**, **28**, and therefore, reduces or prevents the flow of thermal energy (or heat transfer) between the interior and exterior building component. The disclosure is not limited to a particular direction of thermal energy flow (i.e., inward, outward, or neutral).

**[0052]** A thermal bridge (also referred to as a cold bridge or thermal short), is a fundamental of heat transfer where a penetration of an insulation layer by a highly conductive or non-insulating material takes place in the separation between the interior (or conditioned space) and exterior environments of a building assembly (also referred to as the building enclosure, building envelope, or thermal envelope). Thermal bridging is created when materials that are poor thermal insulators come into contact, allowing heat to flow through the path of least thermal resistance created, although nearby layers of material separated by insulation and or by airspace allow little heat transfer. For example, sun shades anchored to the side of a building typically go through the insulation and their anchorage creates a thermal bridge to the building's interior.

**[0053]** In general, insulation around a thermal bridge is of little help in preventing heat loss or gain due to thermal bridging. As an example, if thermal bridges at balconies of a building are not taken care of, the balconies can act as "cooling fins". Such cooling fins conduct heat off the building and cool rooms adjacent to the balconies. A wall with a thermal bridge may be analogized to a bucket with a hole in it. Adding insulation without breaking thermal bridges is like increasing the thickness of the walls of the bucket but not plugging the hole. In various embodiments utilizing

insulation, the only part that breaks the insulation layer is the thermal break **38**. In this way, foam wall boards for example, can be used in a way that provides truly continuous insulation.

[0054] A method is also disclosed. The method is useful for securing the exterior building component **46** to the interior building component **48**. The method includes the step of providing the anchor **20**. The method further includes the step of attaching the anchor **20** to one of the building components to form a sub-assembly. For example, the anchor **20** can be attached to the interior building component **48** or to the exterior building component **46** to form the sub-assembly.

[0055] The method yet further comprises the step of connecting the sub-assembly and the remaining building component to secure the exterior building component **46** to the interior building component **48**. For example, the exterior building component **46** can be attached to a sub-assembly including the anchor **20** and the interior building component **48**. Conversely, the interior building component **48** can be attached to a sub-assembly including the anchor **20** and the exterior building component **46**. One or more fasteners may be utilized for such attachment.

[0056] One or more anchors **20** can be utilized to attach the building components **46**, **48** of a structure. A person of ordinary skill in the art can select an appropriate number of anchors **20** based on the use, location, load, etc., of the anchors **20**. The same can be said for determining the size, configuration, and location of the anchors **20**. The anchor **20** should be of a sufficient size to support the exterior building component **46** from both climactic and gravity loads. The anchor **20** can be designed based on end application. In certain embodiments, the anchor **20** and/or the assembly **50** can be designed to be fire safe by including additional mechanical clips that engage when and if the polymeric thermal break material **38** is burned away in a fire, wherein this system can be verified with testing to NFPA 285.

[0057] Referring to Figure 3, a photograph of a portion of an assembly **50** is illustrated as having exterior building components **46**, interior building components **48**, clips **56**, and rigid foam insulation **60** is shown. The assembly **50** is just one example of a possible configuration of an assembly in which the anchor **20** of the disclosure can be utilized, e.g. in place of, or in addition to, the clips **56**.

[0058] Figure 4 illustrate an exploded view of another embodiment of an assembly **50** that includes the anchor **20** according to Figure 2 disposed between an exterior building component **46** and an interior building component **48** for securing the exterior building component **46** to the interior building component **48**.

[0059] In Figure 4, the outer side **24** of a first end **22** of the anchor **20** is positioned against an outer surface **156** of the exterior building component **46**. A fastener **165**, shown herein as a screw **165**, is inserted through a respective hole **36** and secures the second end **28** to the exterior building component **46**. Additional fasteners **165** are also inserted through the holes **36** in the second end **28** to secure the interior building component **48** to the second end **28**.

[0060] As also illustrated in Figure 4, a thermal break **38** is disposed in the space **34** between the first end **22** and the second end **28**. The thermal break **38** has a first coupling surface **40** bonded to the inner side **26** of the first end **22**. The thermal break **38** also has a second coupling surface **42** opposite the first coupling surface **40**. The second coupling surface **42** is bonded to the inner side **32** of the second end **28**. In this embodiment, as described above, the thermal conductivity of the thermal break **38** is lower than the thermal conductivity of at least one of the ends **22,28** to reduce thermal bridging between the exterior building component **46** and the interior building component **48** while such building components **46,48** are subject to temperature differences. Rigid foam insulation (not shown) may also be positioned between the exterior building component **46** and the interior building component **48** in a space between the interior building component **46** and the exterior building component **48** and adjacent to the space **34** not defined by the anchor **20**.

[0061] In another embodiment of the present invention, as illustrated in Figures 5 and 6, the assembly **50** includes wherein the inner side **26, 32** of each of the first and second ends **22, 28** of an anchor **20** in accordance with another embodiment of the invention are configured to include a catch structure **72, 74** that are complementary with each other. The catch structures **72, 74** are designed to mechanically interlock, or engage one another, in the event of a fire burning away the thermal break **38** or other situations in which the thermal break **38** is removed. As such, in Figure 5, wherein the thermal break **38** is present, the catch structures **72, 74** are positioned in such a manner that they are spaced apart from each other and within the thermal break

**38.** If the thermal break **38** is burned away or otherwise removed, such as shown in Figure 6, the catch structures **72, 74** engage or otherwise mechanically interlock with each other in a manner such that the positioning of the exterior building components relative to the interior building components that are secured by the anchor **20** is maintained.

**[0062]** The following examples, illustrating the anchor **20** of the disclosure, are intended to illustrate and not to limit the invention.

#### EXAMPLES

**[0063]** Examples of the anchor are made by injection molding. Configuration of the anchors can be appreciated with reference to Figure 1. A mold is configured to make 5 anchors at the same time. First and second ends are loaded into the mold. There are 5 pairs of the ends. The inner sides of the ends of each pair are spaced apart by about 0.25 inches (0.635cm). Each end is a 1 inch (2.54cm) T-bracket, and is formed from 304 stainless steel. A silicone composition is injected between the inner sides to form a thermal break between each pair of the ends. The thermal break adhesively couples each pair the ends together. The silicone composition is illustrated in Table I below.

Table I

| Component                                                | CAS Number | Wt. %       |
|----------------------------------------------------------|------------|-------------|
| Dimethyl siloxane, dimethylvinyl-terminated              | 68083-19-2 | 40.0 - 60.0 |
| Trimethylated silica                                     | 68909-20-6 | 30.0 - 50.0 |
| Dimethyl, methylvinyl siloxane, dimethylvinyl-terminated | 68083-18-1 | 7.0 - 13.0  |
| Dimethyl, methylhydrogen siloxane                        | 68037-59-2 | 1.0 - 5.0   |
| Dimethylcyclsiloxanes                                    | None       | 1.0 - 5.0   |

**[0064]** The silicone composition in Table I is classified as an addition cure silicone rubber typically cured using a platinum-based catalyst. The mold is heated to facilitate curing. After molding, the thermal breaks have a Shore A hardness of about 70 (ASTM D2240 - 05(2010)). The silicone rubber of the thermal break has excellent adhesive and cohesive strength.

**[0065]** The anchors can be used to form various assemblies for a structure. For example, if the exterior building component of a structure is subject to a windload of upwards of 50 pounds per square foot (2394.01 Pascal), one skilled in the art can determine the size and number of anchors required to achieve a desired wind load per anchor design. If an anchor is placed every 32 square feet (e.g. 8 feet x 4 feet (*i.e.*,

approximately 2.44 meters x 1.22 meters, or 2.97 square meters)), each anchor will be subject to about 1600 pounds wind load (7116.8 newtons). The single anchor would have to have a minimum breaking load of 6,400 pounds (about 28,467.2 newtons) for a 4:1 safety factor. For example, if the anchor has an ultimate breaking strength of 350 pounds per square inch (2.4 megapascals), the above-mentioned 4:1 safety factor would therefore require a 20 square inch cross-section (about 129 square centimeters).

[0066] It is to be understood that the appended claims are not limited to express and particular compounds, compositions, or methods described in the detailed description, which may vary between particular embodiments which fall within the scope of the appended claims. With respect to any Markush groups relied upon herein for describing particular features or aspects of various embodiments, it is to be appreciated that different, special, and/or unexpected results may be obtained from each member of the respective Markush group independent from all other Markush members. Each member of a Markush group may be relied upon individually and or in combination and provides adequate support for specific embodiments within the scope of the appended claims.

[0067] It is also to be understood that any ranges and subranges relied upon in describing various embodiments of the present invention independently and collectively fall within the scope of the appended claims, and are understood to describe and contemplate all ranges including whole and/or fractional values therein, even if such values are not expressly written herein. One of skill in the art readily recognizes that the enumerated ranges and subranges sufficiently describe and enable various embodiments of the present invention, and such ranges and subranges may be further delineated into relevant halves, thirds, quarters, fifths, and so on. As just one example, a range “of from 0.1 to 0.9” may be further delineated into a lower third, i.e., from 0.1 to 0.3, a middle third, i.e., from 0.4 to 0.6, and an upper third, i.e., from 0.7 to 0.9, which individually and collectively are within the scope of the appended claims, and may be relied upon individually and/or collectively and provide adequate support for specific embodiments within the scope of the appended claims. In addition, with respect to the language which defines or modifies a range, such as “at least,” “greater than,” “less than,” “no more than,” and the like, it is to be understood that such language includes subranges and/or an upper or lower limit. As another

example, a range of “at least 10” inherently includes a subrange of from at least 10 to 35, a subrange of from at least 10 to 25, a subrange of from 25 to 35, and so on, and each subrange may be relied upon individually and/or collectively and provides adequate support for specific embodiments within the scope of the appended claims. Finally, an individual number within a disclosed range may be relied upon and provides adequate support for specific embodiments within the scope of the appended claims. For example, a range “of from 1 to 9” includes various individual integers, such as 3, as well as individual numbers including a decimal point (or fraction), such as 4.1, which may be relied upon and provide adequate support for specific embodiments within the scope of the appended claims.

**[0068]** The present invention has been described herein in an illustrative manner, and it is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than of limitation. Many modifications and variations of the present invention are possible in light of the above teachings. The present invention may be practiced otherwise than as specifically described within the scope of the appended claims. The subject matter of all combinations of independent and dependent claims, both single and multiple dependent, is herein expressly contemplated.

## CLAIMS

What is claimed is:

1. An assembly **50** for a structure, said assembly comprising:
  - an interior building component **48**;
  - an exterior building component **46** spaced from said interior building component **48**; and
  - an anchor **20** disposed between said building components **46**, **48** to secure said exterior building component **46** to said interior building component **48**, said anchor **20** comprising:
    - a first end **22** having an outer side **24** for engaging said interior building component **48** and an inner side **26** opposite said outer side **24** of said first end **22**;
    - a second end **28** having an outer side **30** for engaging said exterior building component and an inner side **32** opposite said outer side **30** of said second end **28**,
    - said inner sides **26**, **32** of said ends **22**, **28** facing each other with a space **34** defined therebetween; and
    - a thermal break **38** disposed in the space **34**, with said thermal break **38** having a first coupling surface **40** bonded to said inner side **26** of said first end **22** and a second coupling surface **42** opposite said first coupling surface **40** and bonded to said inner side **32** of said second end **28**;
    - wherein a thermal conductivity of said thermal break **38** is lower than a thermal conductivity of at least one of said ends **22**, **28** to reduce thermal bridging between said building components **46**, **48** while said building components **46**, **48** are subject to a temperature difference between said building components **46**, **48**.
2. The assembly **50** as set forth in claim 1, wherein said thermal break **38** adhesively bonds said ends **22**, **28** together.
3. The assembly **50** as set forth in claim 1 or 2, wherein said thermal break **38** exclusively bonds said ends **22**, **28** together.

4. The assembly **50** as set forth in any one of claims 1 through 3, wherein the thermal conductivity of said thermal break **38** is lower than the thermal conductivity of each of said ends **22**, **28**.
5. The assembly **50** as set forth in any one of claims 1 through 4, wherein:
  - i) said thermal break **38** comprises a polymeric material;
  - ii) each of said ends **22**, **28** comprises a metallic material; or
  - iii) both i) and ii).
6. The assembly **50** as set forth in any one of claims 1 through 5, wherein said thermal break **38** comprises silicone, alternatively silicone rubber.
7. The assembly **50** as set forth in any one of claims 1 through 5, wherein said thermal break **38** comprises epoxy, alternatively an epoxy adhesive.
8. The assembly **50** as set forth in any one of claims 1 through 5, wherein said thermal break **38** comprises an elastomer selected from the group consisting of thermoplastic elastomers, unsaturated rubbers, saturated rubbers, and mixtures thereof.
9. The assembly **50** as set forth in claim 8, wherein said thermoplastic elastomer is selected from the group consisting of styrenic block copolymers, polyolefins, elastomeric alloys, polyurethanes, copolyesters, polyamides, and mixtures thereof.
10. The assembly **50** as set forth in claim 8 or claim 9, wherein said unsaturated rubber is selected from the group consisting of polyisoprenes, polybutadienes, chloroprenes, butyl rubbers, styrene-butadienes, nitrile rubbers, and mixtures thereof.
11. The assembly **50** as set forth in any one of claims 8 through 10, wherein said saturated rubber is selected from the group consisting of ethylene propylene rubber, ethylene propylene diene rubber, epichlorohydrin rubber, polyacrylic rubber, silicone rubber, fluorosilicone rubber, fluoroelastomers, perfluoroelastomers, polyether block amides, chlorosulfonated polyethylene, ethylene-vinyl acetate, and mixtures thereof.
12. The assembly **50** as set forth in any one of claims 1 through 11, wherein each of said ends **22**, **28** comprises iron, alternatively steel.
13. The assembly **50** as set forth in any one claims 1 through 12, wherein said thermal break **38** has a cross-sectional area of from about 1 to about 800 square centimeters (cm<sup>2</sup>).

14. The assembly **50** as set forth in any one claims 1 through 13, wherein said thermal break **38** has an average thickness of from about 1 to about 50 millimeters (mm).

15. A structure comprising said assembly **50** as set forth in any one of claims 1 through 14.

16. An anchor **20** for securing an exterior building component **46** to an interior building component **48**, said anchor **20** comprising:

a first end **22** having an outer side **24** for engaging the interior building component **48** and an inner side **26** opposite said outer side **24** of said first end **22**;

a second end **28** having an outer side **30** for engaging the exterior building component **46** and an inner side **32** opposite said outer side **30** of said second end **28**,

said inner sides **26**, **32** of said ends **22**, **28** facing each other with a space defined therebetween; and

a thermal break **38** disposed in the space, said thermal break **38** having a first coupling surface **40** bonded to said inner side **26** of said first end **22** and a second coupling surface **42** opposite said first coupling surface **40** and bonded to said inner side **32** of said second end **28**;

wherein a thermal conductivity of said thermal break **38** is lower than a thermal conductivity of at least one of said ends **22**, **28** to reduce thermal bridging between the building components **46**, **48** while the building components **46**, **48** are subject to a temperature difference between the building components **46**, **48**.

17. The anchor **20** as set forth in claim 16, wherein said thermal break **38** adhesively bonds said ends **22**, **28** together.

18. The anchor **20** as set forth in claim 16 or 17, wherein said thermal break **38** exclusively bonds said ends **22**, **28** together.

19. The anchor **20** as set forth in any one of claims 16 through 18, wherein the thermal conductivity of said thermal break **38** is lower than the thermal conductivity of each of said ends **22**, **28**.

20. The anchor **20** as set forth in any one of claims 16 through 19, wherein:

- i) said thermal break **38** comprises a polymeric material;
- ii) each of said ends **22**, **28** comprises a metallic material; or
- iii) both i) and ii).

21. The anchor **20** as set forth in any one of claims 16 through 20, wherein said thermal break **38** comprises silicone, alternatively silicone rubber.
22. The anchor **20** as set forth in any one of claims 16 through 20, wherein said thermal break **38** comprises epoxy, alternatively an epoxy adhesive.
23. The anchor **20** as set forth in any one of claims 16 through 20, wherein said thermal break **38** comprises an elastomer selected from the group consisting of thermoplastic elastomers, unsaturated rubbers, saturated rubbers, and mixtures thereof.
24. The anchor **20** as set forth in claim 23, wherein said thermoplastic elastomer is selected from the group consisting of styrenic block copolymers, polyolefins, elastomeric alloys, polyurethanes, copolyesters, polyamides, and mixtures thereof.
25. The anchor **20** as set forth in claim 23 or claim 24, wherein said unsaturated rubber is selected from the group consisting of polyisoprenes, polybutadienes, chloroprenes, butyl rubbers, styrene-butadienes, nitrile rubbers, and mixtures thereof.
26. The anchor **20** as set forth in any one of claims 23 through 25, wherein said saturated rubber is selected from the group consisting of ethylene propylene rubber, ethylene propylene diene rubber, epichlorohydrin rubber, polyacrylic rubber, silicone rubber, fluorosilicone rubber, fluoroelastomers, perfluoroelastomers, polyether block amides, chlorosulfonated polyethylene, ethylene-vinyl acetate, and mixtures thereof.
27. The anchor **20** as set forth in any one of claims 16 through 26, wherein each of said ends **22**, **28** comprises iron, alternatively steel.
28. The anchor **20** as set forth in any one of claims 16 through 27, wherein said thermal break **38** has a cross-sectional area of from about 1 to about 800 square centimeters (cm<sup>2</sup>) (or about 0.5 to about 120 square inches (in<sup>2</sup>)).
29. The anchor **20** as set forth in any one of claims 16 through 28, wherein said thermal break **38** has an average thickness of from about 1 to about 50 millimeters (mm) (or about 0.05 to about 2 inches (in)).
30. The anchor **20** as set forth in any one of claims 16 to 29, wherein the inner side mechanically catches the outer side in the event of fire burning away the polymeric thermal break **38**.

31. A method of securing an exterior building component **46** to an interior building component **48** spaced from the exterior building component **46**, said method comprising the steps of:

providing an anchor **20**;

attaching the anchor **20** to one of the building components **46 or 48** to form a sub-assembly; and

connecting the sub-assembly and the remaining building component **46 or 48** to secure the exterior building component **46** to the interior building component **48**;

wherein the anchor **20** is as set forth in any one of claims 16 through 30.

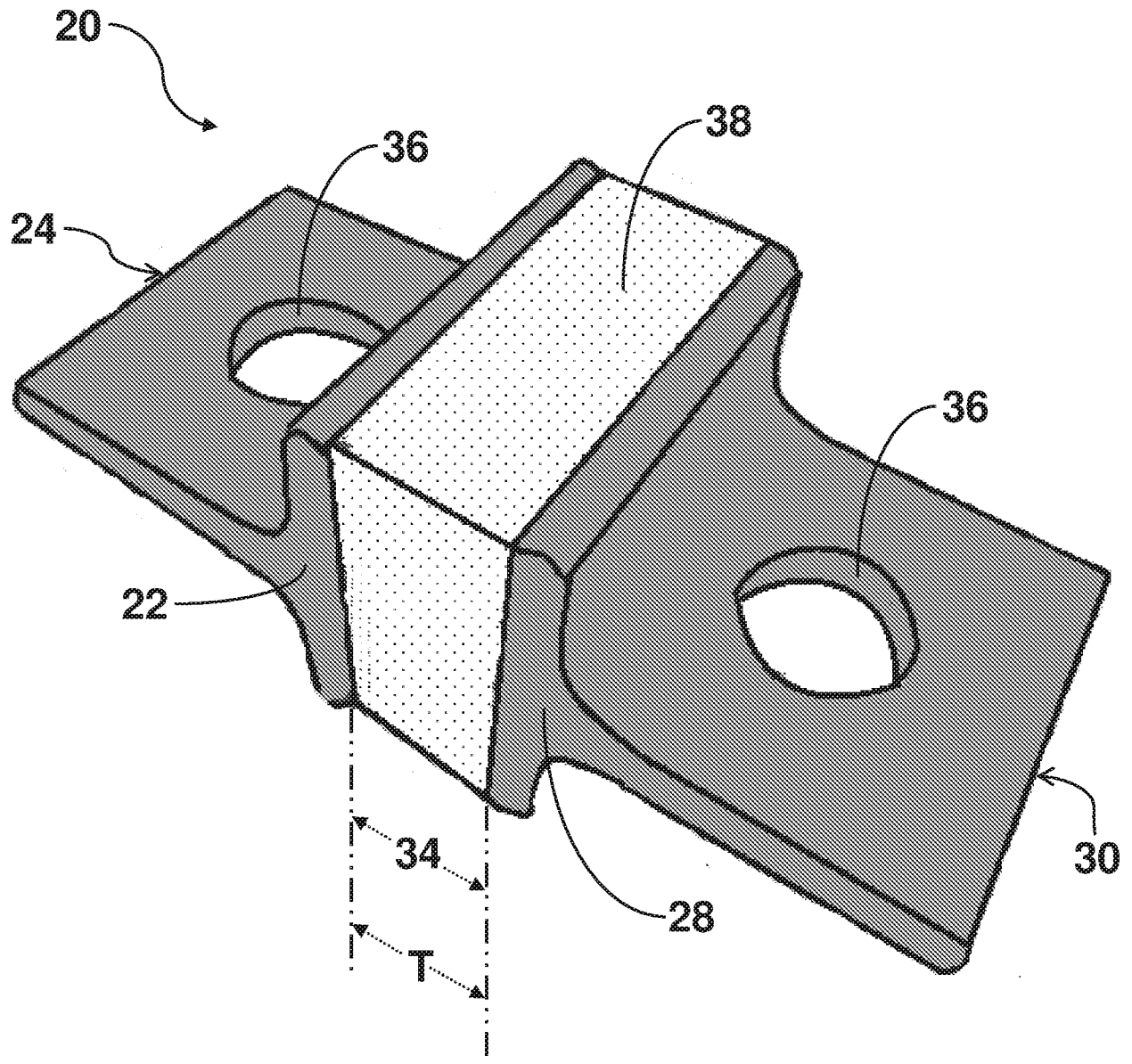
**FIGURE 1A**

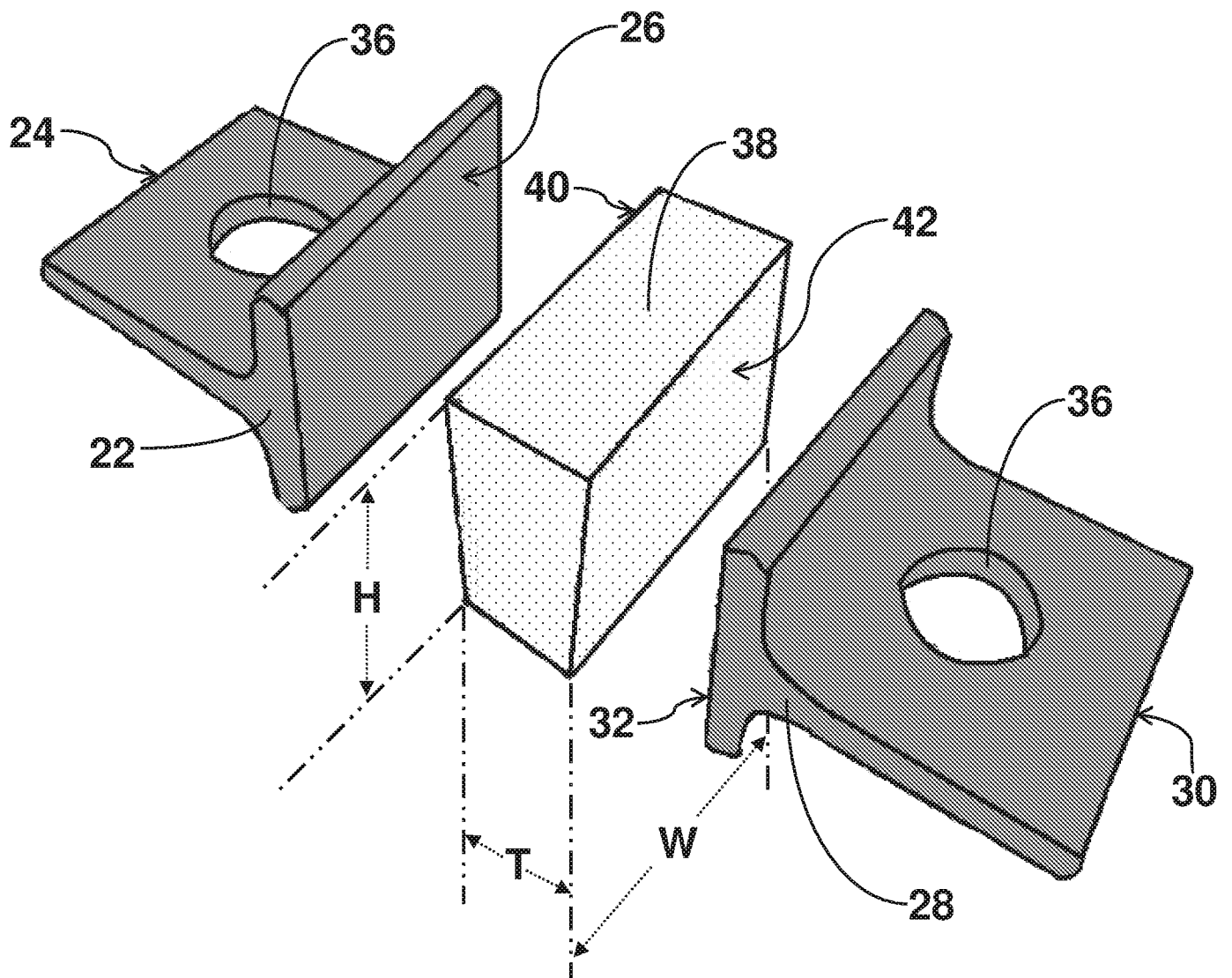
**FIGURE 1B**

FIGURE 2

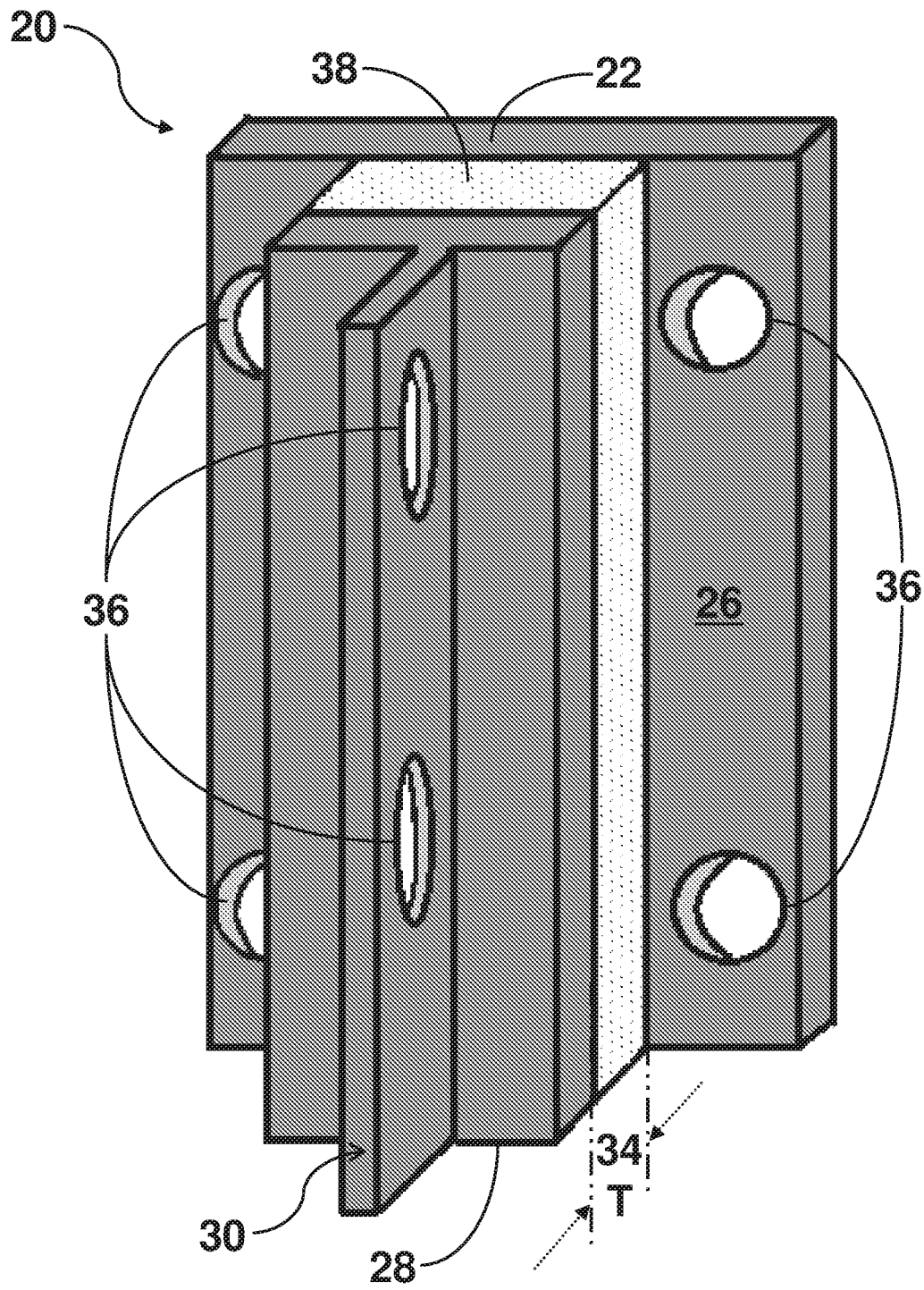
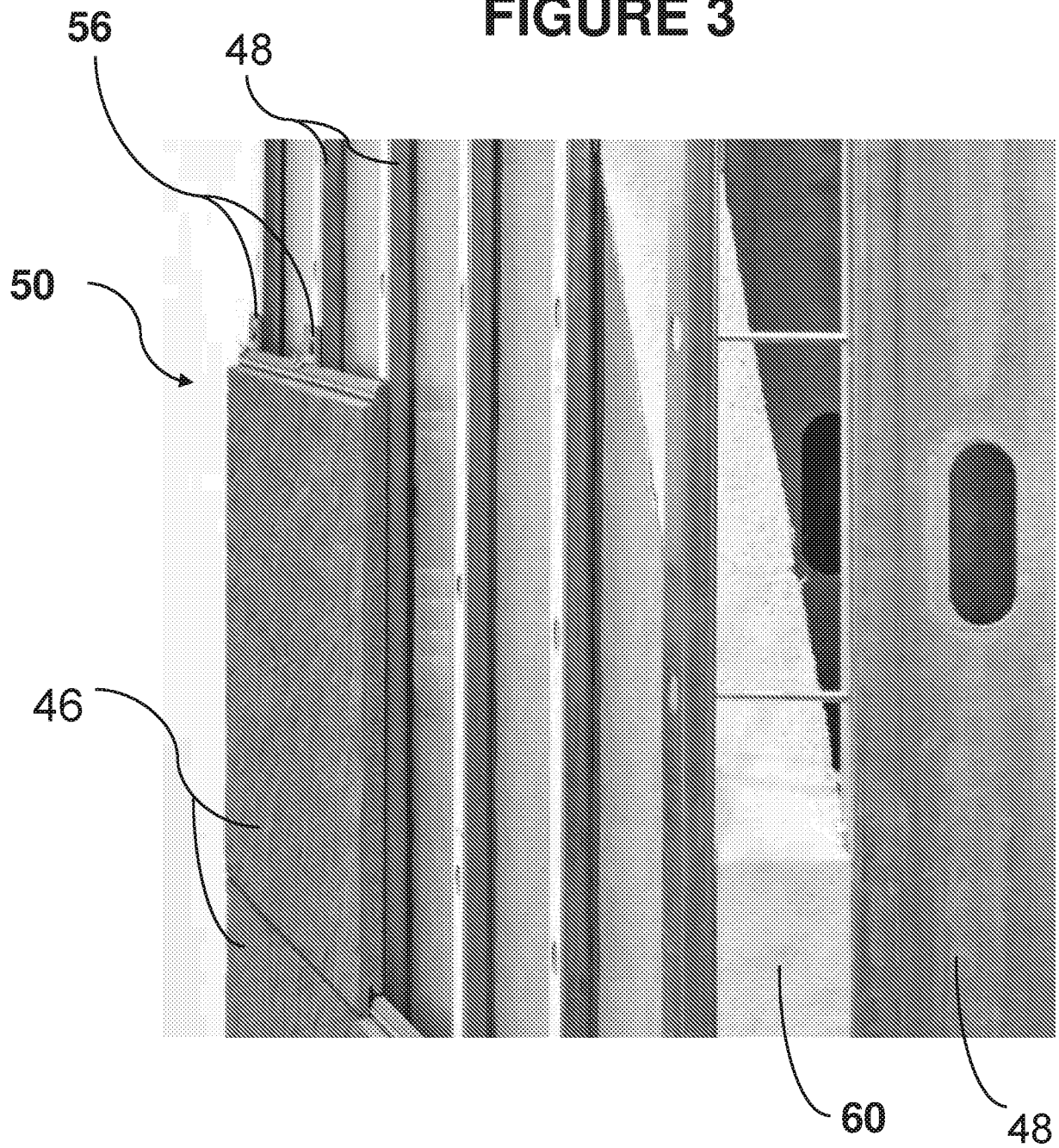


**FIGURE 3**

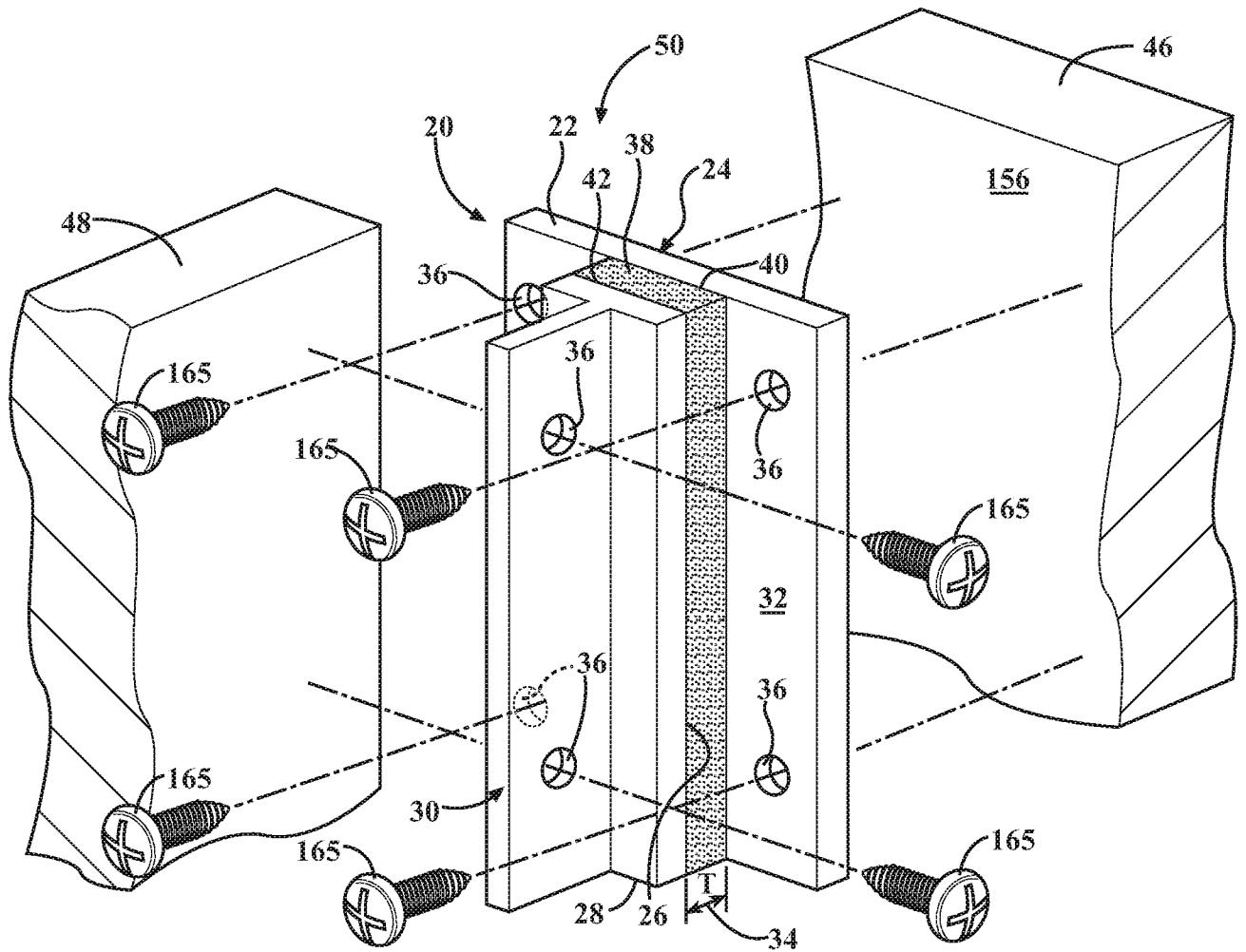


FIG. 4

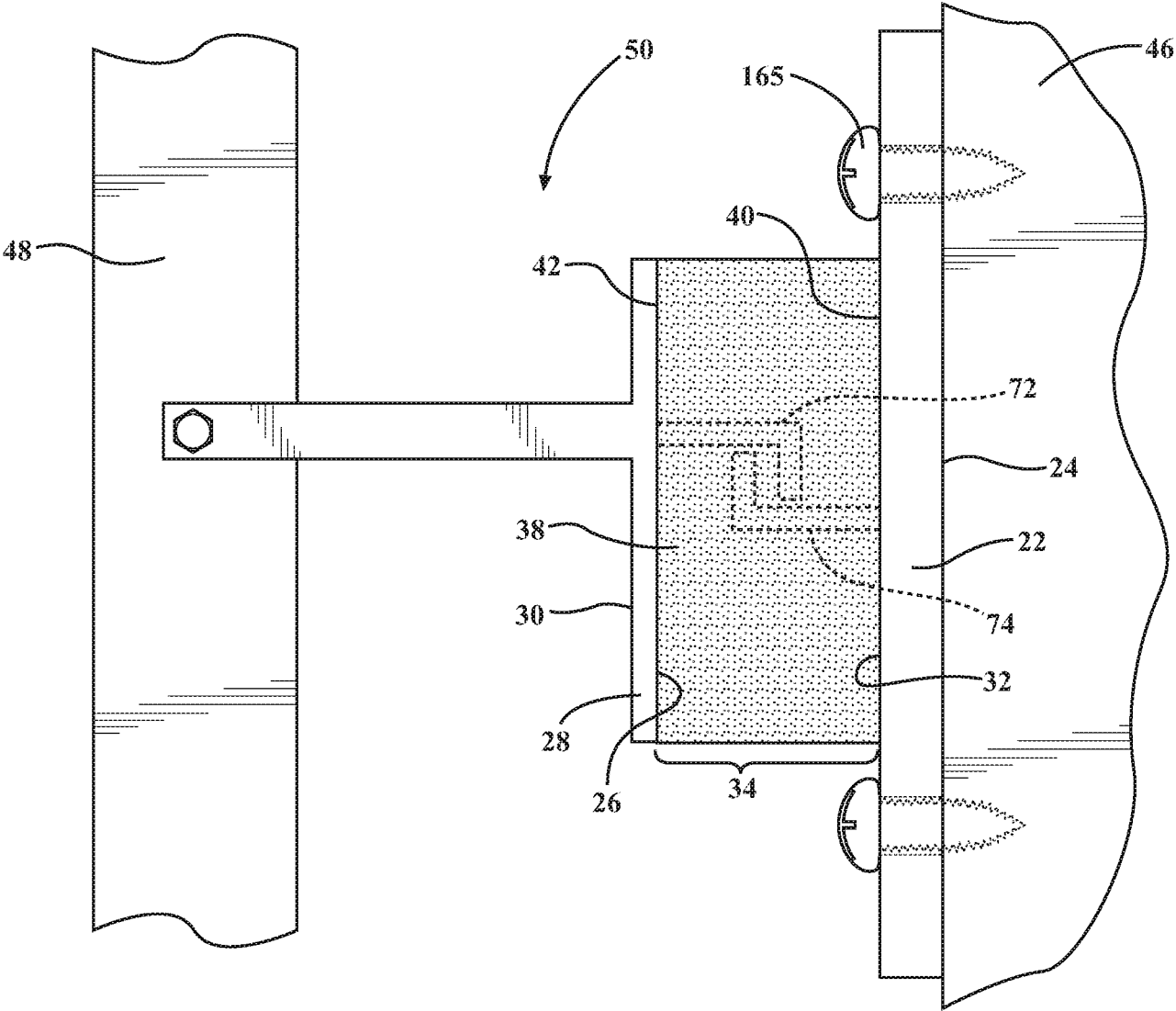


**FIG. 5**

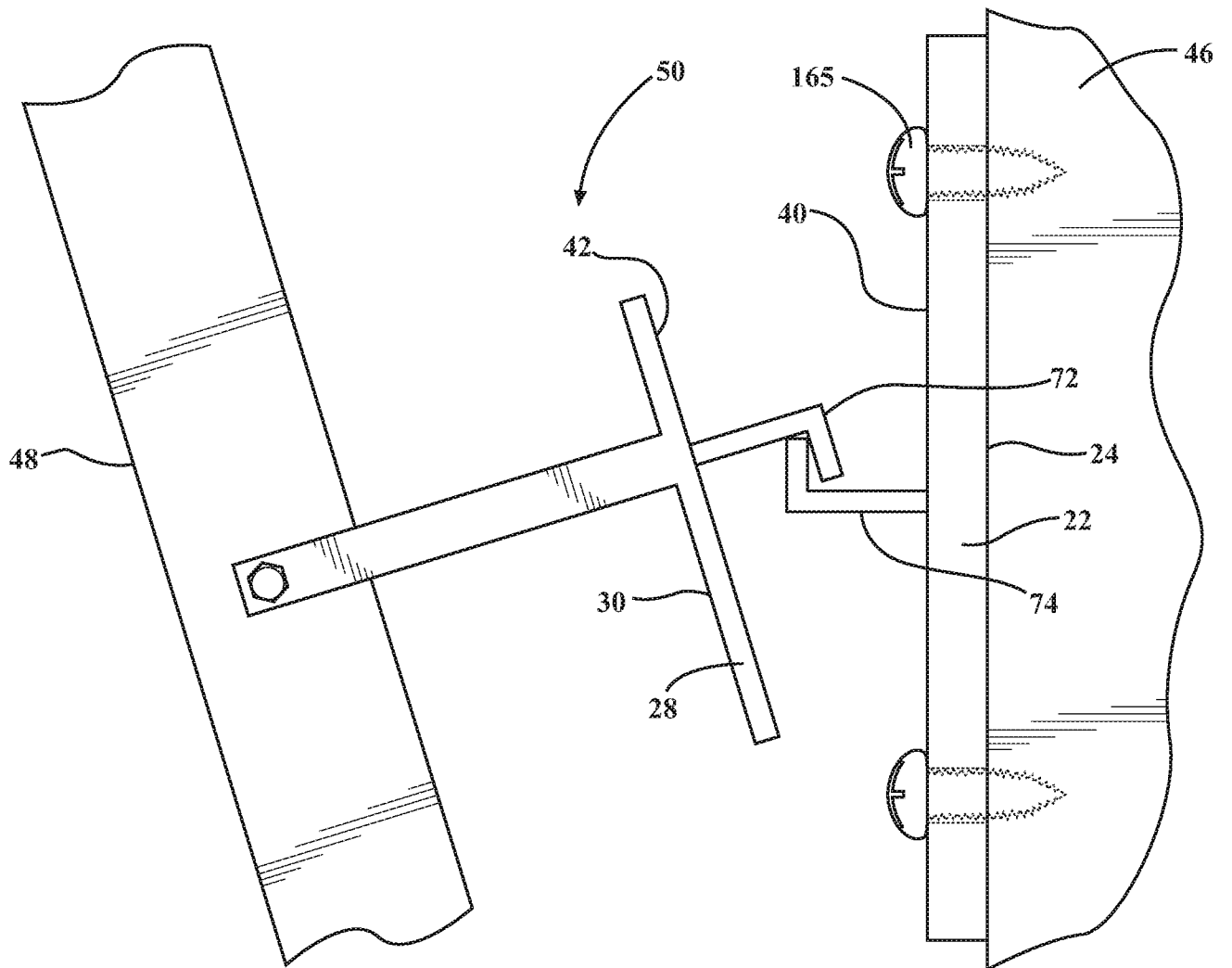


**FIG. 6**

## INTERNATIONAL SEARCH REPORT

International application No  
PCT/US2015/066097

A. CLASSIFICATION OF SUBJECT MATTER  
INV. E04F13/08 E04B1/41 E04B1/76  
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
E04B E04F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category*  | Citation of document, with indication, where appropriate, of the relevant passages                                                                           | Relevant to claim No. |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| X<br>A     | US 2014/096466 A1 (HOHMANN JR RONALD P [US]) 10 April 2014 (2014-04-10)<br>paragraphs [0013], [0017] - [0020]<br>figures 2,3<br>-----                        | 1-29,31<br>30         |
| X,P<br>A,P | US 2015/128518 A1 (KNIGHT DOUGLAS JAMES [US] ET AL) 14 May 2015 (2015-05-14)<br>paragraphs [0081], [0082], [0091],<br>[0092], [0095]<br>figures 1-3<br>----- | 1-29,31<br>30         |
| A          | DE 199 17 533 A1 (FICHTNER GERD [DE])<br>26 October 2000 (2000-10-26)<br>the whole document<br>-----<br>-/--                                                 | 1-31                  |



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

29 February 2016

Date of mailing of the international search report

07/03/2016

Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040,  
Fax: (+31-70) 340-3016

Authorized officer

Arsac England, Sally

## INTERNATIONAL SEARCH REPORT

International application No

PCT/US2015/066097

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                | Relevant to claim No. |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|
| A         | EP 2 500 480 A2 (KORFF MICHAEL [PL])<br>19 September 2012 (2012-09-19)<br>paragraphs [0002], [0003], [0031] -<br>[0034]<br>figures 1,5-8<br>----- | 1-31                  |

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2015/066097

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)          | Publication<br>date      |
|-------------------------------------------|---------------------|-------------------------------------|--------------------------|
| US 2014096466 A1                          | 10-04-2014          | CA 2809080 A1<br>US 2014096466 A1   | 14-09-2013<br>10-04-2014 |
| US 2015128518 A1                          | 14-05-2015          | CA 2820970 A1<br>US 2015128518 A1   | 14-09-2014<br>14-05-2015 |
| DE 19917533 A1                            | 26-10-2000          | NONE                                |                          |
| EP 2500480 A2                             | 19-09-2012          | DE 102011001377 A1<br>EP 2500480 A2 | 20-09-2012<br>19-09-2012 |