

IN THE UNITED STATES DISTRICT COURT
DISTRICT OF COLORADO

D THREE ENTERPRISES, LLC,

Plaintiff,

v.

SUNMODO CORPORATION,

Defendant.

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Case No. 1:15-cv-1151

JURY TRIAL DEMANDED

PLAINTIFF’S FIRST AMENDED COMPLAINT

Plaintiff D THREE ENTERPRISES, LLC (“Plaintiff”) files this First Amended Complaint against Defendant SUNMODO CORPORATION, alleging as follows:

I. THE PARTIES

1. D THREE ENTERPRISES, LLC (“Plaintiff”) is a Limited Liability Company organized and existing under the laws of the State of Colorado, with a principal place of business in Lafayette, Colorado.

2. Upon information and belief, Defendant SUNMODO CORPORATION (“SunModo”) is a corporation organized and existing under the laws of the State of Washington, with a principal place of business in Vancouver, WA. Defendant SunModo may be served with process by serving its Registered Agent, Jun Liu at 1118 NW Klickitat Lane, Camas, WA 98607.

II. JURISDICTION AND VENUE

3. This is an action for infringement of a United States patent. Federal question jurisdiction is conferred to this Court over such action under 28 U.S.C. §§ 1331 and 1338(a).

4. Upon information and belief, Defendant has had minimum contacts with the District of Colorado such that this venue is fair and reasonable. Defendant has committed such

purposeful acts and/or transactions in this district that it reasonably should know and expect that it could be hauled into this Court as a consequence of such activity. Upon information and belief, Defendant has transacted and, at the time of the filing of this Complaint, is transacting business within the District of Colorado.

5. For these reasons, personal jurisdiction exists and venue is proper in this Court under 28 U.S.C. §§ 1391(b) and (c) and 28 U.S.C. § 1400(b).

III. PATENT INFRINGEMENT

6. On April 8, 2014, United States Patent No. 8,689,517 B2 (“the ’517 Patent”) was duly and legally issued for “ROOF MOUNT SEALING ASSEMBLY.” A true and correct copy of the ’517 Patent is attached hereto as Exhibit “A” and made a part hereof.

7. On April 29, 2014, United States Patent No. 8,707,655 B2 (“the ’655 Patent”) was duly and legally issued for “ROOF MOUNT SEALING ASSEMBLY.” A true and correct copy of the ’655 Patent is attached hereto as Exhibit “B” and made a part hereof.

8. On June 30, 2015 (approximately one month after Plaintiff filed its Original Complaint), United States Patent No. 9,068,339 B2 (“the ’339 Patent”) was duly and legally issued for “ROOF STANDOFF DEVICE.” A true and correct copy of the ’339 Patent is attached hereto as Exhibit “C” and made a part hereof.

9. The ’517, ’655 and ’339 Patents are referred to collectively as the “Patents-in-Suit.”

10. By way of assignment, Plaintiff is the owner of all right, title and interest in and to the Patents-in-Suit, with all rights to enforce them against infringers and to collect damages for all relevant times, including the right to prosecute this action.

11. On information and belief, Defendant, without authority, consent, right, or license, and in direct infringement of the Patents-in-Suit, manufactures, has manufactured, makes, has made, uses, imports, has imported, markets, sells, and/or offers for sale systems and/or products that directly infringe one or more claims of the Patents-in-Suit. By way of example only, its EZ Mount assembly with Standoff for Shingle Roofs (Kit #K10070-002) directly infringes at least claims 1 and 14 of the '517 Patent and at least claims 1, 2, 3, 4, 5, 7, 8, 9, 11, and 13 of the '655 Patent. In addition, Defendant's EZ Mount L-Foot Kit for Shingle Roofs (Kit #K10068-001) infringes at least claims 1, 2, 3, 4, 5, 7, and 8 of the '655 Patent. By way of further example only, Defendant's EZ Mount assembly with Standoff directly infringes at least claims 1, 2, 4, 5, 7, 8 and 9 of the '339 Patent, and Defendant's EZ Mount L-Foot Kit directly infringes at least claims 1, 2, 4, 5, 7, 8, 9, and 10 of the '339 Patent.

12. Plaintiff expressly reserves the right to assert additional claims of the Patents-in-Suit and expressly reserves the right to assert additional patents.

13. Plaintiff has been damaged as a result of Defendant's infringing conduct. Defendant is, thus, liable to Plaintiff in an amount that adequately compensates for its infringement, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

14. Upon information and belief, Defendant will continue its infringement of the Patents-in-Suit unless enjoined by the Court. Defendant's infringing conduct has caused Plaintiff irreparable harm and will continue to cause such harm without the issuance of an injunction.

IV. JURY DEMAND

15. Plaintiff hereby requests a trial by jury pursuant to Rule 38 of the Federal Rules of Civil Procedure.

V. RELATED CASES

16. This case is related to three other cases that are being filed concurrently herewith, namely: *D Three Enterprises, LLC v. Rillito River Solar LLC d/b/a EcoFasten Solar*, for infringement of U.S. Patent No. 8,689,517 (one of the two Patents-in-Suit in this suit); *D Three Enterprises, LLC v. EJOT Fastening Systems L.P.*, for infringement of U.S. Patent No. 8,833,032; and *D Three Enterprises, LLC v. Quickscrews International Corp.*, for infringement of U.S. Patent No. 8,833,032. All of the three above-referenced U.S. Patents relate to roof mount sealing assemblies; trace their lineage to the same parent patents (U.S. Patent Nos. 8,707,654, 8,448,405, and 8,661,765) and to the same provisional application (No. 61/150,301, filed on February 5, 2009); list the same inventors, namely, Richard F. Schaefer of Fort Lupton, Colorado, David Kreutzman, of Louisville, Colorado, and Don N. Tamm, of Denver, Colorado; and are owned or controlled by the same entity, namely, Plaintiff D Three Enterprises, LLC. Pursuant to the joinder provision of the America Invents Act, 35 U.S.C. § 299, these four lawsuits were filed separately. However, for the sake of judicial efficiency, for the convenience of the parties and witnesses, and to avoid the risk of conflicting claim constructions, Plaintiff respectfully submits that all four lawsuits should be consolidated for all pre-trial purposes, including discovery, claim construction, motion practice, and pre-trial conferences.

VI. PRAYER FOR RELIEF

WHEREFORE, Plaintiff respectfully requests that the Court find in its favor and against Defendant, and that the Court grant Plaintiff the following relief:

- a. Judgment that one or more claims of the Patents-in-Suit have been directly infringed, either literally and/or under the doctrine of equivalents, by Defendant;
- b. Judgment that Defendant account for and pay to Plaintiff all damages to and costs incurred by Plaintiff because of Defendant's infringing activities and other conduct complained of herein;
- c. That Defendant's infringement be found to be willful from the time Defendant became aware of the infringing nature of its services, which is the time of filing of Plaintiff's Complaint at the latest, and that the Court award treble damages for the period of such willful infringement pursuant to 35 U.S.C. § 284.
- d. That Plaintiff be granted pre-judgment and post-judgment interest on the damages caused by Defendant's infringing activities and other conduct complained of herein;
- e. That the Court declare this an exceptional case and award Plaintiff its reasonable attorney's fees and costs in accordance with 35 U.S.C. § 285;
- f. That Defendant be permanently enjoined from any further activity or conduct that infringes one or more claims of the Patents-in-Suit; and
- g. That Plaintiff be granted such other and further relief as the Court may deem just and proper under the circumstances.

Dated: October 26, 2015.

Respectfully submitted,

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ATTORNEYS FOR PLAINTIFF

CERTIFICATE OF SERVICE

I hereby certify that on the 26th day of October, 2015, I electronically filed the foregoing document with the clerk of the court for the United States District Court for the District of Colorado, using the electronic case filing system of the court. The electronic case filing system sent a “Notice of Electronic Filing” to the attorneys of record who have consented in writing to accept this Notice as service of this document by electronic means.

/s/ Dave R. Gunter

EXHIBIT “A”



US008689517B2

(12) **United States Patent**
Schaefer et al.

(10) **Patent No.:** **US 8,689,517 B2**
(45) **Date of Patent:** **Apr. 8, 2014**

(54) **ROOF MOUNT SEALING ASSEMBLY**

(71) Applicant: **D Three Enterprises, LLC**, Lafayette, CO (US)

(72) Inventors: **Richard F. Schaefer**, Fort Lupton, CO (US); **David Kreutzman**, Louisville, CO (US); **Don N. Tamm**, Denver, CO (US)

(73) Assignee: **D Three Enterprises, LLC**, Lafayette, CO (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/018,137**

(22) Filed: **Sep. 4, 2013**

(65) **Prior Publication Data**

US 2014/0007532 A1 Jan. 9, 2014

Related U.S. Application Data

(60) Division of application No. 13/799,359, filed on Mar. 13, 2013, which is a continuation of application No. 13/368,332, filed on Feb. 8, 2012, now Pat. No. 8,448,405, which is a continuation-in-part of application No. 12/700,667, filed on Feb. 4, 2010.

(60) Provisional application No. 61/255,082, filed on Oct. 26, 2009, provisional application No. 61/150,301, filed on Feb. 5, 2009, provisional application No. 61/440,847, filed on Feb. 8, 2011.

(51) **Int. Cl.**
E04B 1/38 (2006.01)
F16B 9/02 (2006.01)
E04D 1/34 (2006.01)
E04H 12/22 (2006.01)

(52) **U.S. Cl.**
CPC . **F16B 9/026** (2013.01); **E04D 1/34** (2013.01); **E04H 12/2276** (2013.01)

USPC **52/710**; 52/60

(58) **Field of Classification Search**
CPC E04D 13/10; E04D 1/34; E04H 12/2276; E04G 21/142; E04G 5/16; E04G 5/162; E04G 5/18; E04B 1/4128; F16B 9/02
USPC 248/237, 500, 505, 656, 669; 52/239, 52/282.1, 282.3, 647, 653.1, 653.2, 654, 52/655.1, 543, 548, 549

See application file for complete search history.

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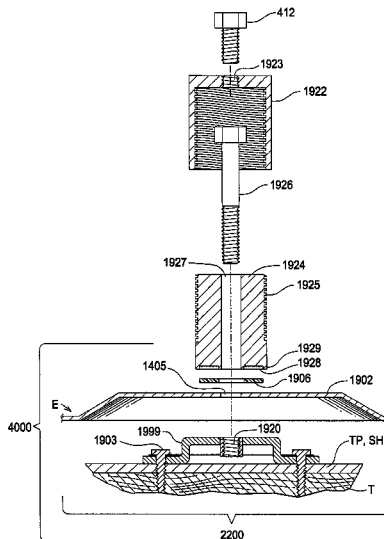
Primary Examiner — William Gilbert

(74) *Attorney, Agent, or Firm* — Russell T. Manning; Marsh Fischmann & Breyfogle LLP

(57) **ABSTRACT**

A variety of roof mount sealing assemblies are disclosed. The roof mount sealing assemblies allow a user to mount rails for solar panels, signs, satellite dish or any other desired item on the roof and have the mounting location sealed against water. The roof mount sealing assemblies has a body with a recess for a flexible washer, which is attached to a bolt body (or formed with the bolt body) and threaded either down in a base plate or directly into the roof. The bolt body and body form a double stud assembly, which also holds a flashing onto the roof to provide further water proofing.

20 Claims, 25 Drawing Sheets



US 8,689,517 B2

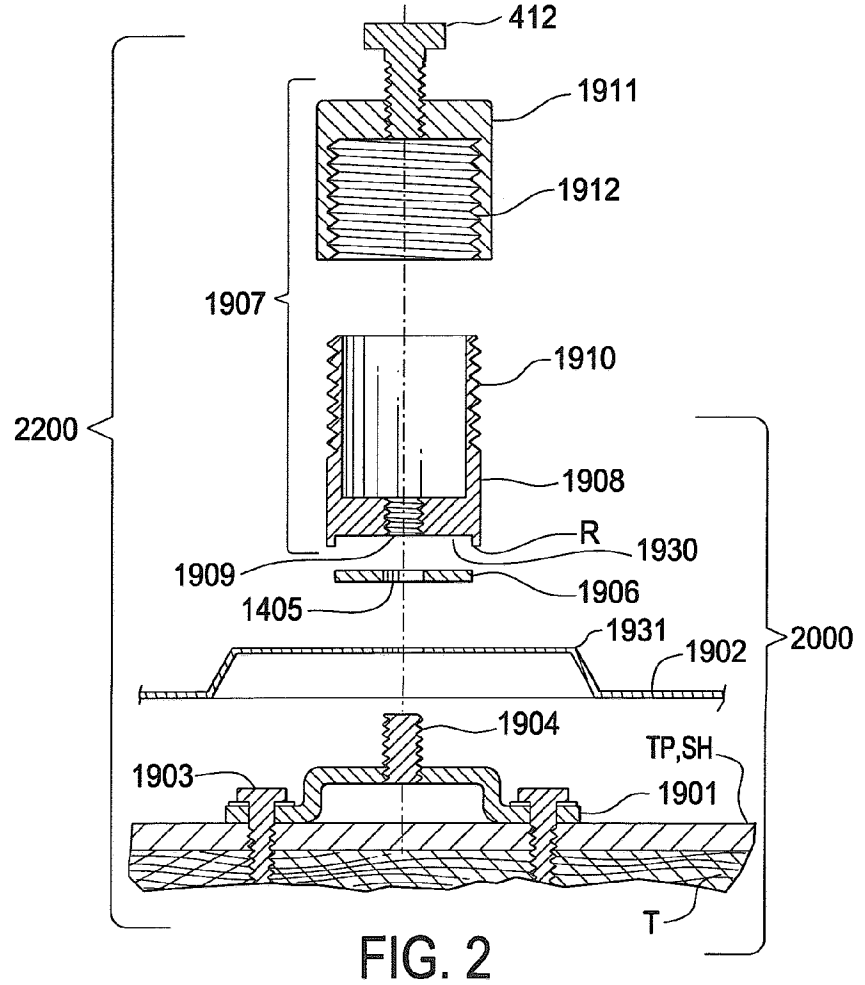
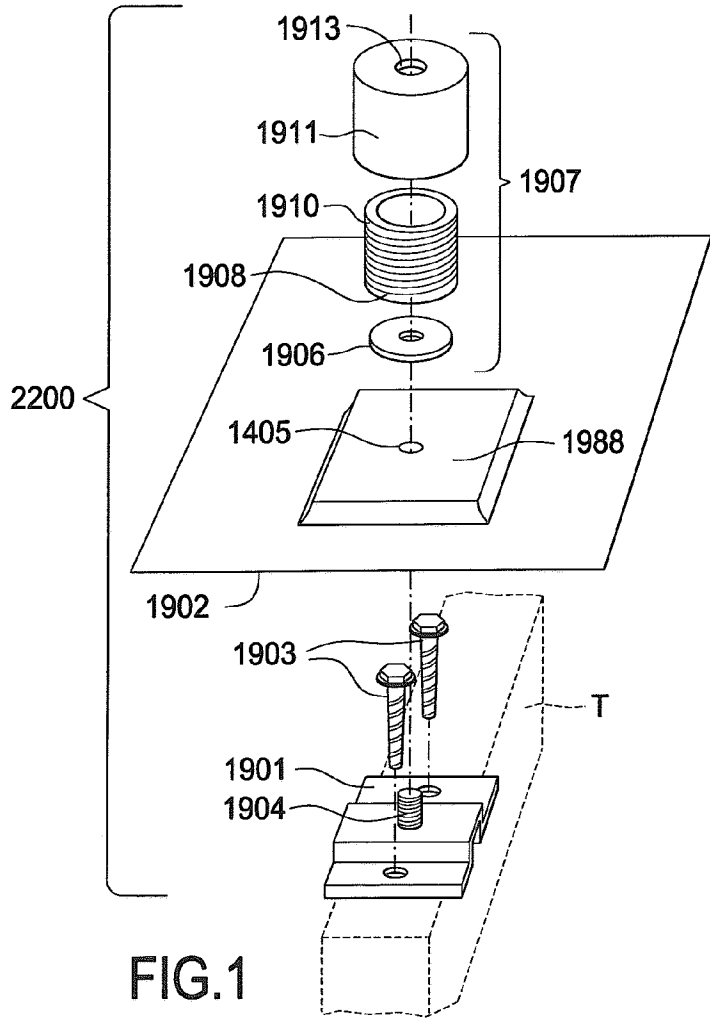
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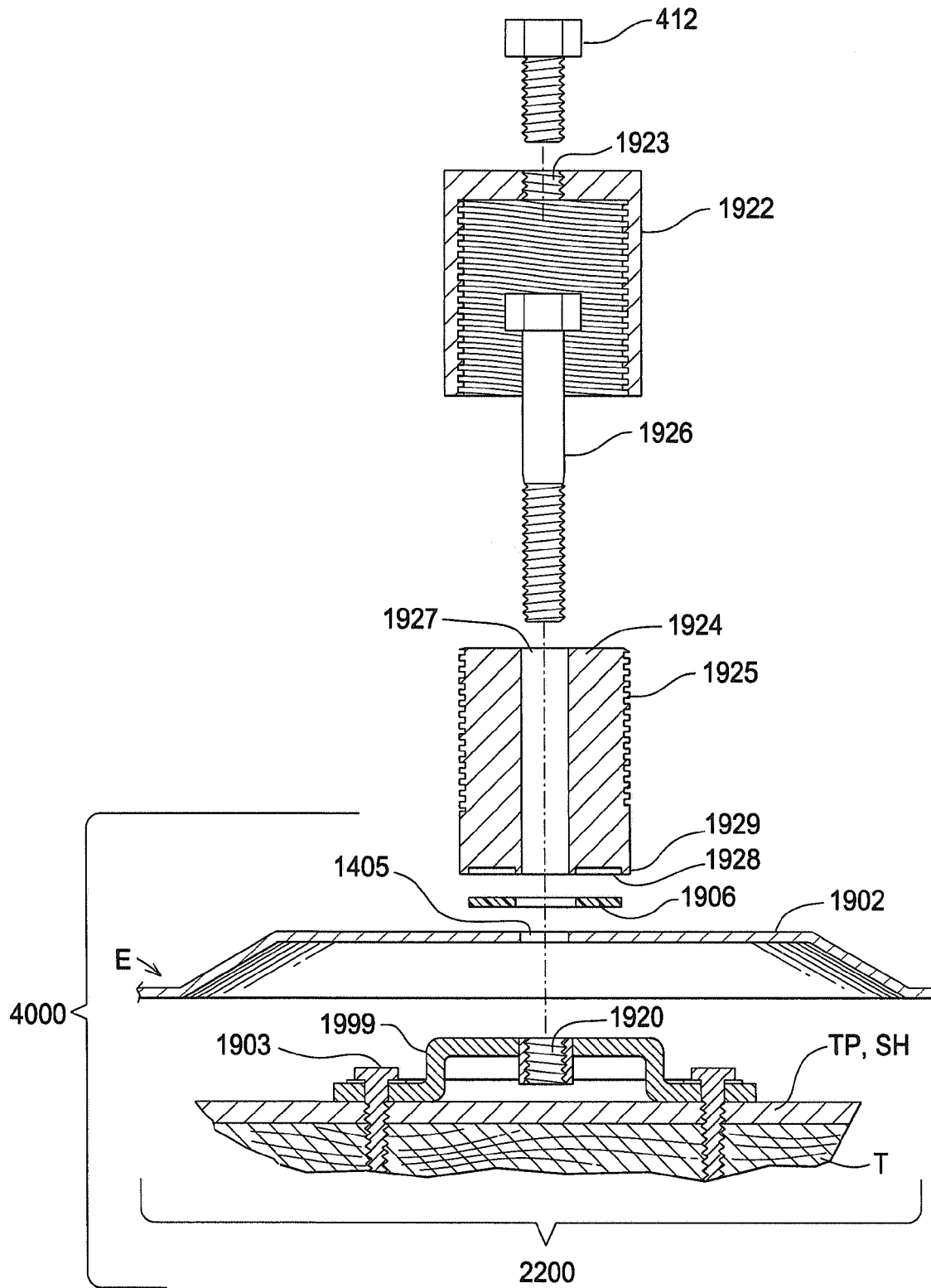


FIG. 3

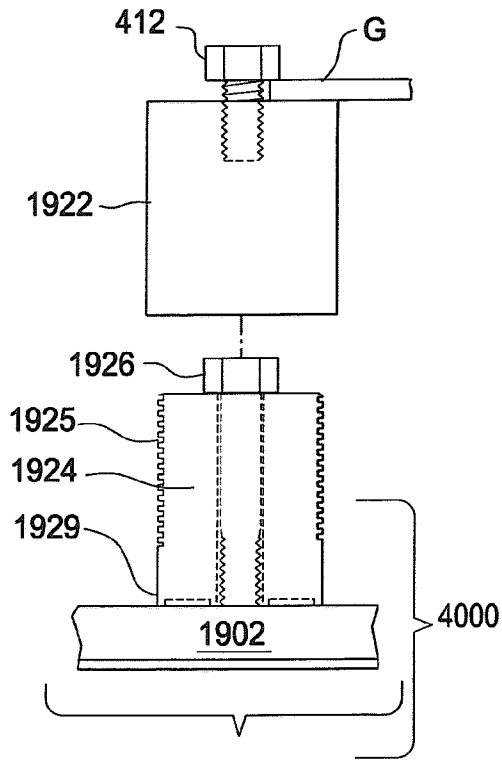


FIG. 4

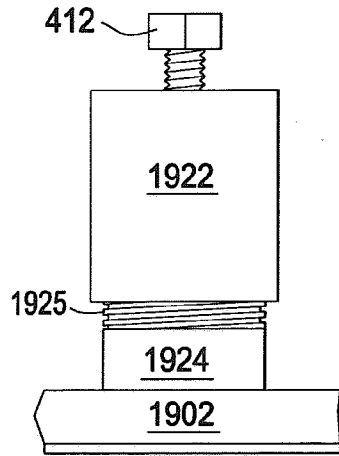


FIG. 5

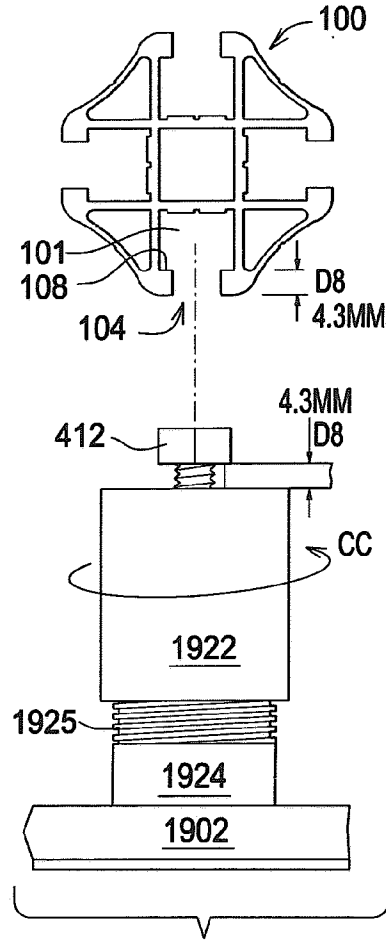


FIG. 6

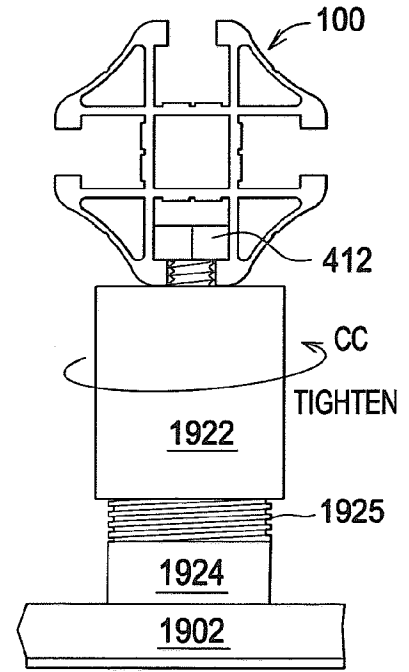


FIG. 7

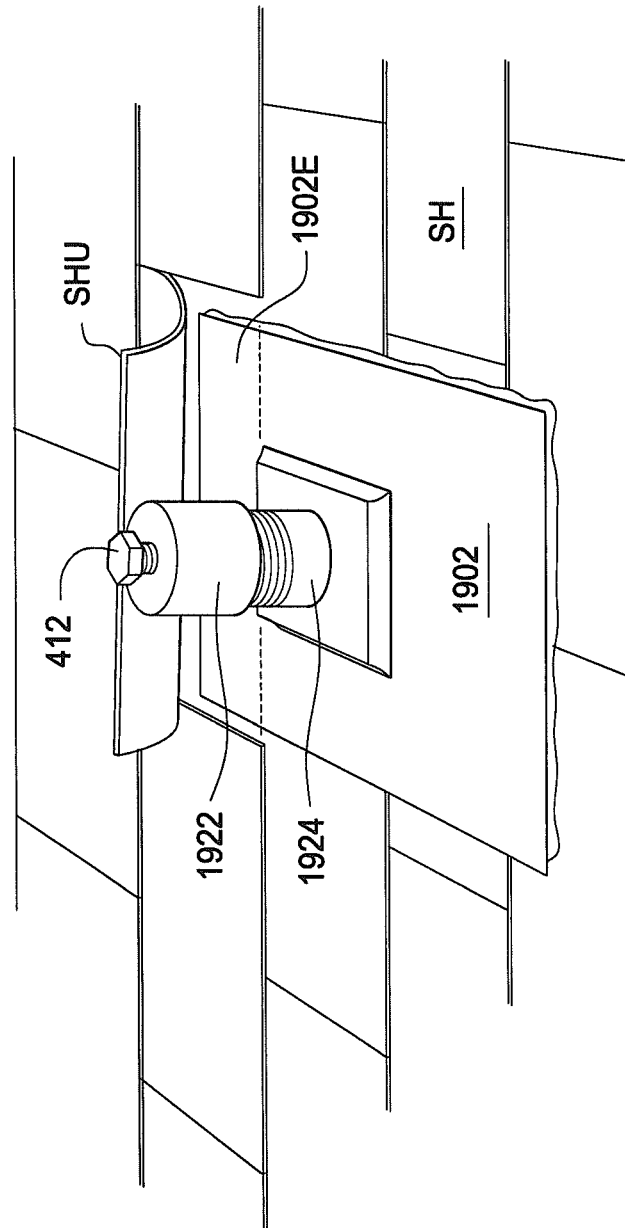


FIG. 8

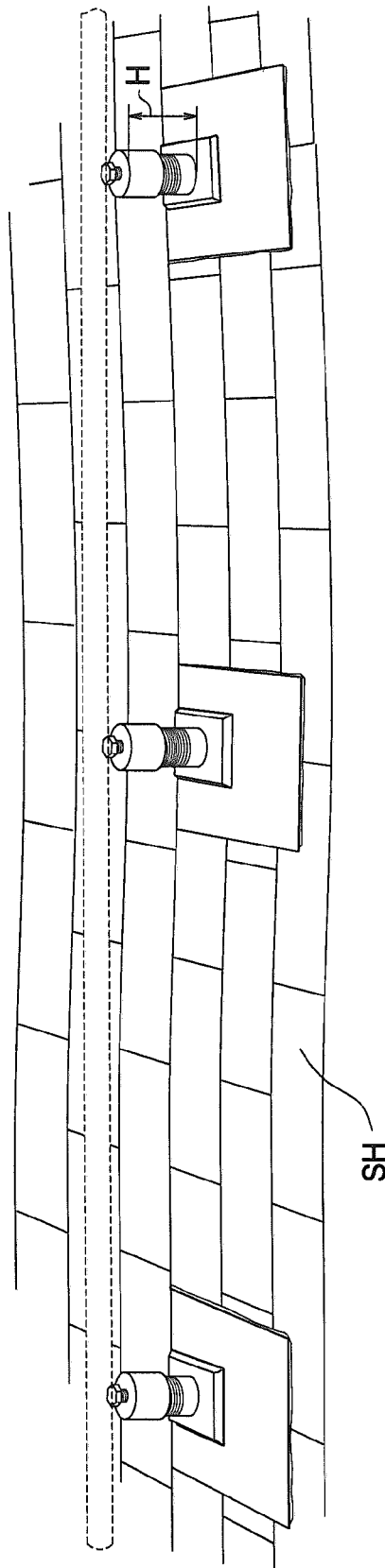
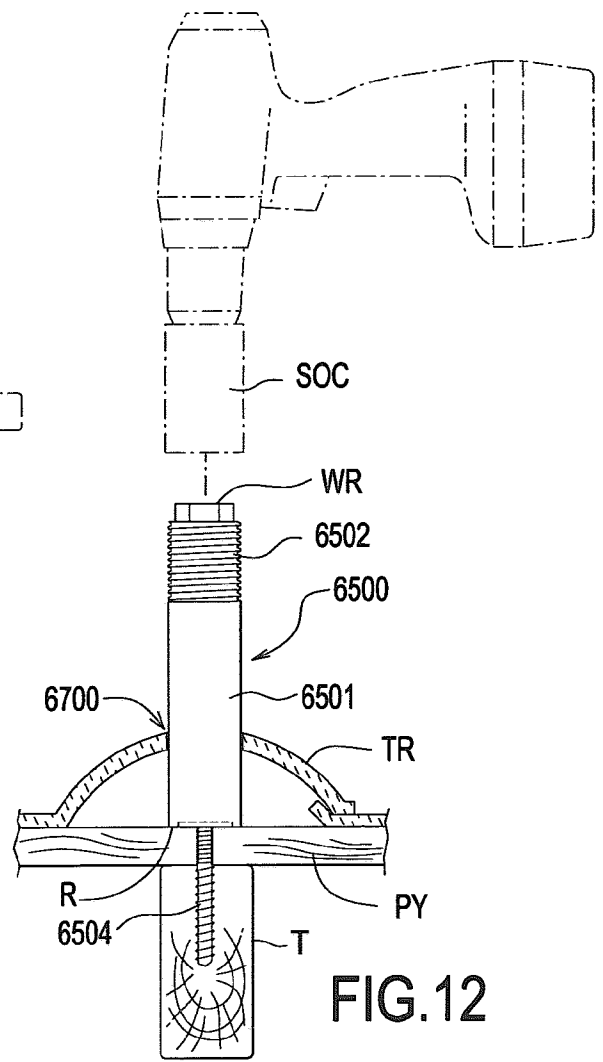
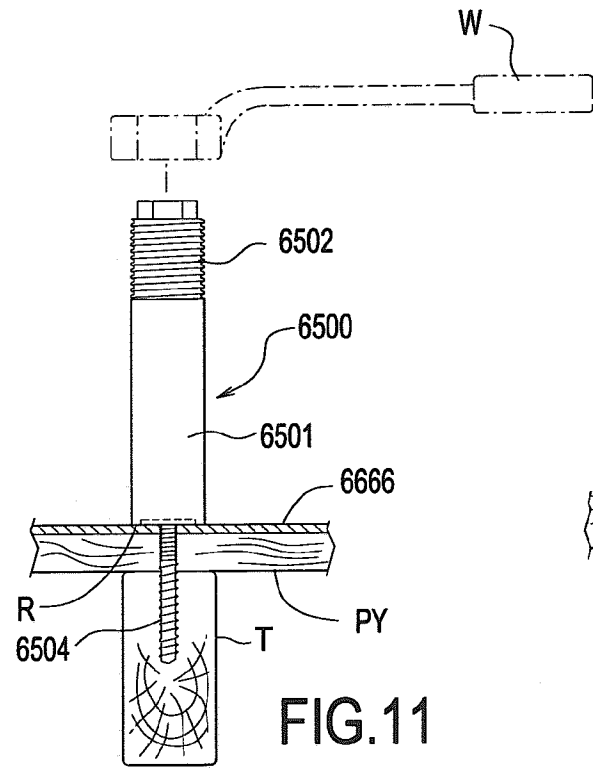
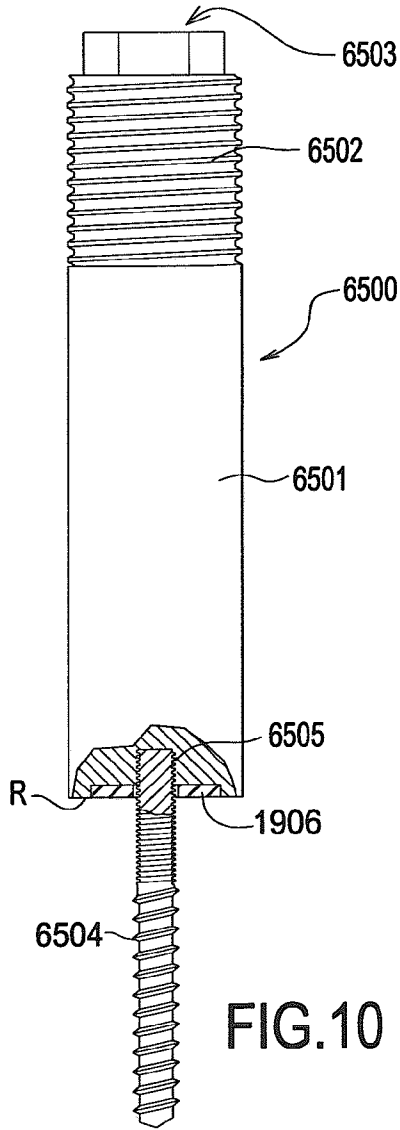


FIG. 9



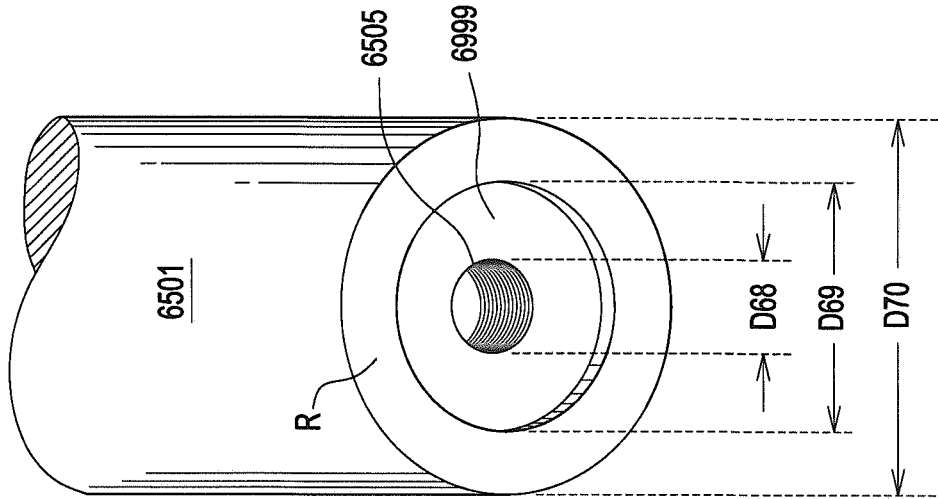


FIG. 14

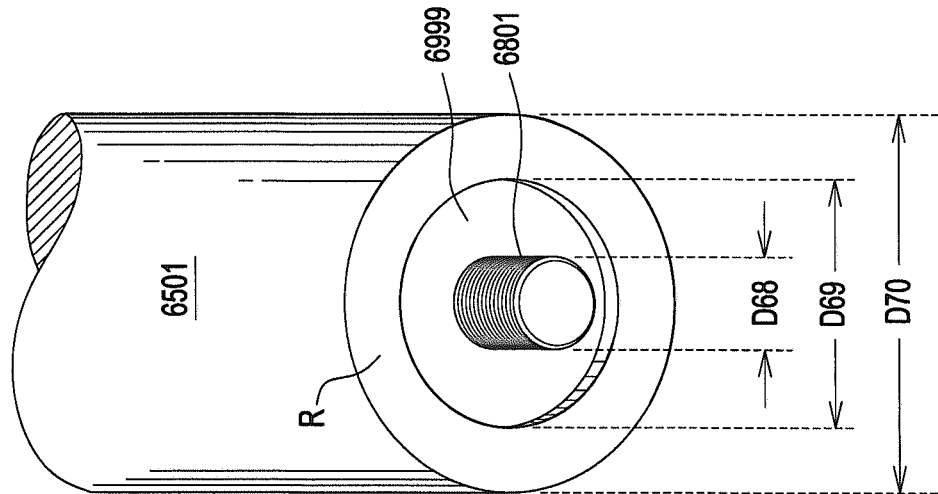
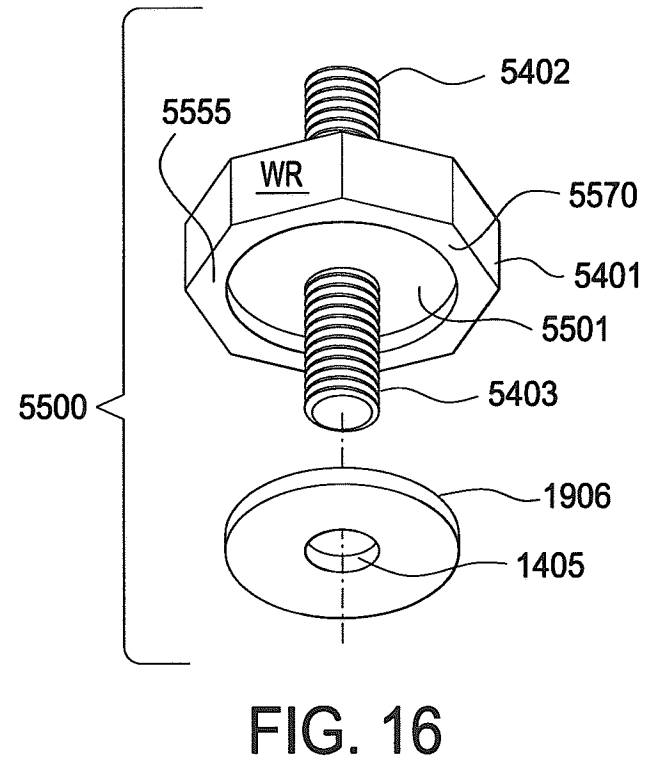
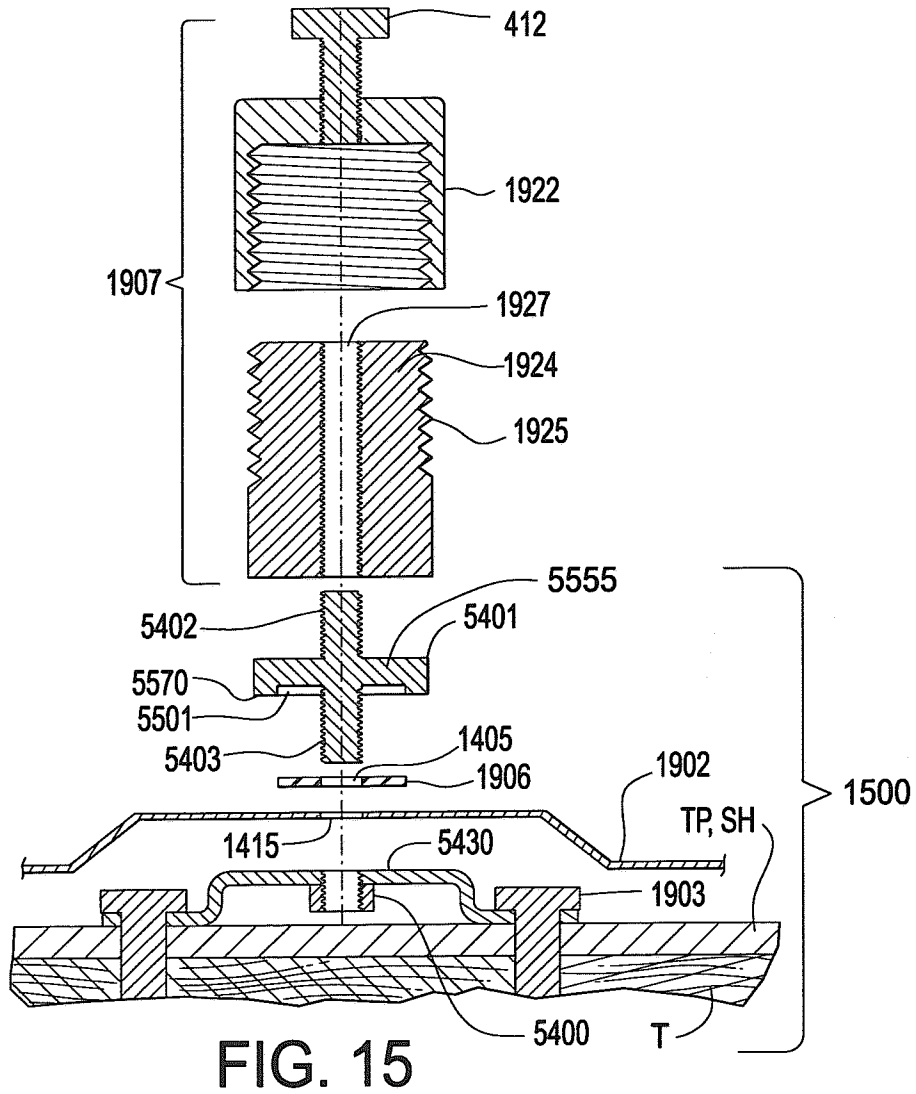


FIG. 13



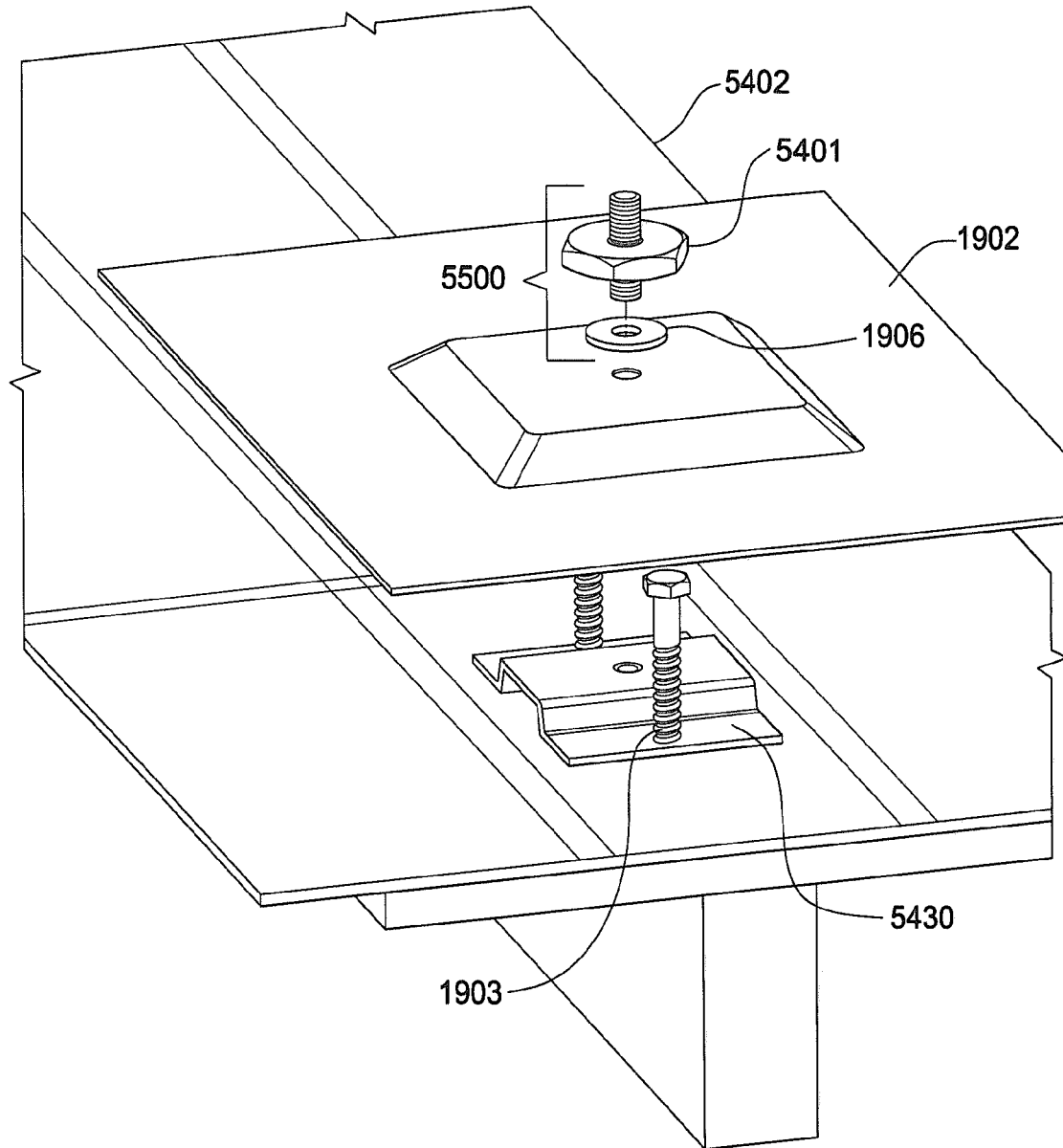


FIG. 17

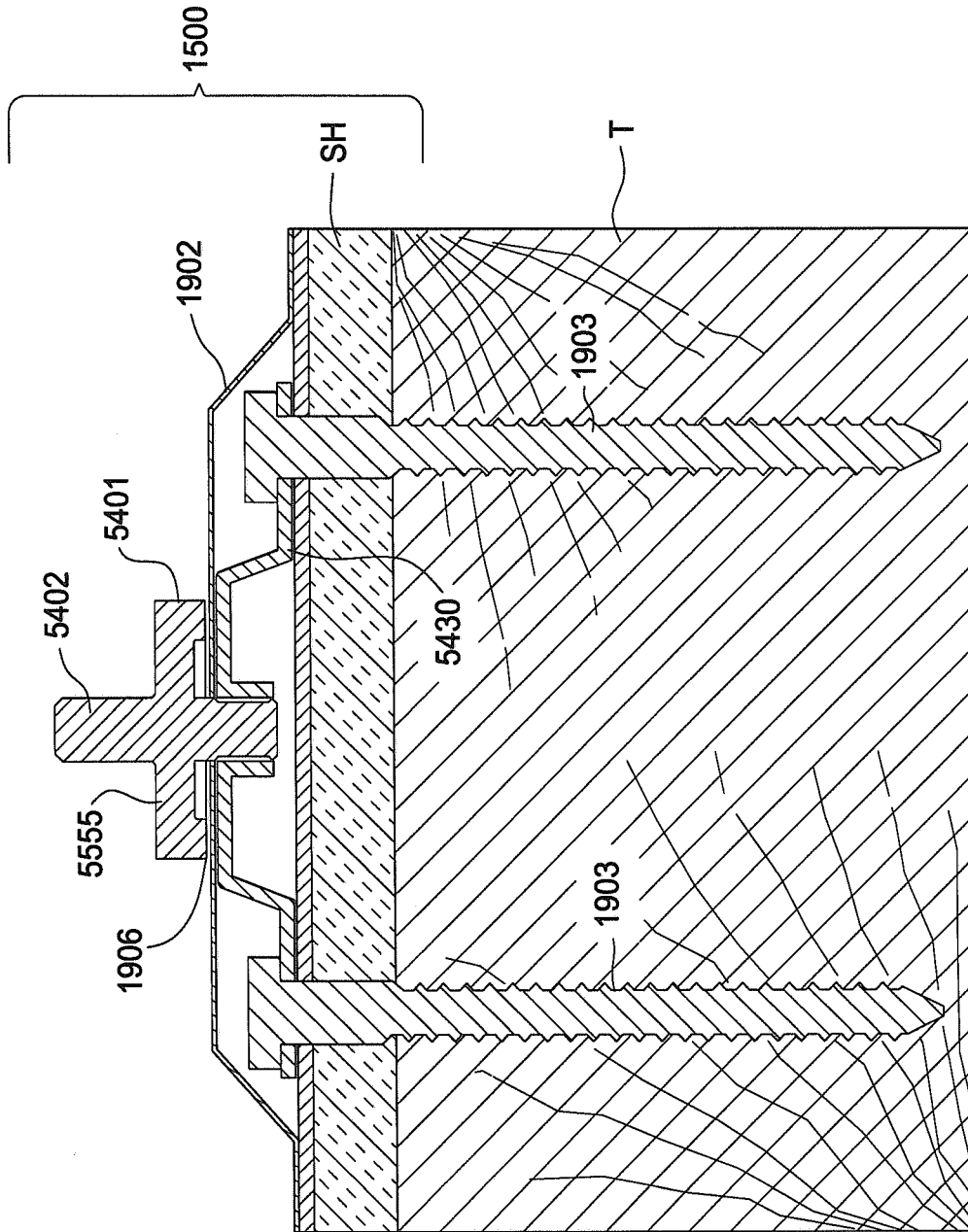
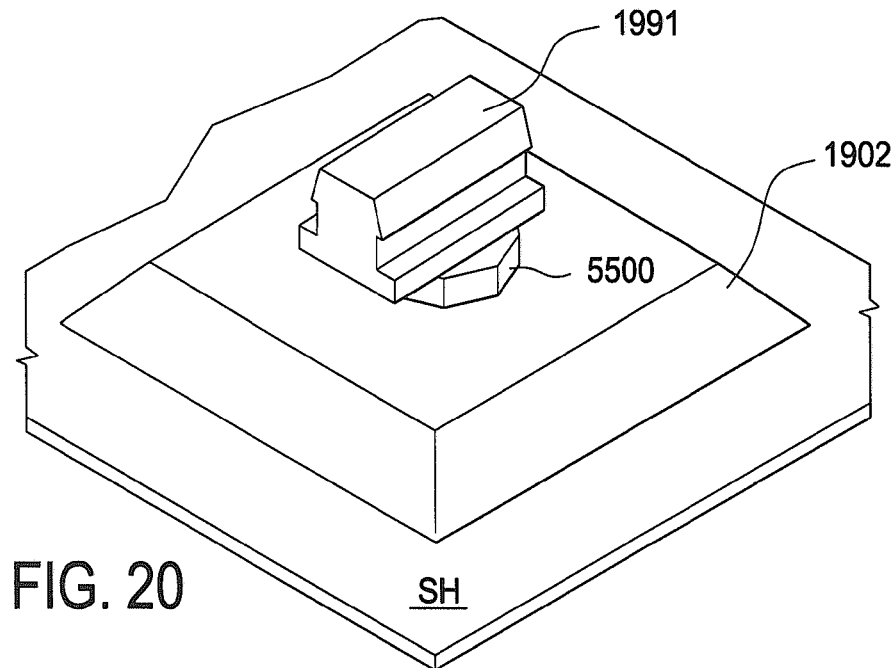
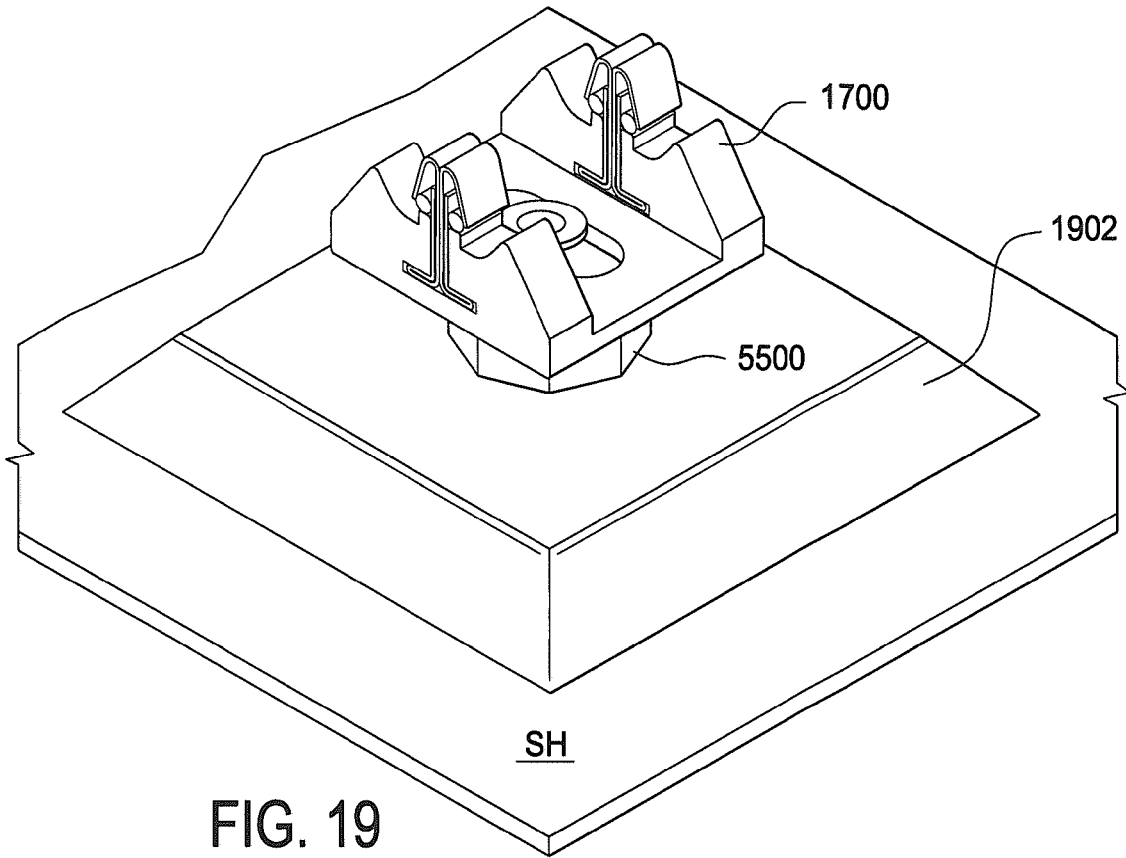


FIG. 18



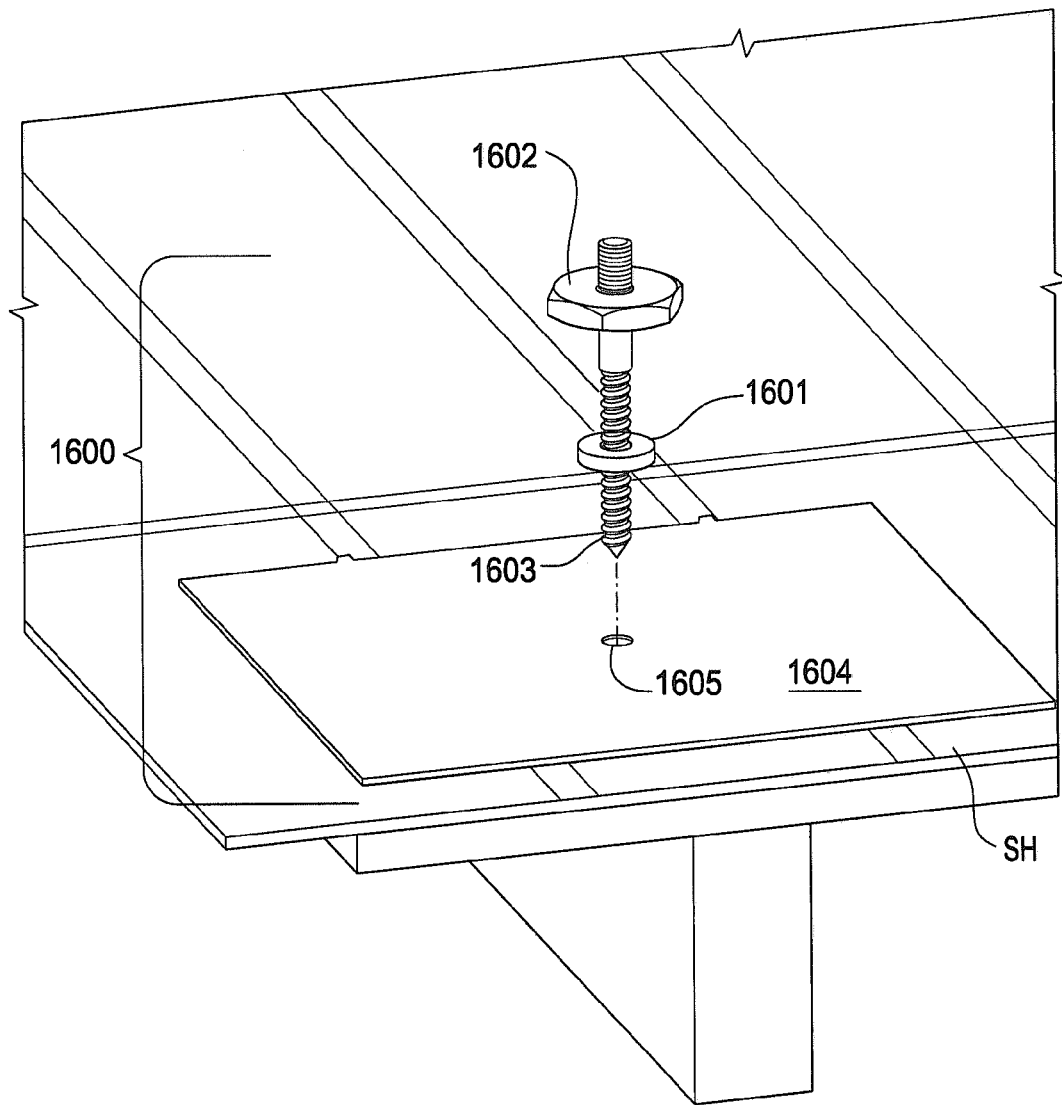


FIG. 21

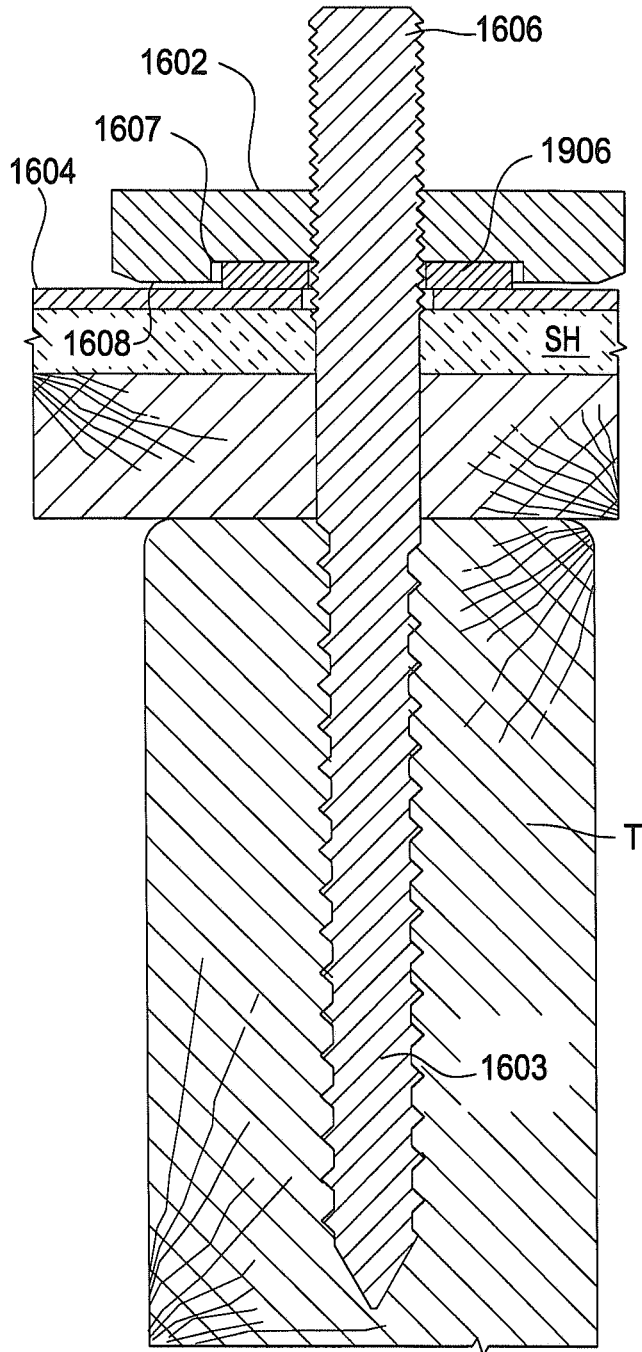


FIG. 22

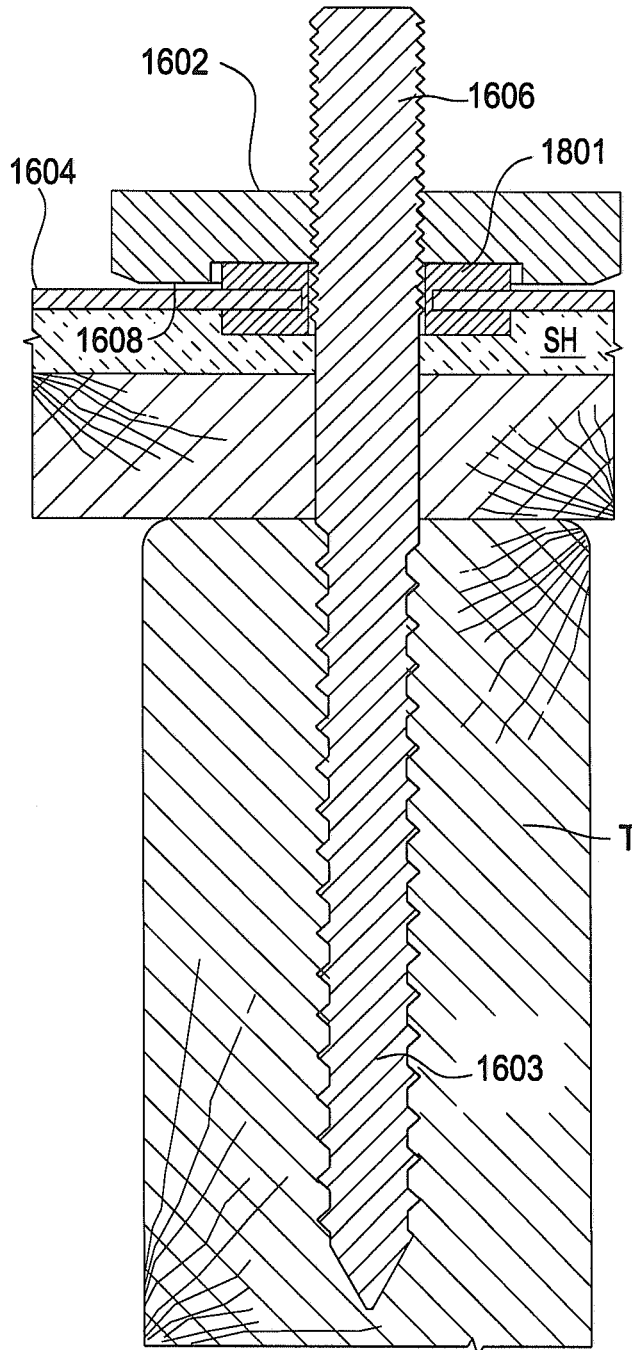


FIG. 23

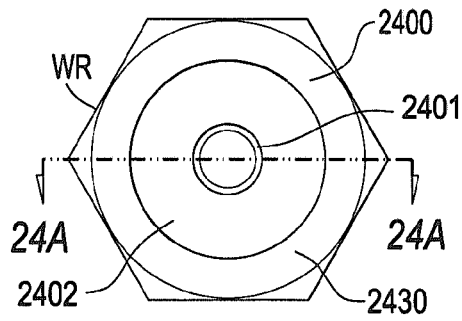


FIG. 24B

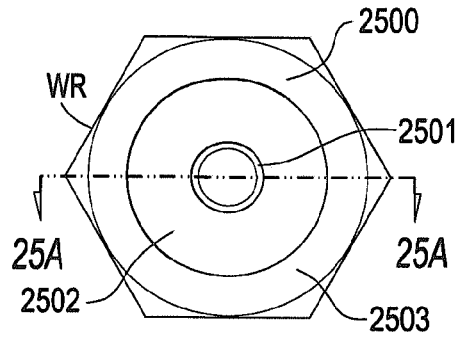


FIG. 25B

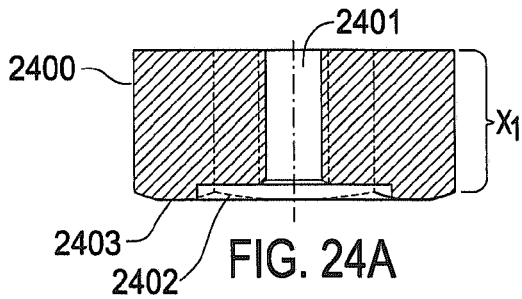


FIG. 24A

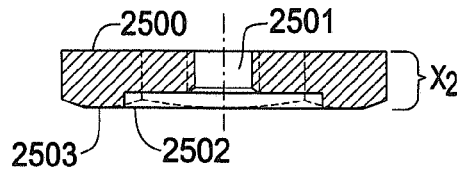


FIG. 25A

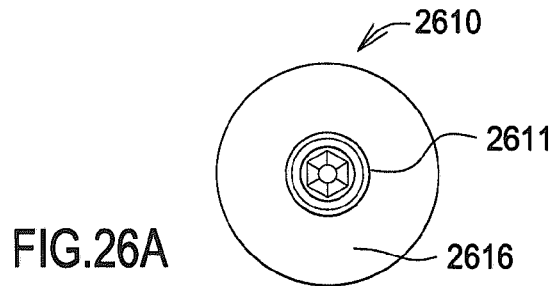


FIG. 26A

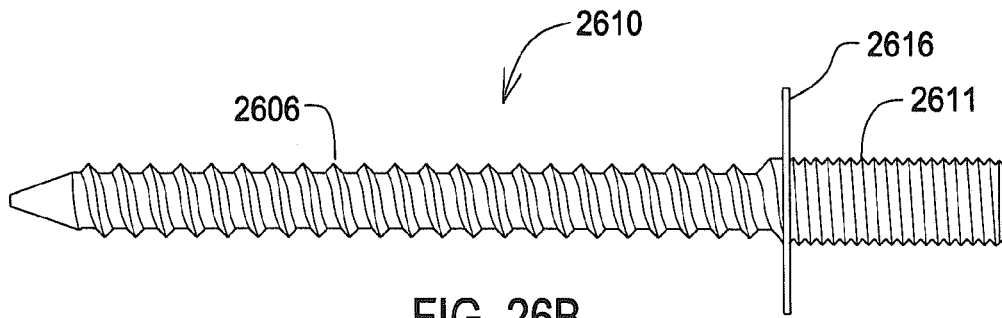
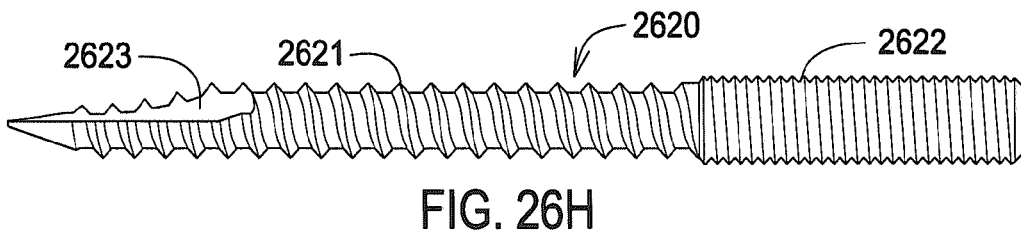
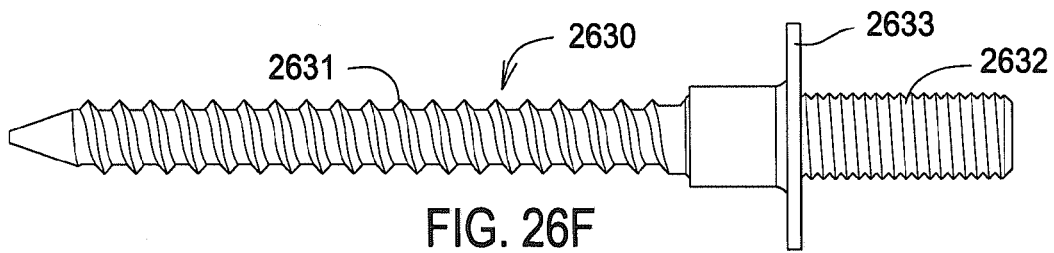
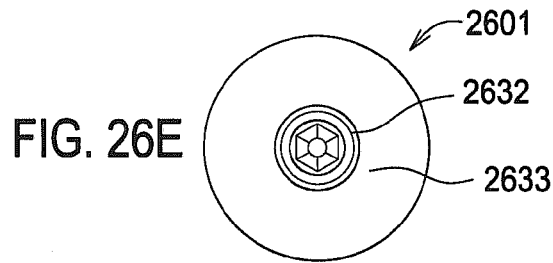
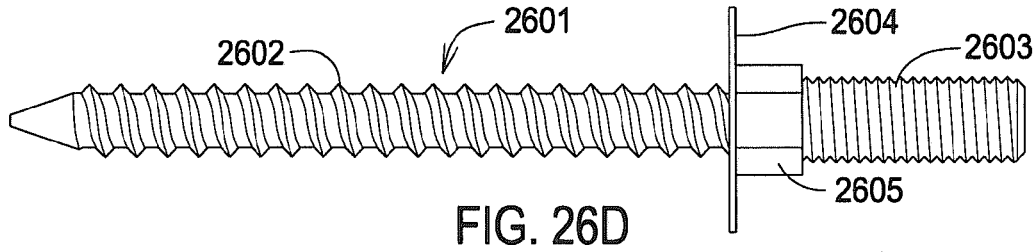
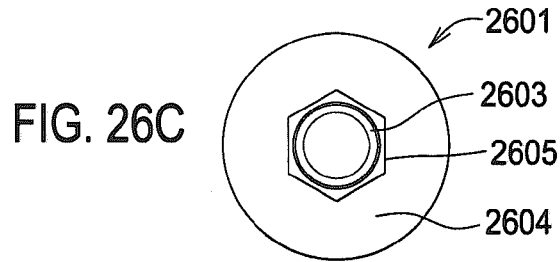


FIG. 26B



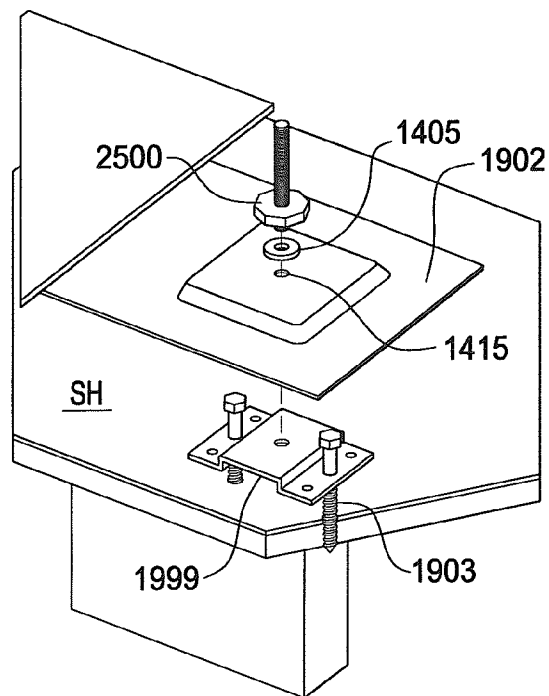


FIG. 27A

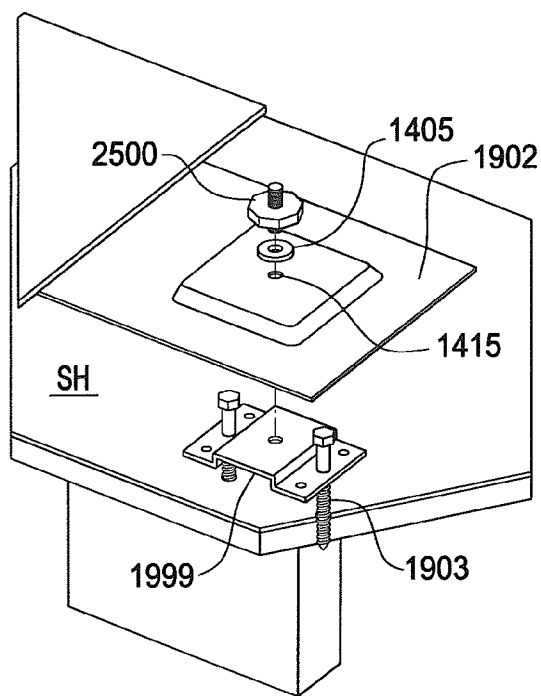


FIG. 27B

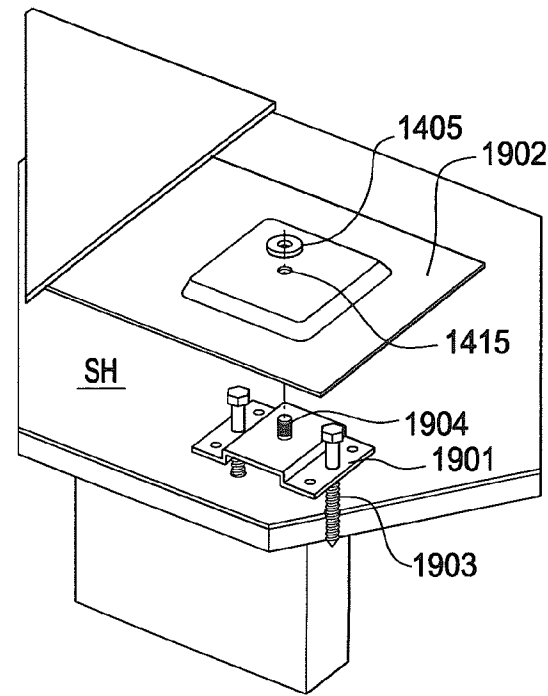


FIG. 27C

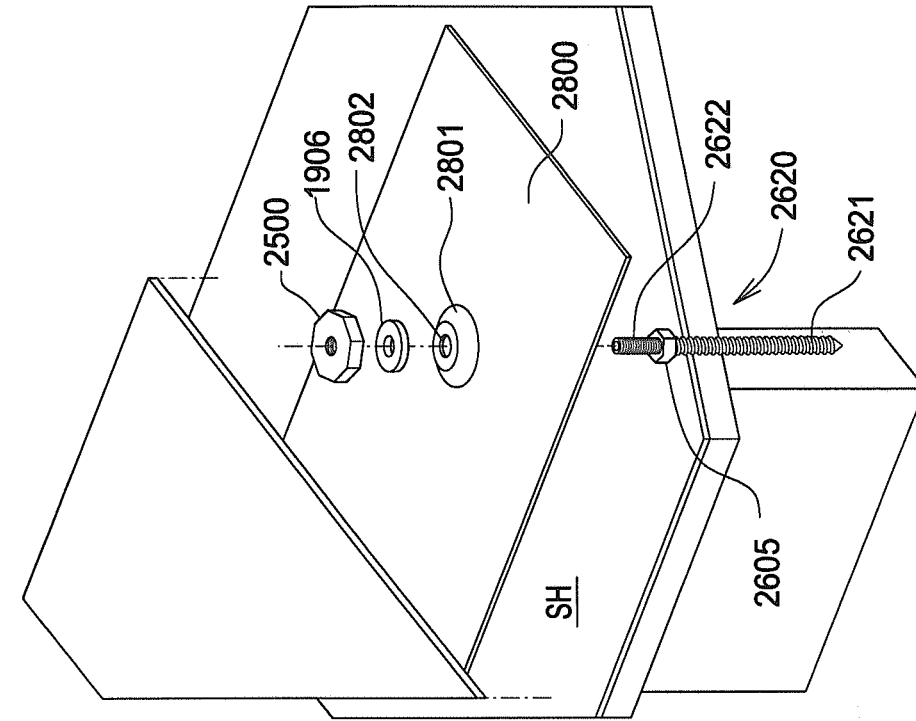


FIG. 28B

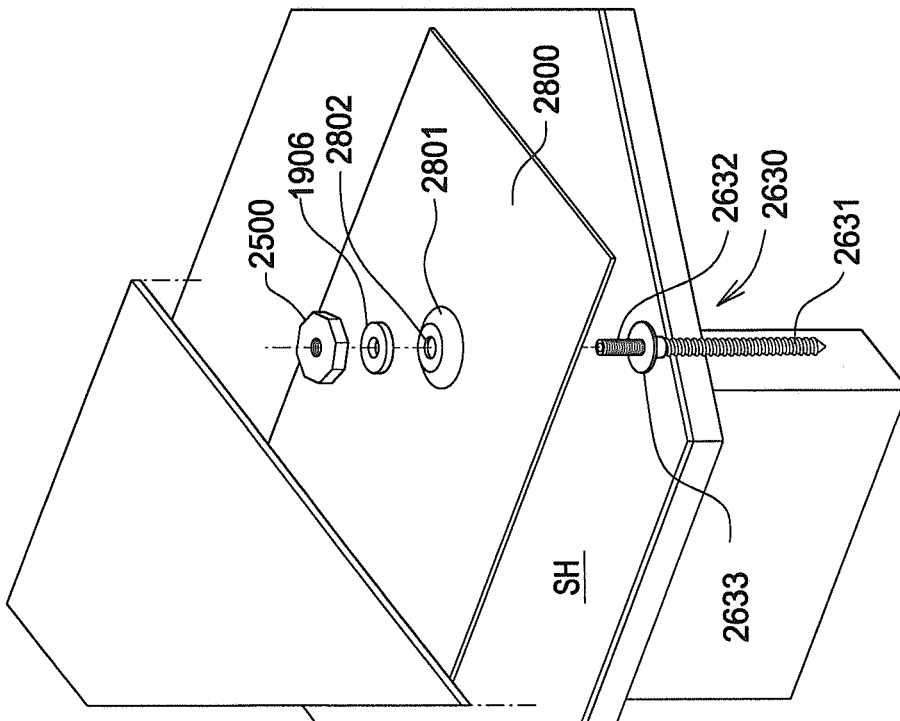


FIG. 28A

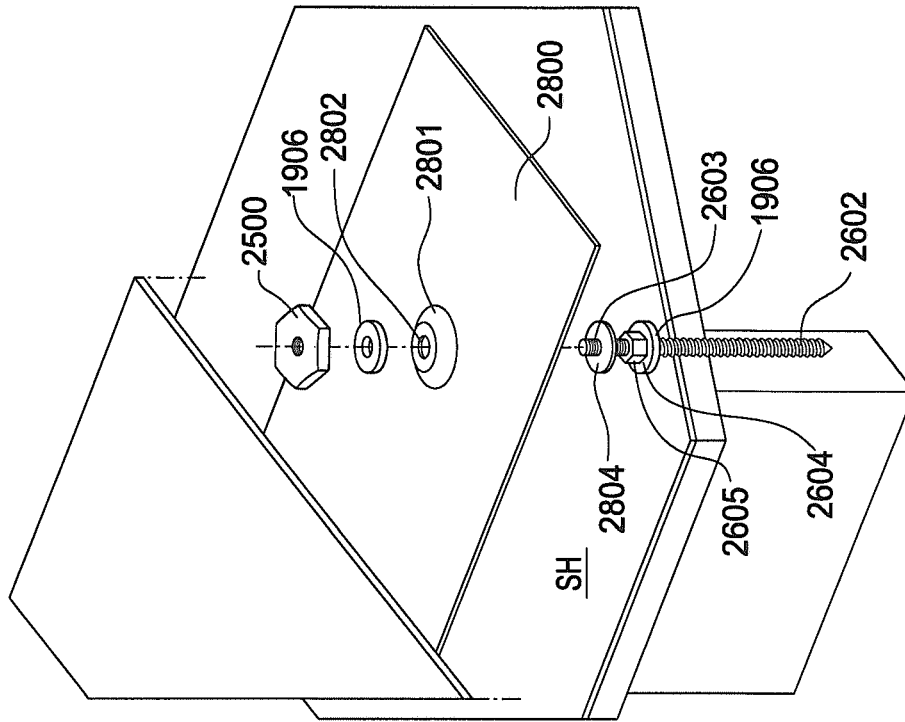


FIG. 28D

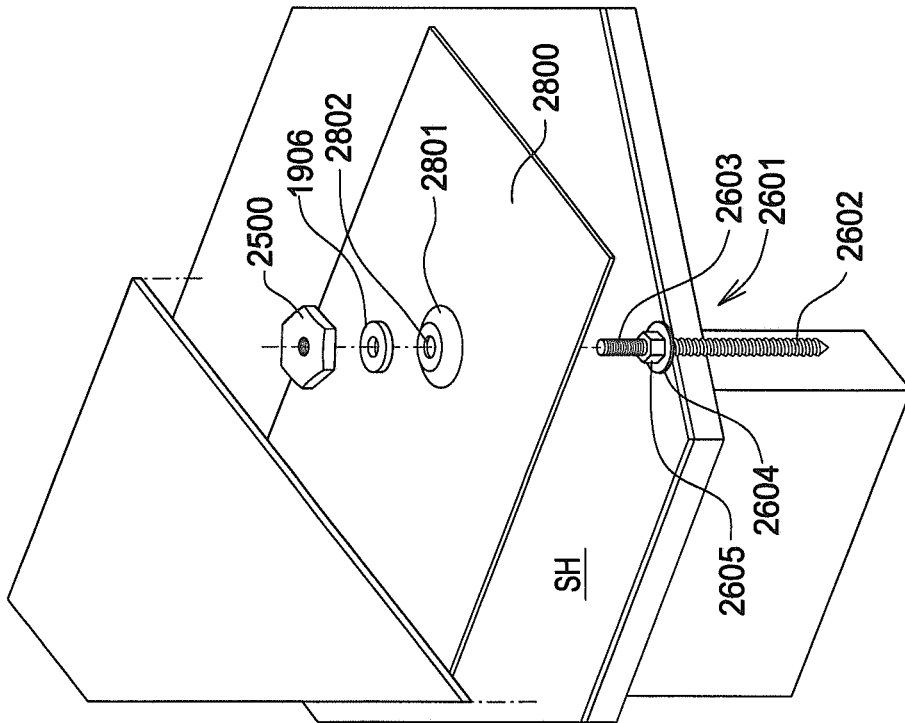


FIG. 28C

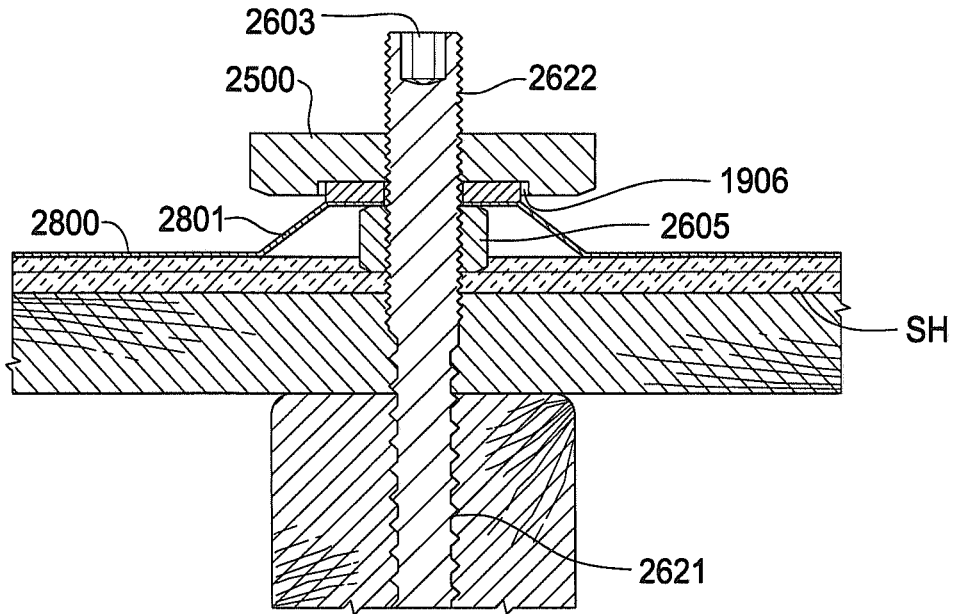


FIG. 29

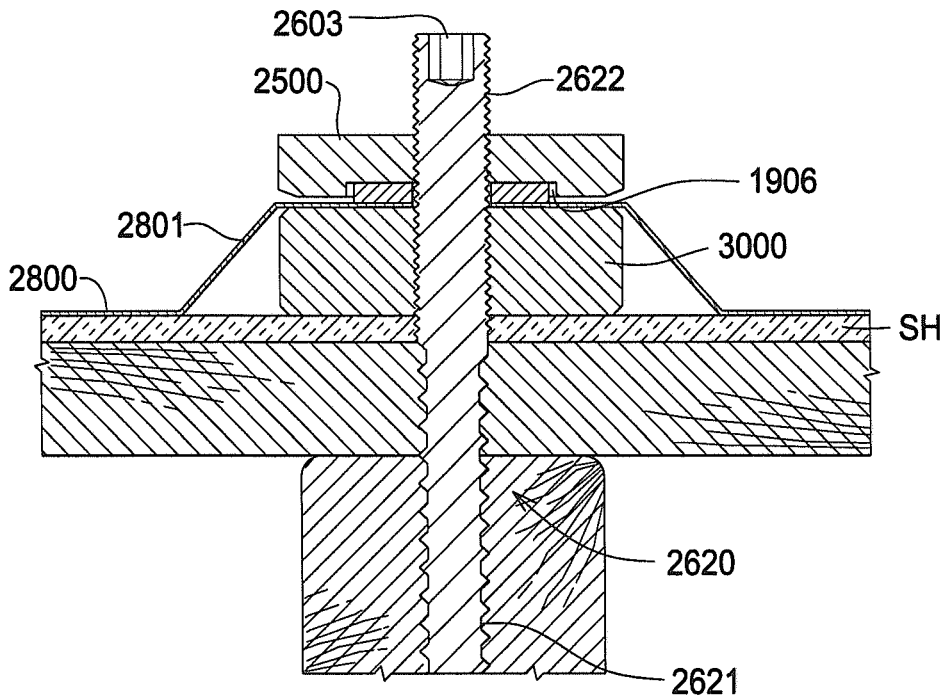


FIG. 30

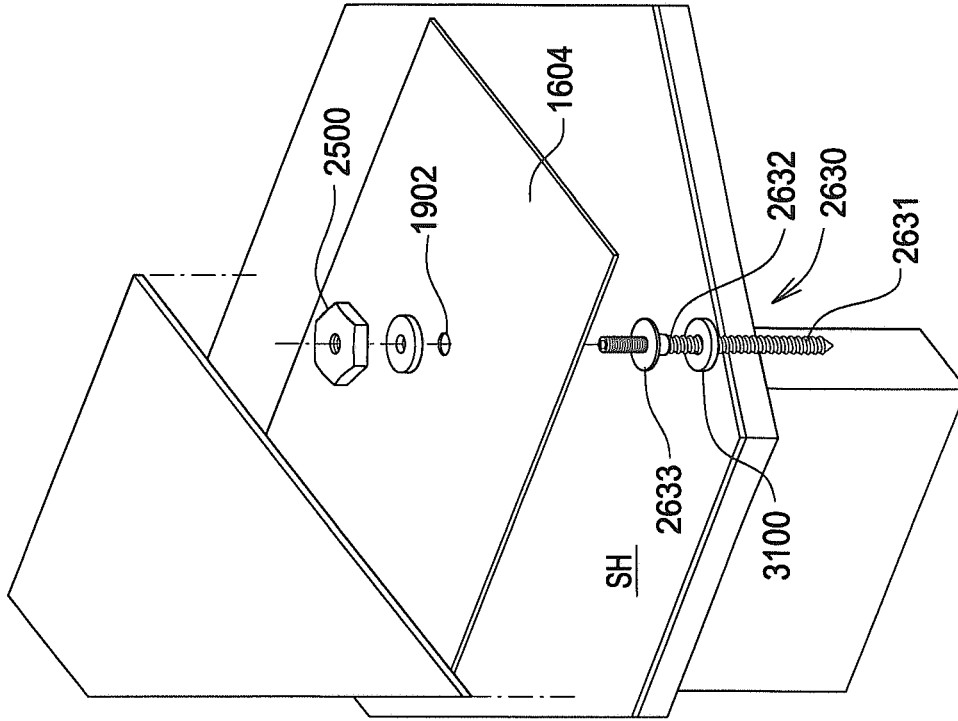


FIG. 31B

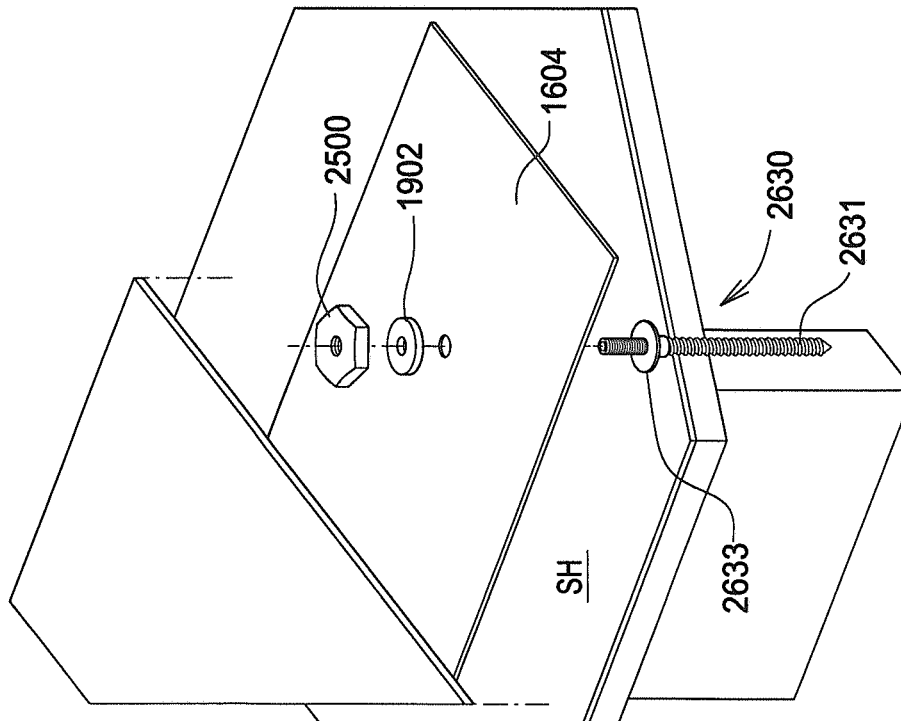


FIG. 31A

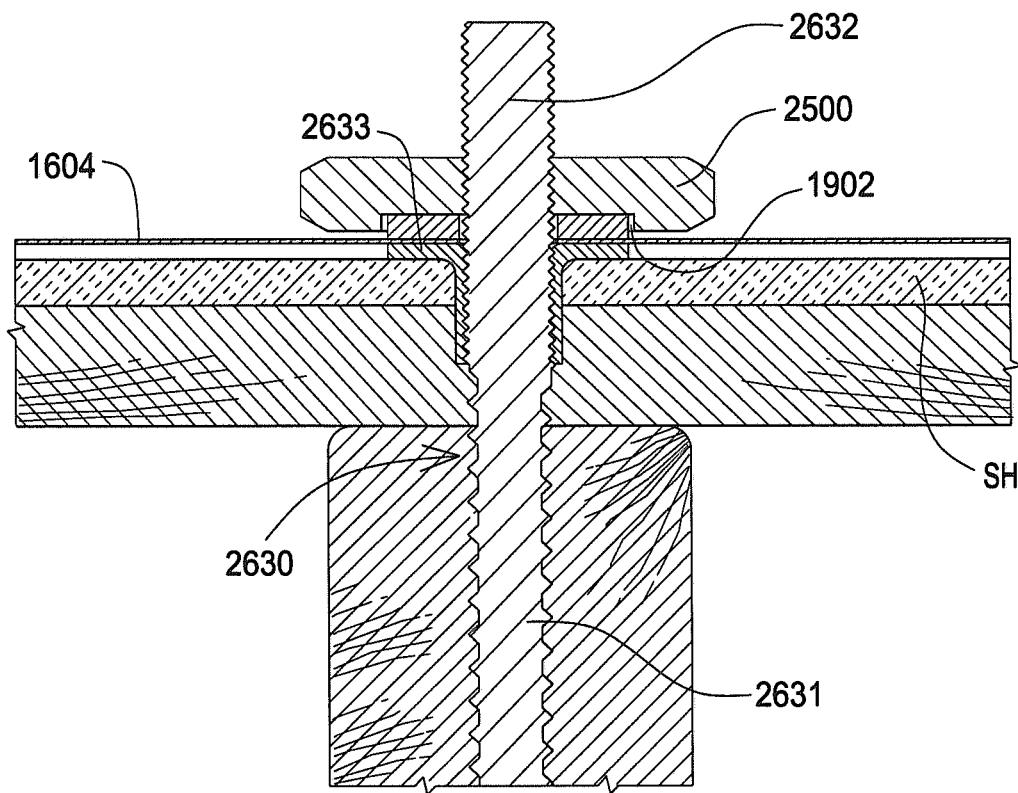


FIG. 32

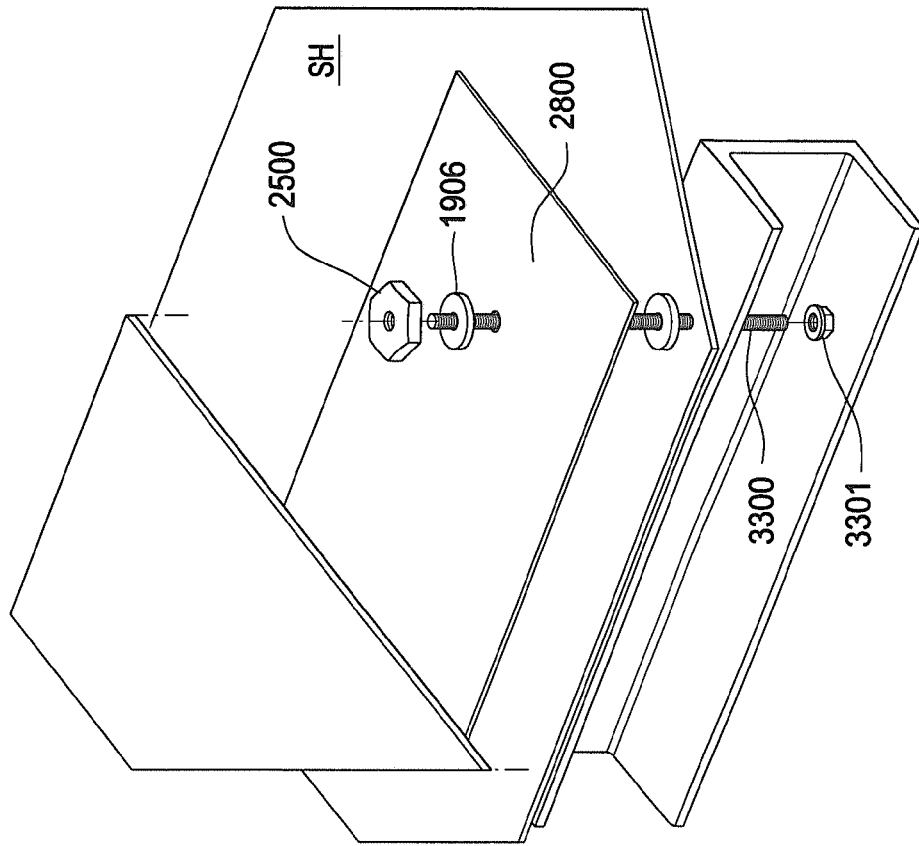


FIG. 33A

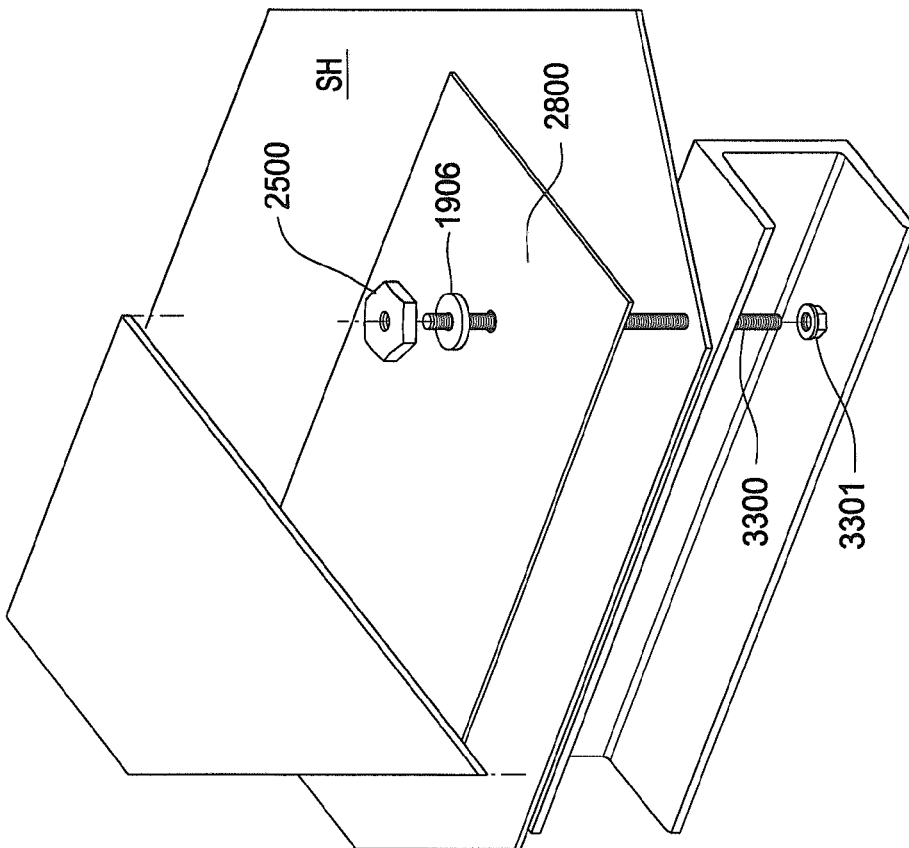


FIG. 33B

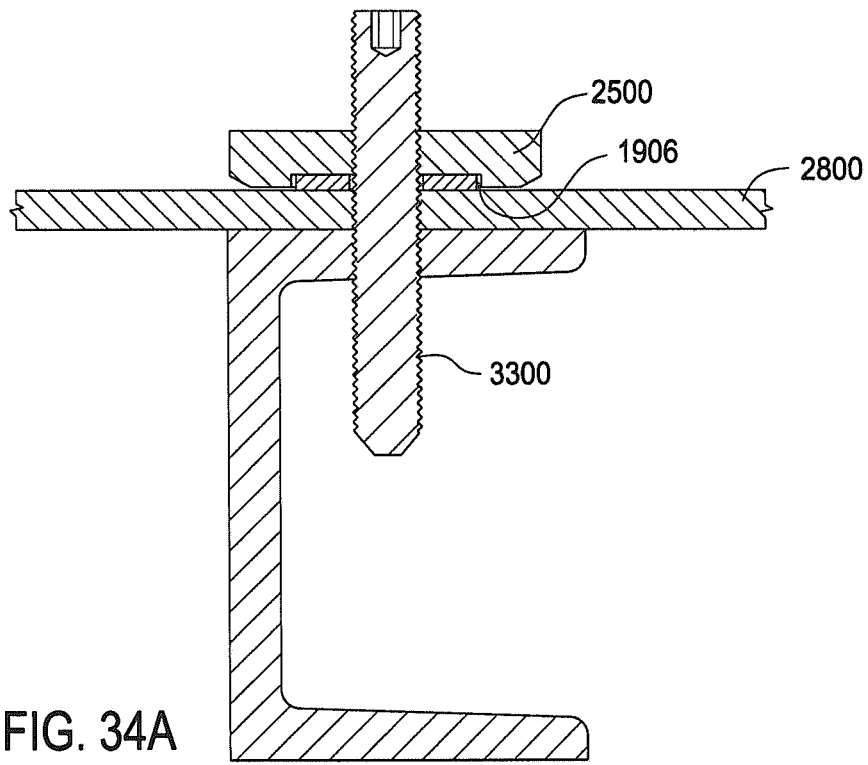


FIG. 34A

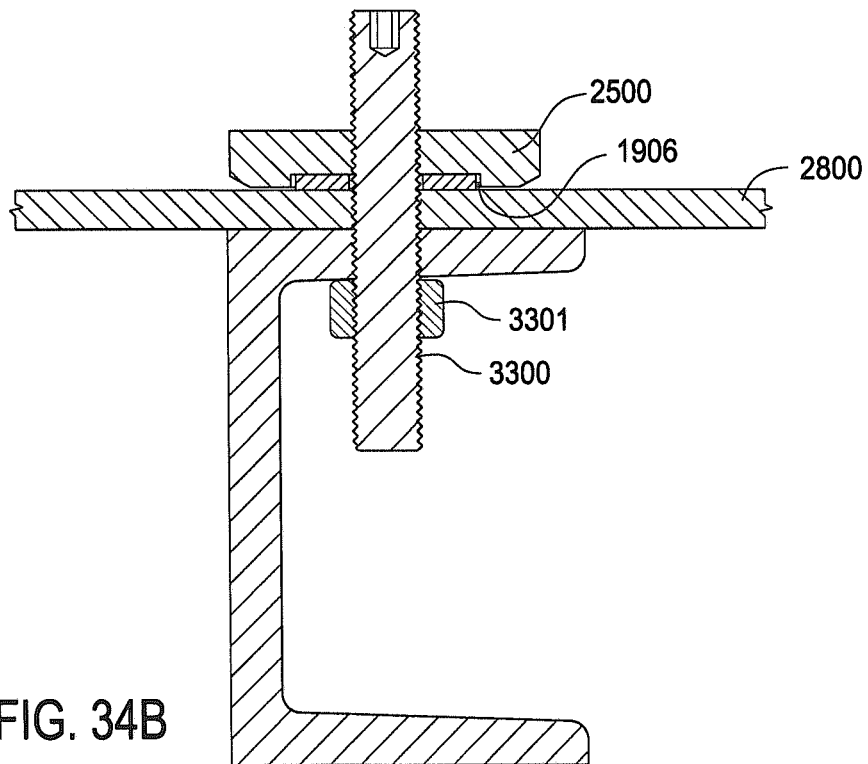


FIG. 34B

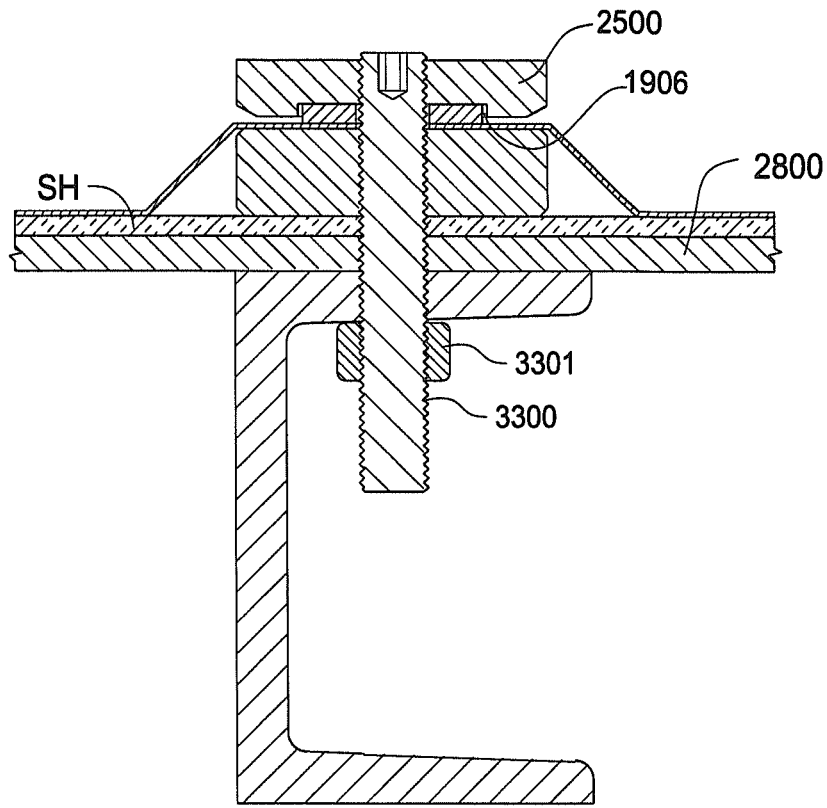


FIG.35

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ROOF MOUNT SEALING ASSEMBLY

CROSS REFERENCE APPLICATIONS

This application is a continuation of Ser. No. 13/799,359 5
 filed Mar. 13, 2012, which is a continuation of application Ser.
 No. 13/368,332, filed Feb. 8, 2012, now U.S. Pat. No. 8,448,
 405, which claims the benefit of provisional application
 61/440,847, filed Feb. 8, 2011; the Ser. No. 13/368,332 appli-
 cation, now U.S. Pat. No. 8,448,405, is also a continuation of 10
 part of non-provisional application 12/700,667 filed Feb. 4,
 2010, pending, which claims the benefits of provisional appli-
 cation no. 61/255,082 filed Oct. 26, 2009 and provisional
 application no. 61/150,301 filed Feb. 5, 2009. All of these
 applications are hereby incorporated by reference for all pur-
 poses. 15

BACKGROUND

Roof pipe and electrical flashings exist to seal penetrations 20
 on roofs. Prior art pipe and electrical flashings provide elastic
 seals which utilize a combination of metal and rubber pieces.
 These rubber pieces are exposed to the elements and eventu-
 ally degrade, allowing elements such as moisture in the home.

The foregoing example of the related art and limitations 25
 related therewith are intended to be illustrative and not exclu-
 sive. Other limitations of the related art will become apparent
 to those of skill in the art upon a reading of the specification
 and a study of the drawings.

SUMMARY

The following embodiments and aspects thereof are 30
 described and illustrated in conjunction with systems, tool
 and methods which are meant to be exemplary and illustra-
 tive, not limiting in scope. In various embodiments, one or
 more of the above described problems have been reduced or
 eliminated, while other embodiments are directed to other
 improvements.

One aspect of the roof mounting assembly described herein 35
 is a waterproof assembly mounting devices such as solar
 panels and signs on roofs. Another aspect of the device
 described herein is to provide a flashing assembly which
 requires no caulking or exposed rubber. If desired, caulking or
 other weather stripping can be added without changing the
 nature of the assembly.

One application uses the watertight standoff system to 40
 support interlocking racks which hold solar panels and/or
 other panels off the surface of a roof.

In the disclosed embodiments, a body is used to encapsu- 45
 late a flexible washer to protect the washer from ultra violet
 light and other environmental factors that degrade the flexible
 washer. This also allow the flexible washer to be put under
 pressure to create a more water resistant seal.

Another aspect is the fact that the washer is or can be 50
 compressed between elements of the roof mounting system
 and not between elements of the roof or other surface. There-
 fore, as the roof components age (wood dries out, shingles
 age) the water proof nature of the disclosed roof mounting
 systems does not change. Known prior systems rely on the
 roof structure to maintain pressure of the waterproof seal,
 which may be degraded as the roof elements age, i.e. a rafter
 may dry out and split.

Another advantage of the disclosed roof mounting system 55
 is that dissimilar material s can be used without causing
 dielectric effects. The washer (or washers) can be used to
 separate elements made of dissimilar metals. Given the mate-

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rials above the roof are in environmental conditions that are
 uncontrollable and can cause severe damage to many prod-
 ucts, the washer separates and prolongs the life of the metal
 embodiments of the roof mounting assembly components due
 to the nature that they are dielectrically separated by the
 silicone rubber (or other material) washer.

In addition to the exemplary aspects and embodiments
 described above, further aspects and embodiments will
 become apparent by reference to the accompanying drawings
 forming a part of this specification wherein like reference
 characters designate corresponding parts in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an exploded view of a standoff and flashing to 15
 attach a support member to a roof or other surface.

FIG. 2 is a cross section of the standoff and flashing of FIG. 1.

FIG. 3 is a cross section of another standoff and flashing.

FIG. 4 is an exploded view of the standoff of FIG. 3.

FIG. 5 shows the FIG. 3 standoff initially installed.

FIG. 6 shows the FIG. 3 standoff ready to accept a support 20
 post.

FIG. 7 shows the FIG. 3 standoff attached to a support post.

FIG. 8 is a top perspective view of a standoff being 25
 installed.

FIG. 9 is a top perspective view of a row of standoffs on a
 roof.

FIG. 10 is a side elevation view of a roof anchor.

FIG. 11 is a partial sectional view of the roof anchor 30
 installed through a metal roof.

FIG. 12 is a partial sectional view of the roof anchor installed
 through a roof tile.

FIG. 13 is bottom perspective view of a bolt embodiment of 35
 the roof anchor of FIG. 10.

FIG. 14 is a bottom perspective view of a threaded hole
 embodiment of the roof anchor of FIG. 10.

FIG. 15 is a cross sectional exploded view of a standoff
 with a double bolt stud.

FIG. 16 is a bottom perspective view of the double bolt 40
 stud.

FIG. 17 is an exploded view of the double bolt stud assem-
 bly being installed.

FIG. 18 is a cross sectional view of an installed double bolt 45
 stud assembly.

FIG. 19 is a top perspective view of the standoff of FIG. 18
 supporting a W spring base.

FIG. 20 is a top perspective view of the standoff of FIG. 18
 supporting a T slide.

FIG. 21 is an exploded view of an alternate embodiment of
 a double stud bolt being installed.

FIG. 22 is a cross sectional view of the double stud bolt of
 FIG. 21 installed n a roof.

FIG. 23 is a cross sectional view of the double stud bolt of
 FIG. 22 with an alternate embodiment of a washer.

FIGS. 24 *a* and *b* are views of one embodiment of the body
 of the double stud bolt.

FIGS. 25 *a* and *b* are views of a second embodiment of the
 body of the double stud bolt.

FIGS. 26 *a* through *h* are views of four possible bolt bodies.

FIGS. 27 *a* through *c* are exploded views of various possi-
 ble configurations of the body being used with a base and
 raised flashing.

FIGS. 28 *a* through *d* are exploded views of various possi- 60
 ble combinations of a body and bolt body being used with a
 bump flashing to encapsulate the washer.

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FIG. 29 is a cross sectional view of the embodiment of FIG. 28a when installed.

FIG. 30 is a cross sectional view of a double stud assembly installed with a bump flashing with a spacer.

FIGS. 31 a and b are exploded views of a double stud assembly installed with a flat metal flashing.

FIG. 32 is a cross sectional view of the embodiment of FIG. 31a when installed.

FIGS. 33 a and b are exploded views of a double stud assembly installed on a roof with a metal support beam.

FIGS. 34 a and b are cross sectional views of double stud assemblies installed in a metal support beam.

FIG. 35 is a cross sectional view of an another embodiment of the double stud assembly.

Before explaining the disclosed embodiment of the present invention in detail, it is to be understood that the invention is not limited in its application to the details of the particular arrangement shown, since the invention is capable of other embodiments. Exemplary embodiments are illustrated in referenced figures of the drawings. It is intended that the embodiments and figures disclosed herein are to be considered illustrative rather than limiting. Also, the terminology used herein is for the purpose of description and not of limitation.

DETAILED DESCRIPTION OF THE DRAWINGS

FIGS. 1, 2 show a flashing and standoff 2200 that can be used when mounting a frame or rack on a roof or similar surface. Base 1901 attaches to the roof truss T or other surface with screws 1903, two screws in the depicted embodiment. Known flashing 1902 (preferably sheet metal) is placed over the base 1901 to prevent water from getting to the holes created by the screws. Flashing 1902 has raised area 1988 to allow the flashing 1902 to enclosed base 1901. With prior art standoffs, there are problems with water getting into the standoff and causing corrosion of the standoff. The present standoff 2200 solves this issue with a roof mount sealing assembly.

Threaded bolt 1904 extends up from base 1901, through hole 1415 in flashing 1902. Core 1908 has a threaded hole 1909 which threads onto bolt 1904. A soft flexible washer 1906 having hole 1405 is placed between the core 1908 and flashing 1903 in circular recess 1930 to provide a water-tight or near water-tight seal with ridge R creating a metal to metal joint against flashing 1902 in the depicted embodiment. As core 1908 is solid other than threaded hole 1909 and recess 1930, once core 1908 is screwed down on to bolt 1904 with the flexible washer 1906, a watertight, or nearly water tight, seal is formed over the hole 1415 in flashing 1902, forming a roof mount sealing assembly 2000. This helps to prevent water from getting under the flashing 1902. The soft flexible washer 1906 is compressed between the top surface 1931 of the flashing 1902 and the recess 1930. In the depicted embodiment the washer is a soft flexible material. Rubber/synthetic rubber/silicone or other suitable compressible washer material using any known or later discovered polymer with similar properties could be used as well.

Core 1908 has an outer surface with threads 1910. Cover 1911 has a threaded recess 1912, seen in FIG. 2, which corresponds to threads 1910, allowing the cover 1911 to be threaded down on to core 1910. The cover 1911 has a top threaded hole 1913, which does not connect to threaded recess 1912. The height of the stand-off is adjusted by choosing how far down cover 1911 is threaded on to core 1908. This allows for very precise and replicable height adjustments. Bolt 412 can be threaded into hole 1913 to allow desired

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objects to be attached to the top of cover 1911 as will be discussed in greater detail below.

FIGS. 3 to 7 show the roof truss T with a roof surface TP on top of truss T with another type of standoff. A shingle SH is exposed to the environment. Base 1999 serves as an anchor for the entire standoff assembly 2222 and is attached to the roof truss T with screws 103 as above. Base 1999 differs from base 1901 in that it has a threaded hole 1920, instead of bolt 1904. Water is prevented from reaching screws 1903 by flashing 1902 as above. The flashing 1902 is made waterproof at its periphery E in known manners including glue, tar, overlay shingles. Hole 1920 has threads to accept bolt 1926 which secures the core 1924 to the base 1999, forming roof mount sealing assembly 4000 as shown in FIG. 4. The soft flexible washer 1906 fits into donut recess 1928 at the bottom of the core 1924. Rim 1928 is circular and seals the flexible washer 1906 inside the metal to metal joint of members 1929 against 1902 in the depicted embodiment. Thus flexible washer 1906 is protected from the elements, particularly ultraviolet light, and little or no water can get into hole 1405.

The threads 1925 receive the cover 1922. After the cover 1922 is set to the desired height the mounting bolt 1921 is set to a desired height as shown by gauge G in FIG. 4 forming height D8 in FIG. 6. Bolt 412 threads into hole 1923.

A series of assemblies 2222 can be mounted on a roof in a straight line ready to support a support post 100 as shown in FIGS. 8 and 9. The jaw 104 is slid down a series of aligned bolts 412. Then each cover 1922 is tightened (turned counterclockwise CC) thereby locking bolt 412 against lip 108, shown in FIGS. 6 and 7. No tools are needed.

FIG. 8 shows a method to affix the FIG. 3 embodiment 2222 on a shingle roof. Shingle SHU is lifted to cover the edge 1902e of flashing 1902.

FIG. 9 shows the support post 100 mounted at a uniform height UH above a curving roof SH. Each bolt 412/cover 1922 combination is raised up or down shown by arrows U, D to level post 100.

Referring next to FIGS. 10-14 a roof anchor 6500 has a cylindrical body 6501 with a threaded upper section 6502 in the depicted embodiment. The external threads 6052 are optional, and are not required in all embodiments. A threaded hole 6503 can receive a bolt so as to act like bolt 412 in FIG. 2. Alternately an Allen head or screw head or the like could be on the top to allow the roof anchor 6500 to be attached. Solar racks can be built atop the bolt (not shown) that would be threaded into hole 6503. The screw 6504 is threaded into mounting hole 6505 at the bottom of body 6501. A recess 6999 receives flexible washer 1906 similar to FIG. 2, wherein ridge R protects the washer from the sun and can provide a metal to metal seal and forming the roof mount sealing assembly. FIG. 11 shows a metal roof 6666 using ridge R for a metal to metal seal. A cover 1911 (FIG. 2) could also be put on threads 6502, thus providing height adjustment for a bolt 412. Wrench face WR allows a socket SOC or wrench W to screw the screw 6504 into a truss T.

FIG. 12 shows a tile roof TR having the tile TR drilled with a hole 6700 to allow anchor 6500 to be placed down atop a truss T. Usually a plywood roof layer PY is present. So even on a tile roof the anchor 6500 provides the support for a solar panel rack and forms the roof mount sealing assembly.

In FIGS. 13, 14 nominal dimensions are D68=0.38 inch, D69=1.0 inch, D70=1.5 inch. The threaded hole 6505 serves as a mount for attaching to various stand offs including the embodiments of FIG. 2 and FIG. 10. The hole 6505 would receive bolt 1904 (FIG. 2). The FIG. 13 embodiment with bolt

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6801 can be used to insert into boss **5400** of FIG. 3. All the embodiments protect the flexible washer **1906** from the sun via a recess such as **6999**.

In all embodiments the user has the option to tighten the threads until the ridge is in contact with the flashing, creating a metal to metal seal. Alternatively, the body is tightened down until the flexible washer is compressed to seal the hole, but the metal to metal contact is avoided. In either situation, the combination of the flashing and the recess substantially enclosed the washer, and encapsulate it, preventing ultraviolet light and other environmental factors from degrading the washer. The flexible washer thickness and the metal recess depth allow the flexible washer to compress and completely fill the recess void when desired. The physical properties of the flexible washer will hold also a space between the flexible washer body and the flashing, but this can be adjusted for the desired result.

In all embodiments, the flashing can be made of aluminum, copper, stainless steel, metal, coated metal plastic, fiberglass, composites, plastic, ceramic, rubber, polymer, concrete, cementitious or any other material that is sufficiently rigid and durable to provide the flat surface for compression of the flexible washer and, if desired the contact between the ridge and the flashing. The roof mount sealing assembly and stand-off components can be made of aluminum, mild steel, stainless steel, copper, nickel or any other material with the necessary physical characteristic. In some applications the roof mount sealing assembly and/or standoff will need to be conducting, in order to allow for grounding of the components mounted on the system. In all embodiments, if desired the installer can put caulk or other sealant around all joins as a further assurance of water proof joins. This is not necessary under normal usage conditions, but may be desired in harsh environments and/or remote locations.

Referring next to FIGS. 15, 16 a standoff **1907** is attached to a base **5430** screwed into a roof truss T via screws **1903**. The base **5430** has a threaded boss **5400**. A flashing **1902** with hole **1415** is placed atop the boss **5400**. A soft flexible washer **1906** has hole **1405** aligned with hole **1415**. The double bolt stud **5401** has a body **5555**, a lower bolt **5403** and an upper bolt **5402**. The lower bolt **5403** extends through hole **1425** and screws into boss **5400** in base **5430**. The flexible washer **1906** is received in recess **5501** in body **5555**. The ridge **5570** protects the flexible washer **1906** from the sun and forms a watertight or nearly watertight seal, against flashing **1902**, forming another embodiment of the roof mount sealing assembly **1500**. If desired, the body **5555** can be tightened down until a metal to metal contact between the ridge **5570** and the flashing **1902** is achieved. The body **5555** has wrench surfaces WR to allow a wrench to tighten the stud **5401** as desired in the depicted embodiment. The wrench surfaces WR could be configured in a wide variety of shapes and configurations to use with different tightening devices. In alternate embodiments the double bolt stud can be tightened with screw drivers (strait and Phillips) Allen wrenches and other such tightening devices by forming appropriate recesses in upper bolt **5402** (not shown). Additionally, other types of wrench surfaces could be formed on the upper surface of double bolt stud **1501**. In this embodiment, the upper bolt **5402** receives the core **1924** of a standoff **1907** via threaded hole **1927**. The core outer threads **1925** receive the cover **1922**. A mounting bolt **412** is screwed into the top of the cover **1922** to provide an anchor for support posts and any desired attachment. The double bolt stud/washer assembly is denoted **5500**.

Referring next to FIG. 17, the double stud/washer assembly **5500** is shown exploded with the flashing **1902**, base **5430**

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and screws **1903**, which combined form one embodiment of the roof mount sealing assembly **1500**. The upper bolt **5402** can be attached to a wide variety of items that one could wish to mount on a roof. The recess **5501** and flexible washer **1906** combine to make a water tight, or near water tight seal that can be used for a wide variety of applications.

FIG. 18 is a cross section of the double stud assembly **5500** mounted on a truss T. The flexible washer **1906** is enclosed in the body **5555** and ridge **5570** and protected from elements. Also, the configuration of the flashing **1902** and the body **5555** allow the washer to be compressed between two substantially flat surfaces while being prevented from deforming outward by ridge **5570**. This protects the flexible washer **1906** and allows for better seals than other arrangements.

Referring next to FIGS. 19, 20 the double stud assembly **5500** can anchor a bracket **1700** or a T slide which has a hole on its bottom (not shown). A vast array of racks can be built atop the protective flashing **1902**.

FIGS. 21 and 22 show one type of an alternate embodiment of a double stud assembly **1600** formed of a body **1602** and a bolt body **1601**. The variations of this embodiment allow the body **1602** to be attached to a large number of types of materials. The bolt body **1601** has a lower bolt section **1603** and an upper bolt section **1606**. The lower bolt body is chosen to allow insertion and attachment to the desired material/surface and the upper bolt body is chosen for what is to be attached to the surface. The height, threading and diameter of both the lower bolt body and the upper bolt body can be varied as desired. The embodiment depicted in FIGS. 21 and 22 allows the body **1602** to be attached more directly to a roof using a lag bolt as the lower bolt body **1603**. Flat flashing **1604** is placed atop shingles SH with hole **1605** in the desired attachment location. Lag bolt **1603** is the screwed into truss T, as seen in FIG. 21. The upper bolt **1606** is sized to accept whatever attachment is desired. The relative diameter of lag bolt **106** and upper bolt **1606** shown in the depicted embodiment is not required. The upper bolt **1606** could have a much larger diameter. As in prior embodiments body **1602** has recess **1607** and ridge **1608** that encapsulate flexible washer **1906** and form a water tight or near water tight seal around bolt body **1601**. If desired, body **1602** can be tightened down onto flashing **1604** to achieve a metal to metal seal.

FIG. 23 shows an alternate embodiment of the washer **1801**. In this embodiment the washer brackets the flashing **1604**, reducing or preventing electrically conductive contact between the bolt body **1601** and the flashing **1604**. This can also be used to reduce and/or eliminate contact between dissimilar metals.

FIGS. 24a-b and 25a-b shows two possible alternate embodiment of the body. FIGS. 24a-b shows a body **2400** of the double stud assembly with a chosen thickness X_1 , which in depicted embodiment is about $\frac{3}{8}$ of an inch. In this embodiment the body **2400** is formed as a separate piece from the bolts and permanently affixed thereto by a chosen adhesive. The body **2400** has a central hole **2401** that is sized to closely fit the chosen bolt body (not shown). On one side the body has recess **2402** and ridge **2403** for the washer as described above. Body **2400** also can have wrench faces WR to allow the double stud assembly to be screwed down. As before, the configuration and/or location of the wrench faces WR can be chosen to allow any number of known tools to be used. No limitation to the depicted embodiment is intended, or should be inferred.

FIG. 25a-b, shows a body **2500** with a chosen thickness X_2 , which in the depicted embodiment is larger than X_2 . Thickness of the body is chosen based on several parameters, including being thick enough to allow adequate number of

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threads for bolt size for good attachment and if additional height is wanted to give more clearance between flashing and whatever is mounted on top. In this embodiment the body **2500** is formed as a separate piece from the bolts and permanently affixed thereto by a chosen adhesive. The body **2500** has a central hole **2501** that is sized to closely fit the chosen bolt body (not shown). Alternatively, central hole **2501** could be threaded and the body threaded on to the bolt body. Further the double stud assembly could be molded or machined as a single piece. On one side the body has recess **2502** and ridge **2503** for the washer as described above. Body **2500** also can have wrench faces WR to allow the double stud assembly to be screwed down. As before, the configuration and/or location of the wrench faces WR can be chosen to allow any number of known tools to be used.

As seen in some of the other embodiments of the roof mount sealing assemblies, the body **5555**, **1900**, **2000**, **2400**, **2500** can have a threaded hole on the top surface instead of the upper bolt **5402** to allow a greater number of possible attachments. In all embodiments the washer could be formed as an O ring with suitable changes to the size of the recess. In all embodiments of the body the central hole can be threaded and the body attached to the bolt body by the threads or the central hole can be smooth and the body is attached to the bolt body by adhesives. Further the bolt body and the body could be molded and/or machined as a single unit.

Referring next to FIGS. **26a-b**, four possible variations of the bolt body are shown. Bolt body **2601** has a lower bolt body **2602** that is formed with a lag thread bolt. This type of lower bolt body **2601** works well on wood. Bolt body **2601** has an upper bolt body **2603** with machine threads. In all embodiments upper bolt body and lower bolt body have external threads. The spacing and configuration of the threads will vary depending on the desired use of the double stud assembly. Choosing appropriate threading for the desired application is well known in the art and will not be further discussed. Washer **2604** and nut **2605** are provided between the upper bolt body **2603** and the lower bolt body **2602**. The nut **2605** allows the lower bolt body **2602** to be driven into the wood of the roof and the washer **2604** serves as a stop to control the depth that the bolt body **2601** is driven. The washer also assists in ensuring a good support for the flexible washer **1902** to ensure a good compression. In this embodiment the bolt body and washer would most likely be cast or machined. Bolt body **2601** would require a raised flashing (**2800**).

Bolt body **2610** has a lower bolt body **2602** and an upper bolt body **2611** with a metal washer **2612**. As can be seen in FIG. **26a**, the upper bolt body **2611** of bolt body **2610** has a tool space **2616** formed into its top end. In the depicted embodiment the tool space is formed to receive an Allen wrench. Other configurations of the tool space (not shown) could be used as well, such as tool spaced configured for standard screw drivers and Phillips head screw drivers.

Bolt body **2620** has an upper bolt body **2622** and a lower bolt body **2621**. Lower bolt body **2621** has a self tap section **2623**. The self tap section can be used on any of the depicted bolt bodies. Upper bolt section **2622** is depicted with optional tool space **2624**. This bolt body **2620** might be used on metal roof application or tile where the body **2500** could be provided at roof level and the upper bolt section **2622** would stick up the appropriate length. The lower bolt section **2631** of this application could be machine or lag.

Bolt body **2630** has lower bolt body **2631** and upper bolt body **2632** and metal washer **2633** placed between. Washer **2633** is a combination washer with a lower internally threaded body attached to the washer, commonly known as a weld nut. The washer threaded onto upper bolt body **2632** and

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serves as a stop to prevent over threading lower bolt body **2631** into the roof. The washer **2633** also serves as a base for the flashing and prevents pushing/deforming the flashing into the roof/shingle when threading an attachment onto the upper bolt body **2632**. The washer **2633** facilitates the compression of the flexible washer between the flashing and the body with recess when installed without a base plate. The washer **2633** is attached to the bolt either chemically, welded, or mechanically crimped. In the depicted embodiment a thread locking compound (chemically) locks the weld nut onto the bolt. The washer **2633** has no external threads which facilitates going into the plywood of most roofing assemblies and not lifting the plywood from the rafter due to threads not lining up properly upon installation. Also given the larger shaft diameter, it helps friction fit the predrilled hole and provide additional horizontal support. It also provides a semi-impermeable seal in asphalt shingle roofing applications, and tile underlayment applications, should water penetrate the roofing from other locations (not our flashing). This is a the one location that caulk would be recommended in certain applications providing another "safety" barrier to moisture or water from roofing failures above

The washer **2633** facilitates the body **2500** to be tightened in a metal to metal compression zone to achieve the waterproofing. As stated above if the structural member splits, degrades or ever the roofing material under the flashing the waterproofing is not affected. Bolt configuration **2630** is the most common one used for wooden roof installations. It has a lag bottom that needs to be predrilled in most applications. **2623** is a self drilling version no pilot hole. Lower bolt body **2632** can be driven in to a wooden stud with just a hanger bolt driver but such driver cannot back out the bolt body should removal (reroof or bad attachment). The bolt body can be backed out with two standard nuts tightened against one another. In some applications this is very difficult and the top hex, Allen, torc, nut or tool spaces facilitate the installation or removal of the bolt bodies. The tool spaces could be configured for a slot or Phillips screw driver.

FIGS. **27a-c** show a body **2701** being used with base **1901** and base **1999** and flashing **1902** as described previously. In all embodiment the body **2701** (**1602**, **2400**, **2500**) with its recess and ridge encapsulated washer **1405** as seal hole **1415** in flashing **1902**. As mentioned previously the body can have many different configurations, depending on its desired function. The necessary features are the recess and the sealing ridge to encapsulate the washer **1405** or and O-ring (now shown) to seal the exterior of the roof mounting assembly against water.

FIG. **28a** is an exploded view of bolt body **2630** being mounted on a roof with a bump flashing **2800** and a body **2500**. Any of the disclosed bodies could be used as well; no limitation to the depicted body **2500** is intended or should be inferred. The bump flashing **2800** has a smaller raised area **2801** than flashing **1902** with hole **2802** in raised area to allow the upper bolt body **2632** to extend there through. The smaller raised area **2801** of flashing **2800** is useful when no metal to metal contact of the flashing and the body is **2500** is desired. Additionally, the bump may assist in diverting water around the penetration in the roof, which may assist in keeping the mount sea. In installations of photovoltaic panels, the added height above the roof allows for greater heat dissipation. In the depicted embodiment the central hole **2501** of body **2500** is threaded and screws on the threads of upper bolt body **2632**. Flexible washer **1906** is placed over upper bolt body **2632** and then body **2500** is threaded down onto upper bolt body **2632**, encapsulating the flexible washer **1906** and forming the seal discussed above.

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FIG. 28*b* is an exploded view of a bolt body 2620 with nut 2605. Bump flashing 2800, flexible washer 1906 and body 2500 as attached as above. FIG. 28*c* shows the same with metal washer 2604 added under nut 2605. FIG. 28*d* adds another flexible washer 1906 between the metal washer 2604 and the single SH and another metal washer 2804 above the nut.

FIG. 29 is a cross sectional view of the assembly of FIG. 28*b* installed on a roof. The lower bolt body 2621 is drilled into the wooden stud, the plywood sheathing and the shingle SH. Upper bolt body 2622 has

FIG. 30 is a cross sectional view of a roof mount sealing assembly with bolt body 2620 and body 2500. Bump flashing 2800 is used with spacer 3000 placed between the raised area 2801 and shingle SH.

FIG. 31 is an exploded view of a double stud assembly being mounted with a flat metal flashing 1604. In this embodiment bolt body 2630 has weld nut 2633 and the flexible washer 1906 is placed between the flashing and the body 2500. FIG. 31*b* an additional metal washer 3100 is placed between the weld nut and the shingle SH. FIG. 32 is a cross section of the embodiment of FIG. 31 mounted on a roof.

When the body with the recess is screwed onto the bolt body in the field, it utilizes thread compound on the threads for waterproofing threaded connection. This thread compound also can provide dielectric separation as the body can be aluminum, stainless, steel, or other material that may be different from the bolt body.

One example, a bolt body is going into wood and has hanger bolt bottom with weld nut. Bolt body is carbon steel zinc plated as the weld nut. Flashing is steel but body is aluminum as is the device that will be attached to the upper bolt section. In this case the dielectric properties facilitate a proper connections with economical options i.e. not having to utilize all stainless components

A wide variety of objects could be attached to the roof mount sealing assembly by attaching to the upper bolt section, the threaded hole on the body and/or on to one of the depicted standoffs. No limitation should be implied as to the objects that can be attached to a building by on the disclosed embodiments.

FIGS. 33 *a* and *b* are exploded views of a embodiment of the double stud assembly being mounted on the roof of a building with metal structural members. Bolt body 3300 is used with a flat flashing 2800, a flexible washer 1906 and body 2500. Nut 3301 can be used to secure the bolt body 3300 in place. The size of the bolt body is not necessarily to scale in this figure.

FIGS. 34*a* and *b* are cross sectional views of a double stud sealing assembly mounted in a metal support beam. In FIG. 34*b* nut 3301 is added. FIG. 34*a* has a self tapping metal screw to attach in into beam where access to the beam may or may not be possible. FIG. 34 *b* has a standard bolt nut application where the beam is accessible to place a nut on the underside. The illustration is for a finished metal roof surface or siding. FIG. 35 shows a bump flashing being used on a metal support beam.

While a number of exemplary aspects and embodiments have been discussed above, those of skill in the art will recognize certain modifications, permutations, additions and sub-combinations therefore. It is therefore intended that the following appended claims hereinafter introduced are interpreted to include all such modifications, permutations, additions and sub-combinations are within their true spirit and scope. Each apparatus embodiment described herein has numerous equivalents.

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The terms and expressions which have been employed are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed. Thus, it should be understood that although the present invention has been specifically disclosed by preferred embodiments and optional features, modification and variation of the concepts herein disclosed may be resorted to by those skilled in the art, and that such modifications and variations are considered to be within the scope of this invention as defined by the appended claims. Whenever a range is given in the specification, all intermediate ranges and subranges, as well as all individual values included in the ranges given are intended to be included in the disclosure. When a Markush group or other grouping is used herein, all individual members of the group and all combinations and subcombinations possible of the group are intended to be individually included in the disclosure.

In general the terms and phrases used herein have their art-recognized meaning, which can be found by reference to standard texts, journal references and contexts known to those skilled in the art. The above definitions are provided to clarify their specific use in the context of the invention.

What is claimed:

1. A roof standoff device for use in mounting an object to a roof, said standoff device comprising:

a base bracket having at least one mounting hole for receiving an attachment element for attaching the base bracket to a roof surface, said base bracket further including a first threaded attachment element;

a flashing having:

a raised section with an upper surface and an aperture extending through said raised section, wherein said aperture is configured for alignment with said first threaded attachment element of said base bracket;

a flange extending beyond a base of said raised section, wherein, when disposed over said base bracket on the roof surface, an inside surface of said raised section receives and surrounds said base bracket and said flange rests on the roof surface;

a core body having a first end and a second end, said second end having a contact surface;

a second threaded attachment element associated with said second end of said core body, said second threaded attachment element configured to threadably engage said first threaded attachment element, wherein, upon said first and second threaded attachment elements being threadably engaged, said flashing is compressed between said base bracket and said second end of said core body; and

said core body having a third attachment element disposed proximate to said first end for attaching an object to said core body.

2. The device of claim 1, wherein said upper surface of said raised section comprises a planar surface and said contact surface of said core body is disposed in a common plane.

3. The device of claim 2, wherein a periphery of said contact surface of said core body is in direct contact with said planar surface of said flashing when said first and second threaded attachment elements are threadably engaged compressing said flashing between said base bracket and said second end of said core body.

4. The device of claim 2, wherein said contact surface comprises a continuous ridge extending about a recess in said second end of said core body.

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- 5. The device of claim 4, further comprising:
a soft washer disposed in said recess, wherein said soft washer surrounds said aperture in said flashing and is compressed between said second end of said core body and said planer upper surface of said flashing upon said first and second threaded attachment elements being threadably engaged.
- 6. The device of claim 1, wherein:
said first threaded attachment element comprises a threaded bolt attached to said base bracket, wherein said threaded bolt is configured to extend through said aperture in said raised section of said flashing; and
said second threaded attachment element comprises a threaded aperture formed in said second end of said core body.
- 7. The device of claim 1, wherein:
said first threaded attachment element comprises a threaded aperture in said base bracket; and
said second threaded attachment element comprises a threaded bolt extending from said second end of said core body, wherein said threaded bolt is configured to extend through said aperture in said raised section of said flashing.
- 8. The device of claim 7, wherein said threaded bolt passes through said core body, wherein a head of said threaded bolt engages said core body proximate to said first end of said core body when engaged with said first threaded attachment element.
- 9. The device of claim 1, wherein said base bracket further comprises:
a raised portion surrounding said first attachment element.
- 10. The device of claim 9, wherein a portion of said flashing surrounding said aperture is compressed between said raised portion of said base bracket and said contact surface.
- 11. The device of claim 10, wherein a lower surface of said raised section of said flashing is in direct contact with said raised portion of said base bracket.
- 12. The device of claim 1, wherein said third attachment element comprises a threaded attachment element.
- 13. The device of claim 1, wherein said core body comprises an elongated structure.
- 14. A roof standoff device for use in mounting an object to a roof, said standoff device comprising:
a base bracket having at least one mounting hole for receiving an attachment element for attaching the base bracket to a roof surface, said base bracket further including a

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- first threaded attachment element and a raised surface surrounding the first threaded attachment element;
- a flashing having:
a raised section with a planar upper surface and an aperture extending through said raised section; and
a flange extending beyond a base of said raised section, wherein, when disposed over said base bracket on the roof surface, an inside surface of said raised section overlays said raised surface of said base bracket surrounding said first threaded attachment element;
- a core body having a first end and a second end, said second end having a contact surface disposed in a common plane about its periphery;
- a second threaded attachment element configured to threadably engage said first threaded attachment element, wherein, upon said first and second threaded attachment elements being threadably engaged, said flashing is compressed between said raised surface surrounding said first threaded element and said second end of said core body, wherein said periphery of said contact surface is in direct contact with said planar upper surface of said flashing; and
said core body having a third attachment element disposed proximate to said first end for attaching an object to said core body.
- 15. The device of claim 14, wherein at least a portion of said periphery of said contact surface directly overlays said raised surface of said base bracket.
- 16. The device of claim 14, wherein at least a portion of said raised surface is in direct contact with said inside surface of said raised section of said flange.
- 17. The device of claim 14, further comprising:
a soft washer disposed about said aperture in said flashing, wherein said soft washer is compressed upon said first and second threaded attachment elements being threadably engaged.
- 18. The device of claim 17, wherein said washer is received in a recess.
- 19. The device of claim 18, wherein said recess is formed in said second end of said core body, wherein said contact surface comprises a continuous ridge extending about said recess.
- 20. The device of claim 14, wherein said contact surface and said flange are metal elements and said periphery of said contact surface is in metal to metal contact with said flange.

* * * * *

EXHIBIT “B”



US008707655B2

(12) **United States Patent**
Schaefer et al.

(10) **Patent No.:** **US 8,707,655 B2**
(45) **Date of Patent:** **Apr. 29, 2014**

(54) **ROOF MOUNT SEALING ASSEMBLY**

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(73) Assignee: **D Three Enterprises, LLC**, Lafayette, CO (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/018,143**

(22) Filed: **Sep. 4, 2013**

(65) **Prior Publication Data**

US 2014/0008506 A1 Jan. 9, 2014

Related U.S. Application Data

(60) Division of application No. 13/799,359, filed on Mar. 13, 2013, which is a continuation of application No. 13/368,332, filed on Feb. 8, 2012, now Pat. No. 8,448,405, which is a continuation-in-part of application No. 12/700,667, filed on Feb. 4, 2010, now Pat. No. 8,661,765.

(60) Provisional application No. 61/255,082, filed on Oct. 26, 2009, provisional application No. 61/150,301, filed on Feb. 5, 2009, provisional application No. 61/440,847, filed on Feb. 8, 2011.

(51) **Int. Cl.**
E04B 1/38 (2006.01)

(52) **U.S. Cl.**
USPC **52/710; 52/60**

(58) **Field of Classification Search**

CPC E04D 13/10; E04D 1/34; E04H 12/2276; E04G 21/142; E04G 5/16; E04G 5/162; E04B 1/4128; F16B 9/02
USPC 52/24, 25, 58, 60, 173.3, 296, 551, 704, 52/705, 710, 239, 282.1, 282.3, 647, 52/653.1, 653.2, 654, 655.1, 543, 548, 52/549; 248/237, 500, 505, 656, 669
See application file for complete search history.

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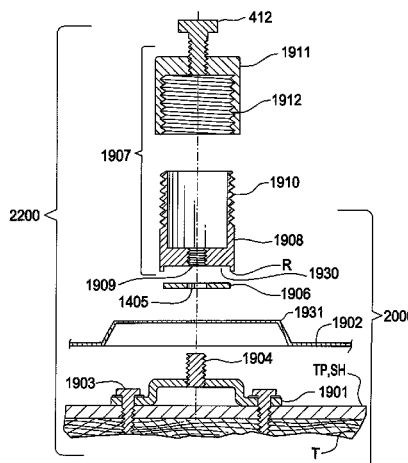
Primary Examiner — William Gilbert

(74) *Attorney, Agent, or Firm* — Russell T. Manning; Marsh, Fischmann & Breyfogle LLP

(57) **ABSTRACT**

A variety of roof mount sealing assemblies are disclosed. The roof mount sealing assemblies allow a user to mount rails for solar panels, signs, satellite dish or any other desired item on the roof and have the mounting location sealed against water. The roof mount sealing assemblies has a body with a recess for a flexible washer, which is attached to a bolt body (or formed with the bolt body) and threaded either down in a base plate or directly into the roof. The bolt body and body form a double stud assembly, which also holds a flashing onto the roof to provide further water proofing.

13 Claims, 25 Drawing Sheets



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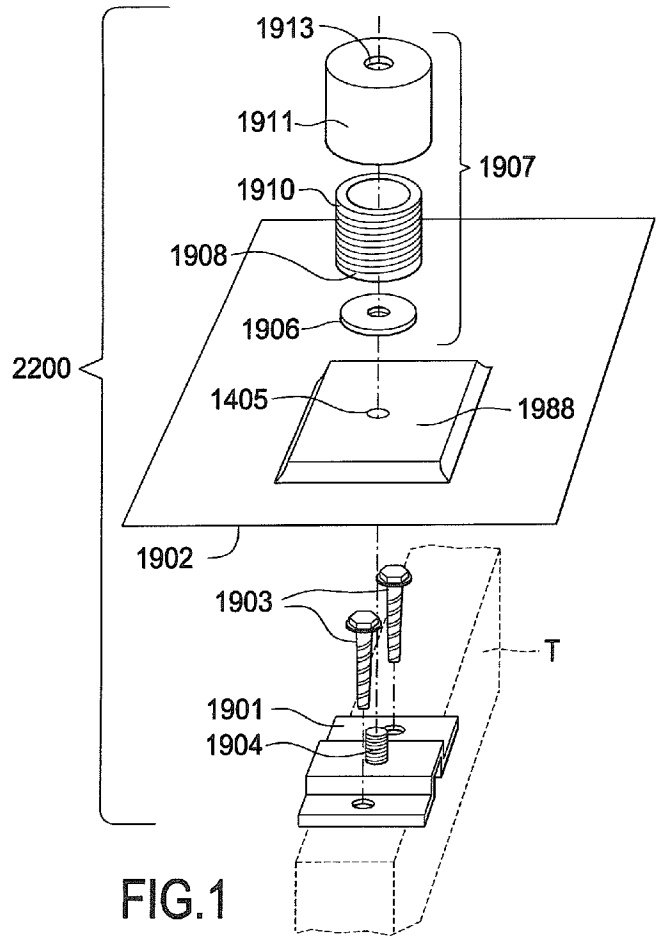


FIG. 1

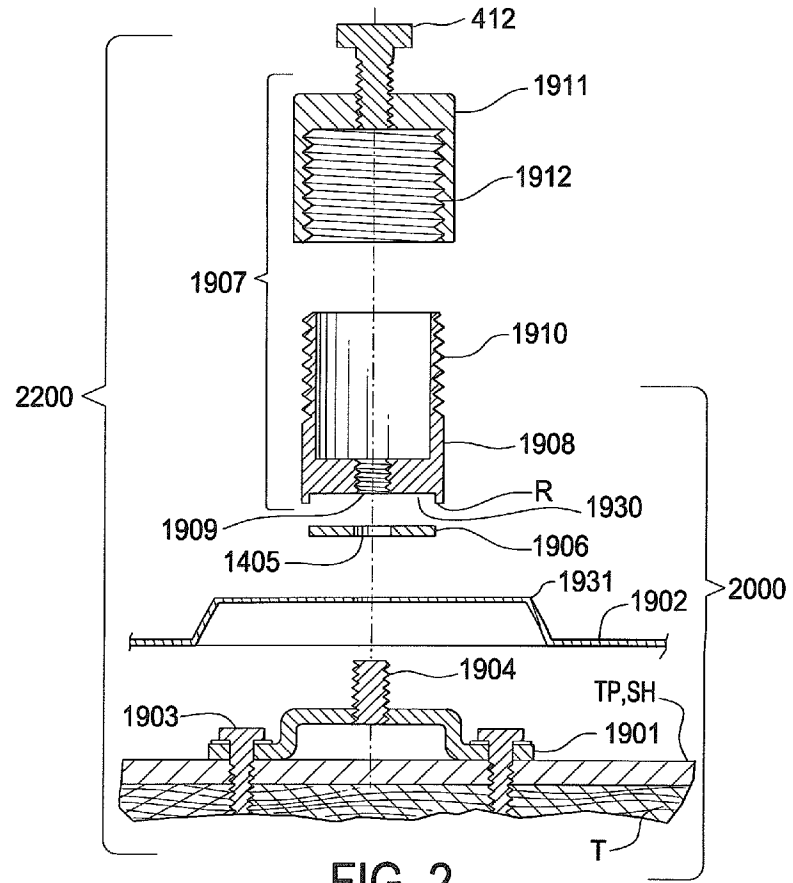


FIG. 2

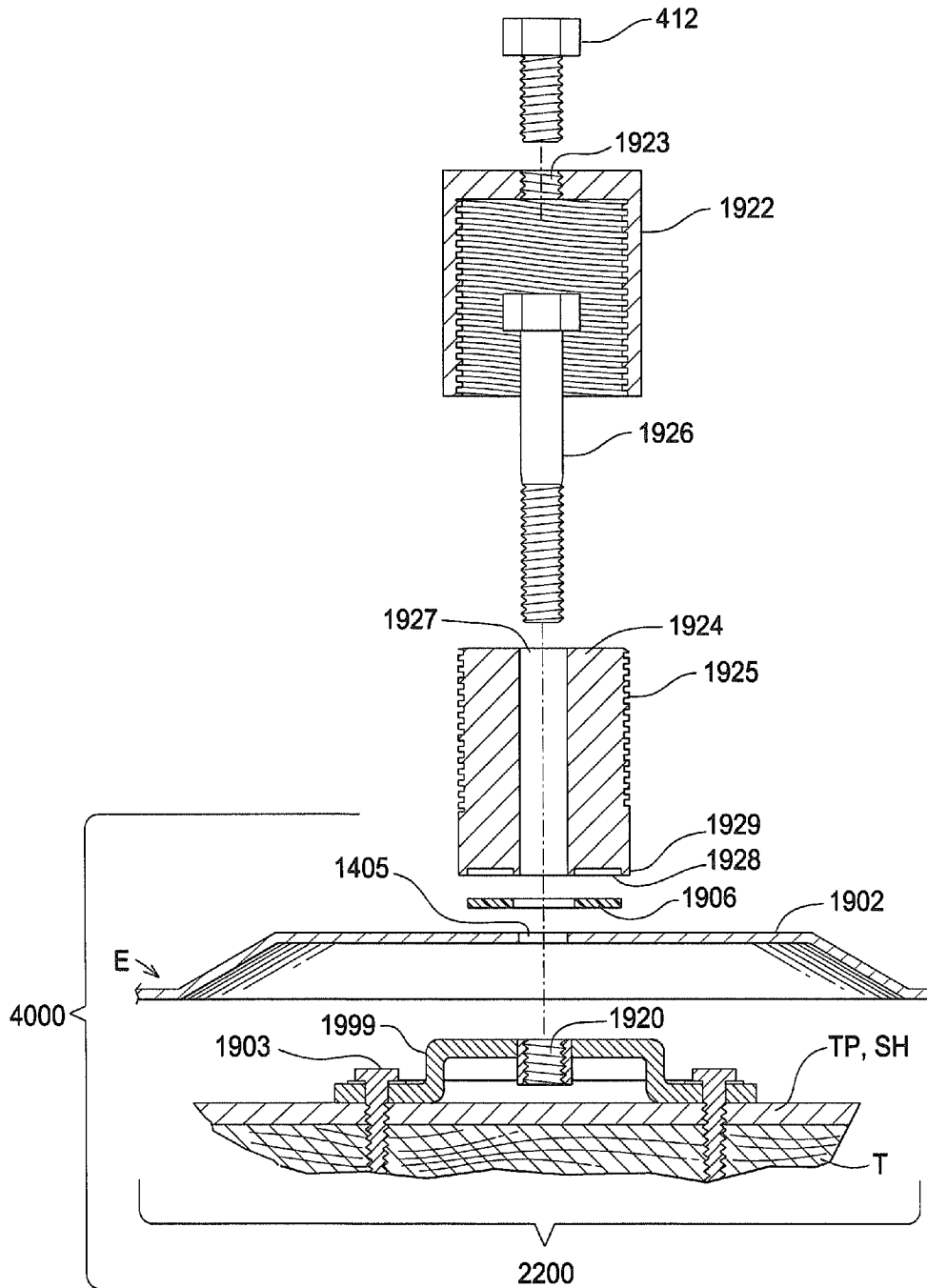
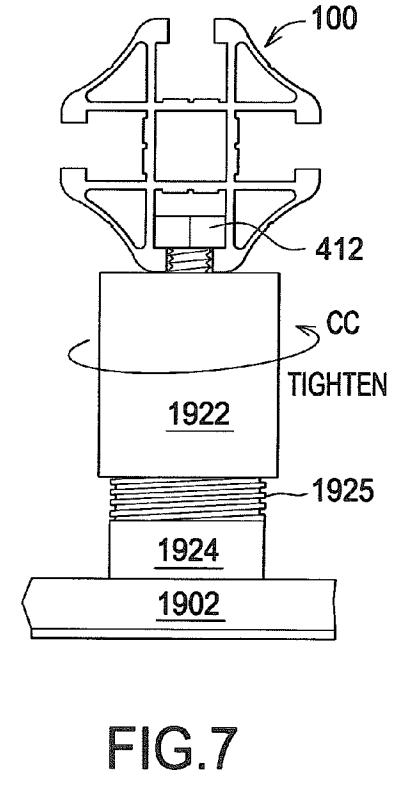
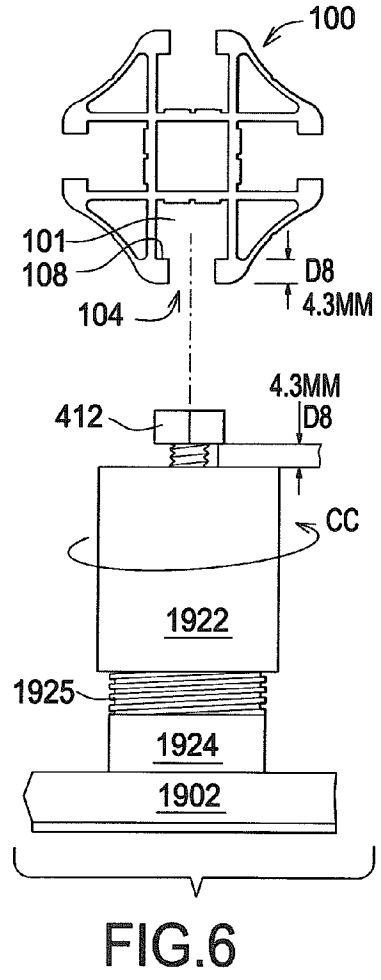
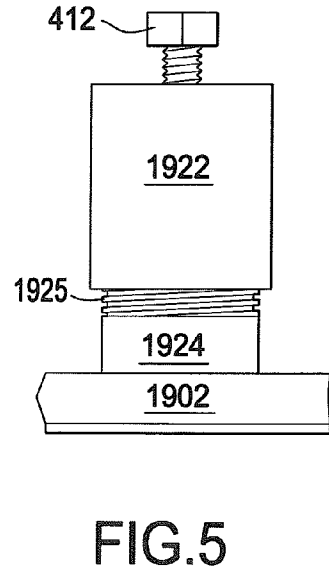
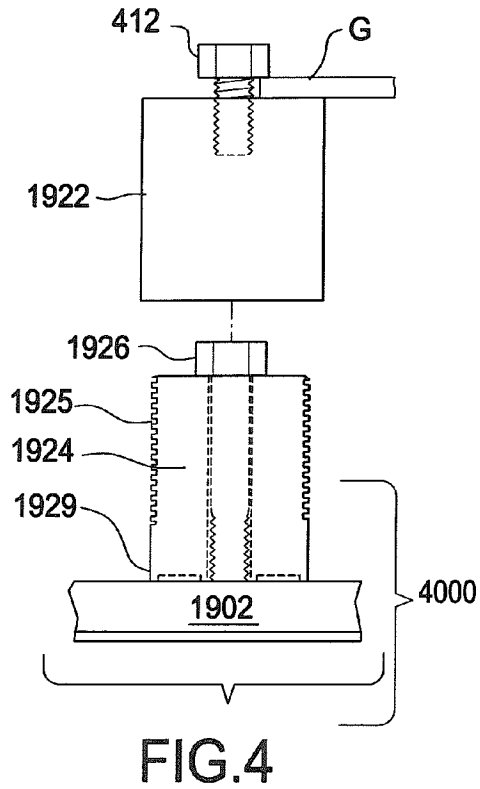


FIG. 3



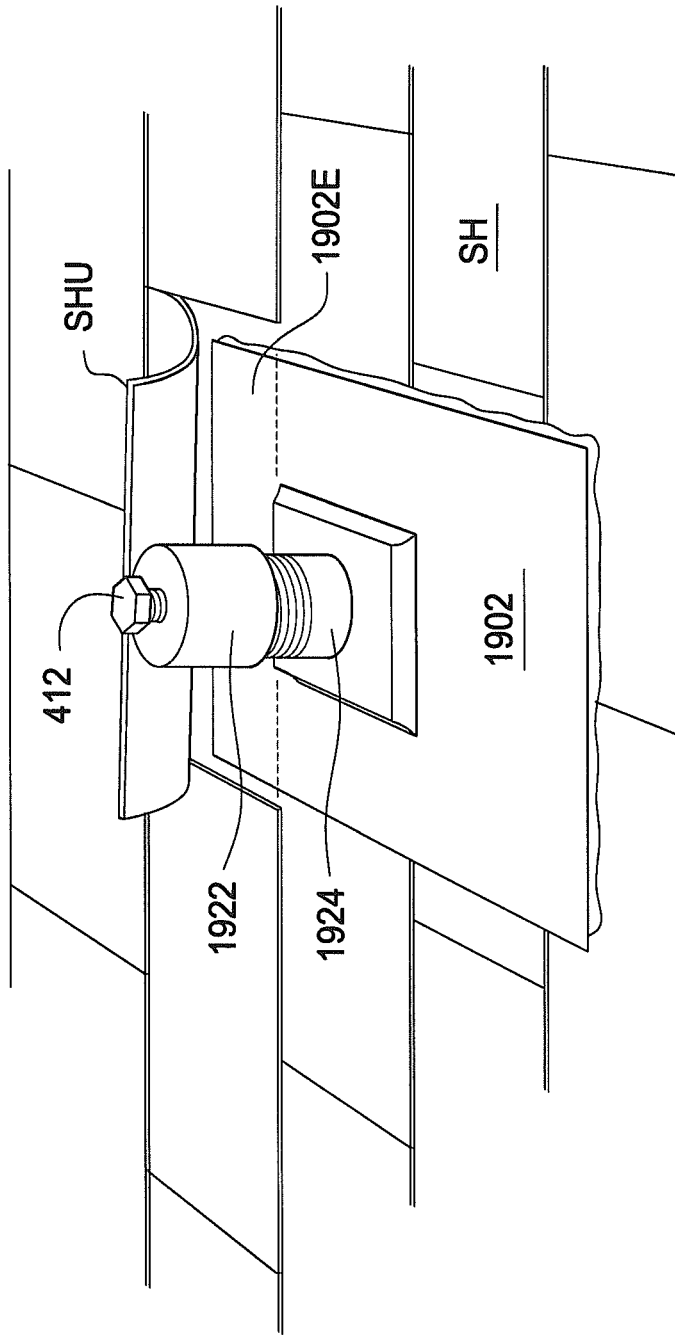


FIG. 8

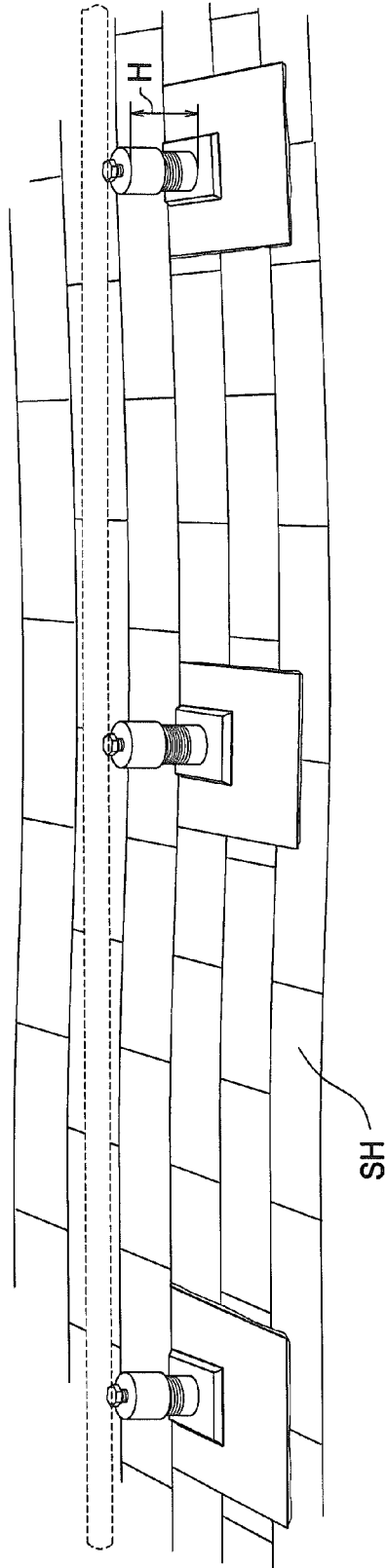
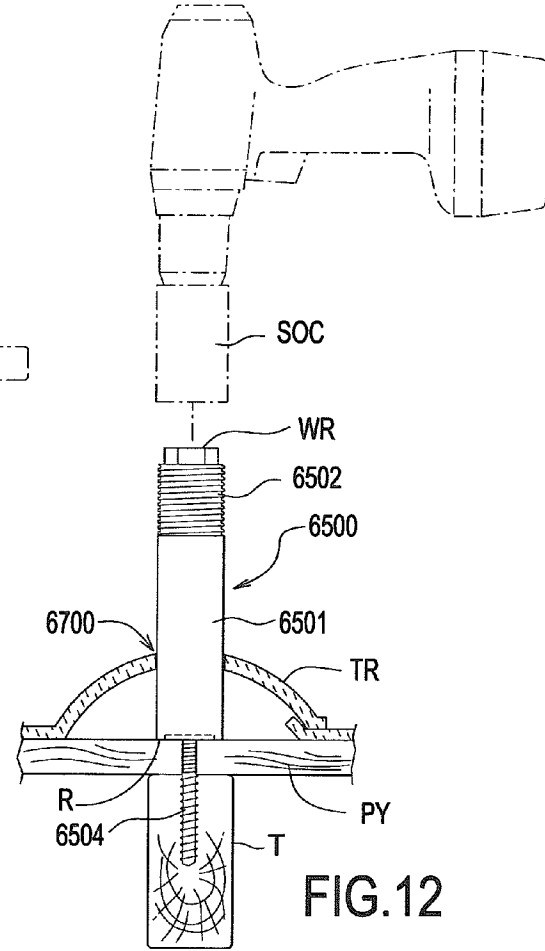
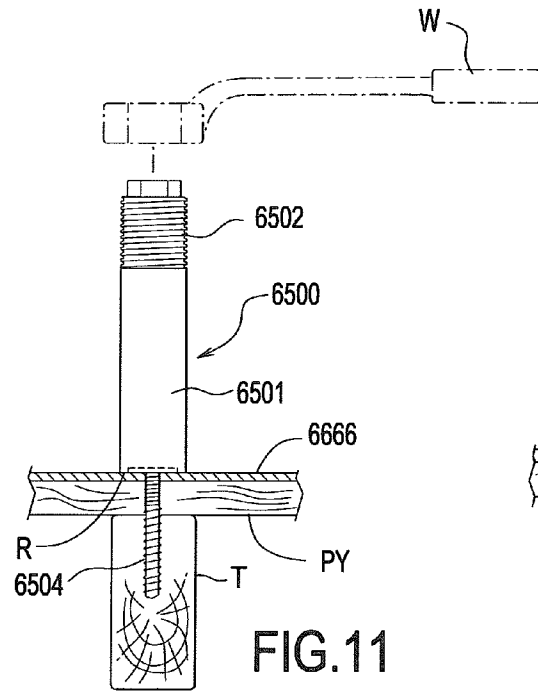
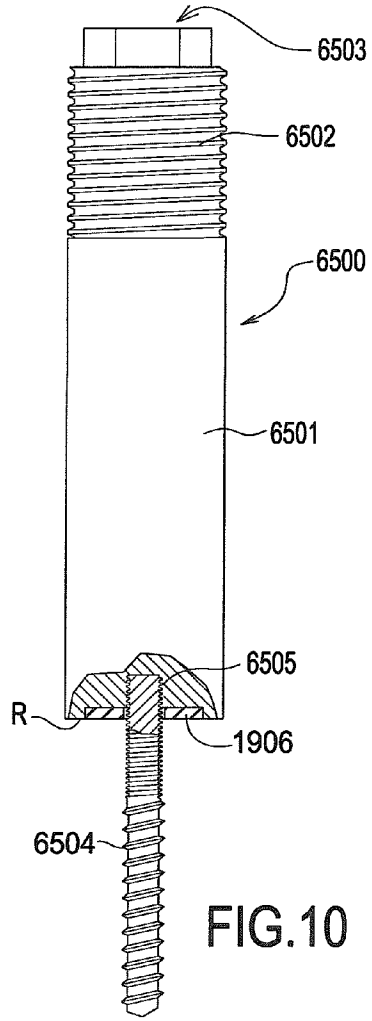


FIG. 9



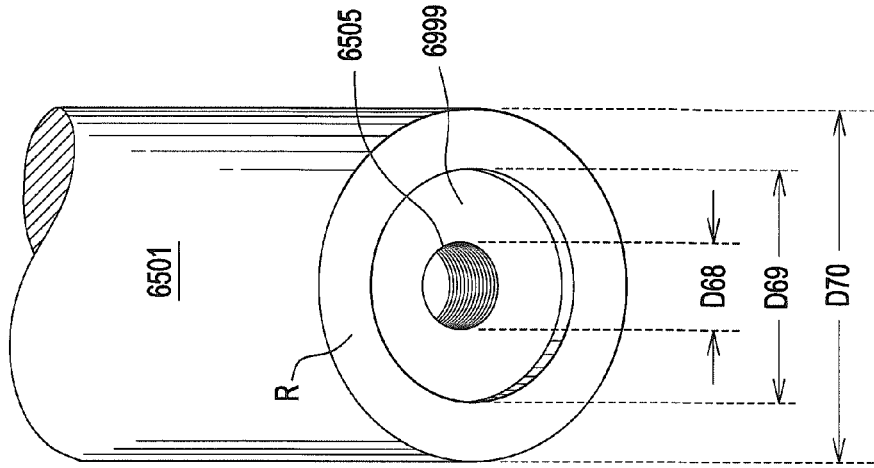


FIG. 14

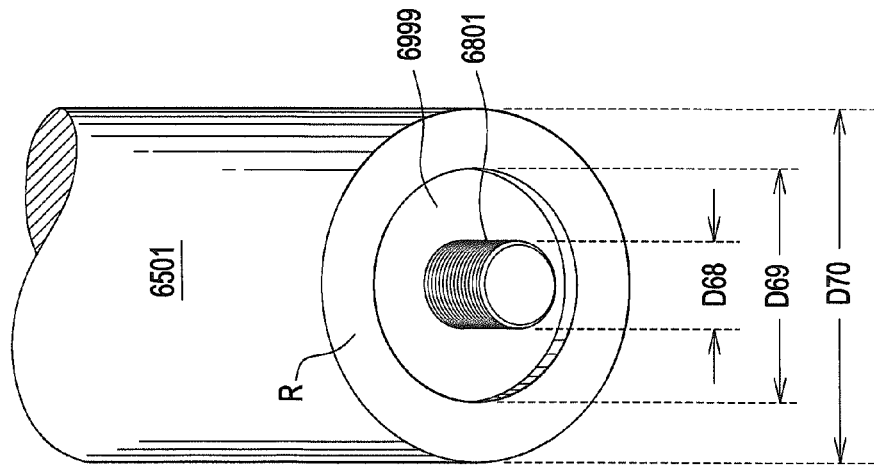
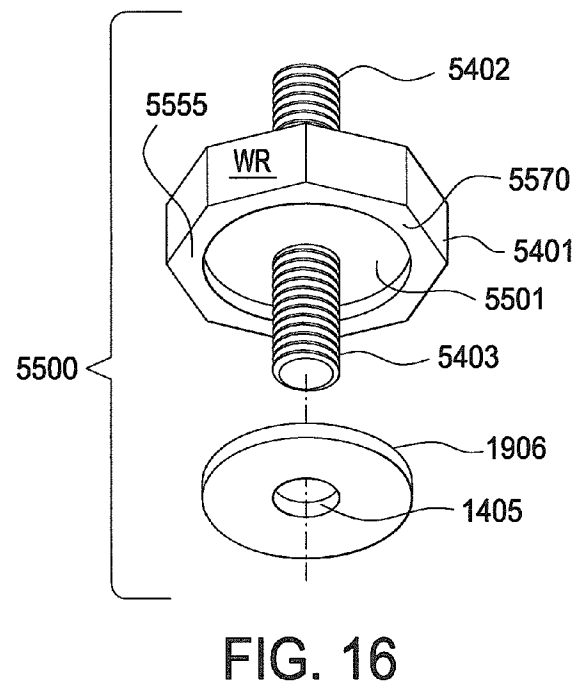
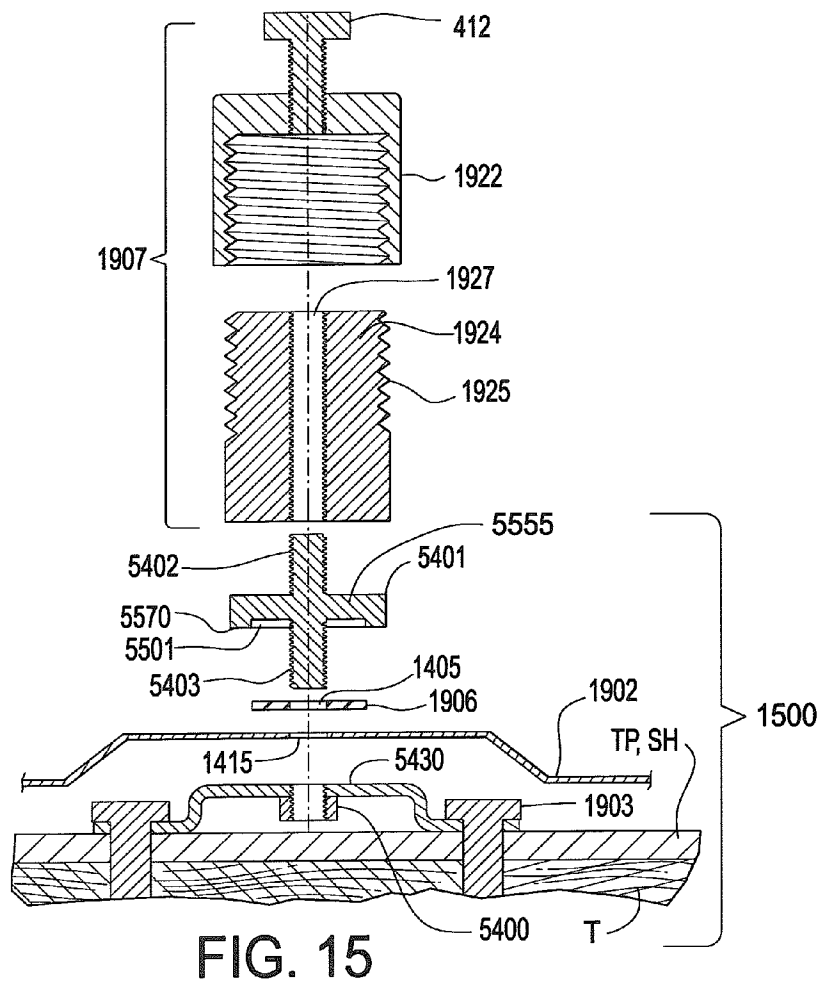


FIG. 13



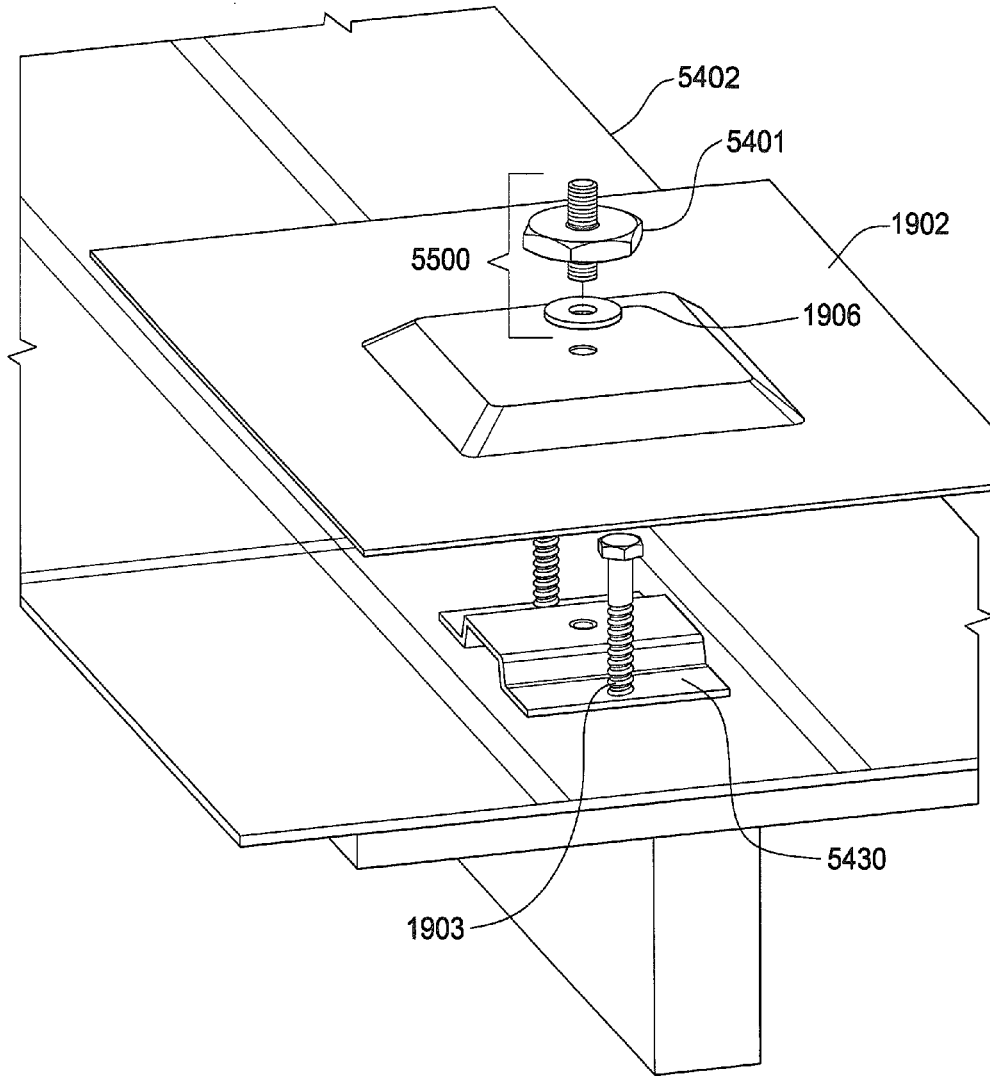


FIG. 17

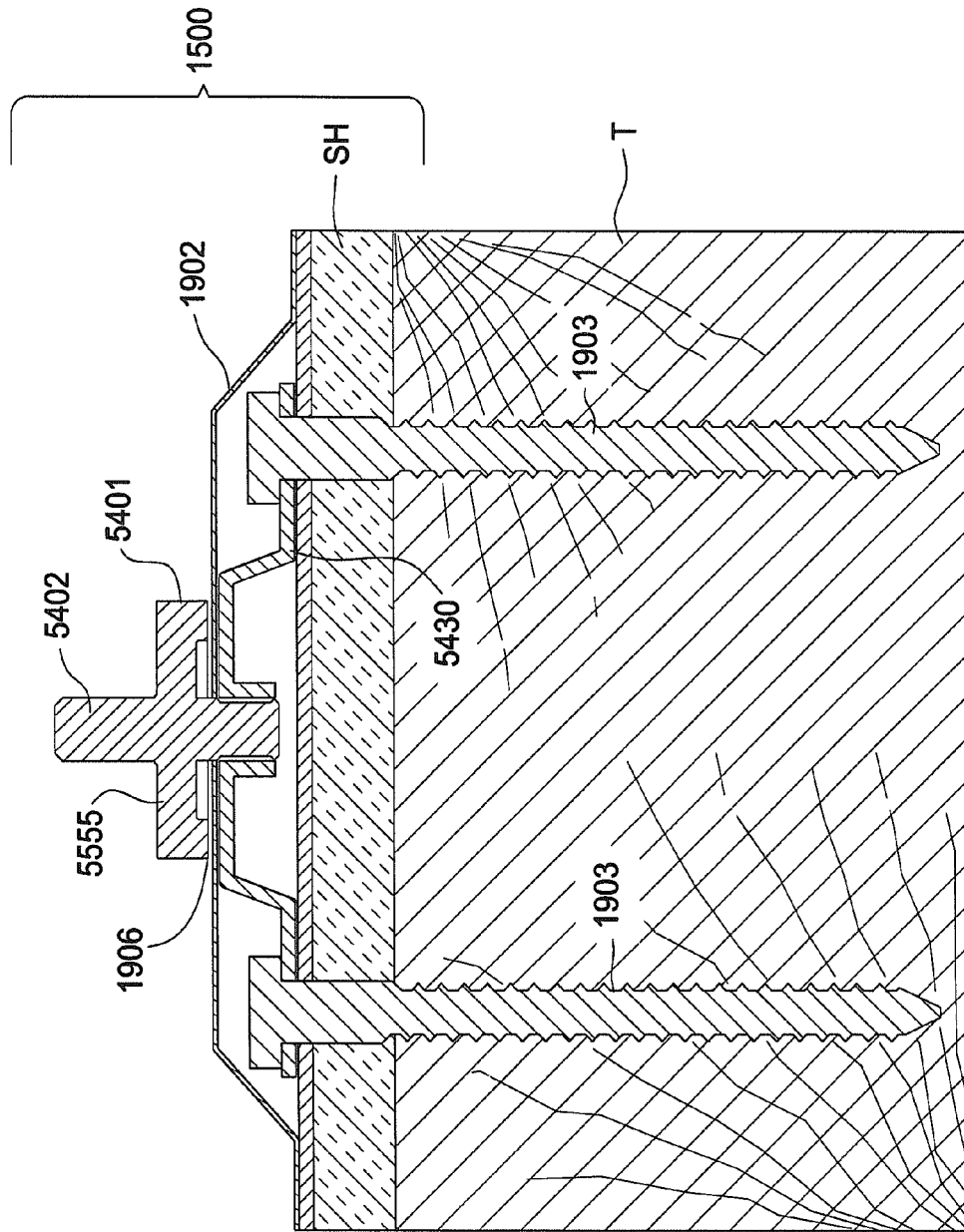


FIG. 18

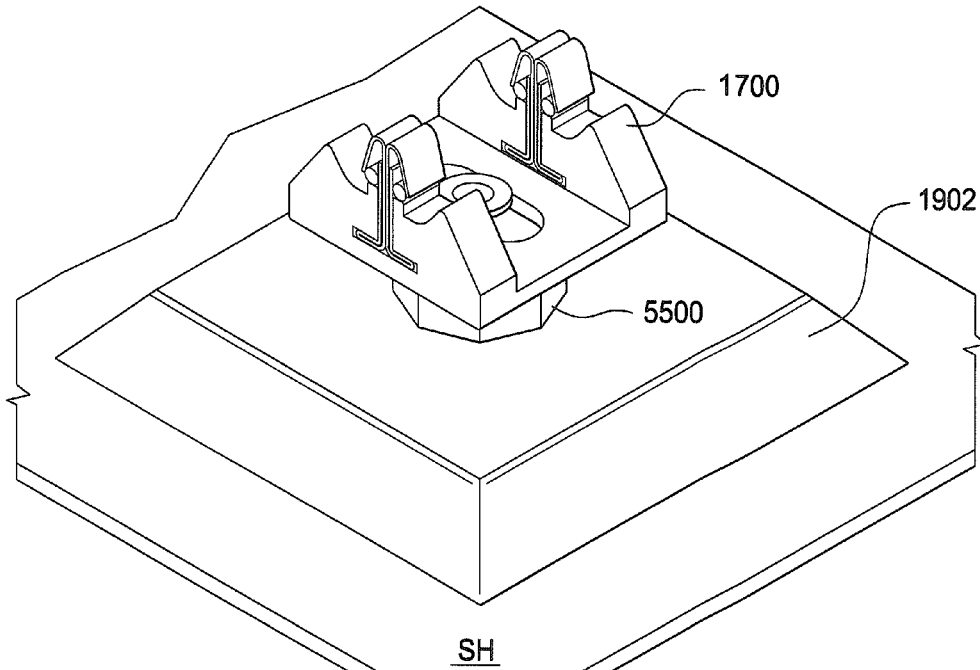


FIG. 19

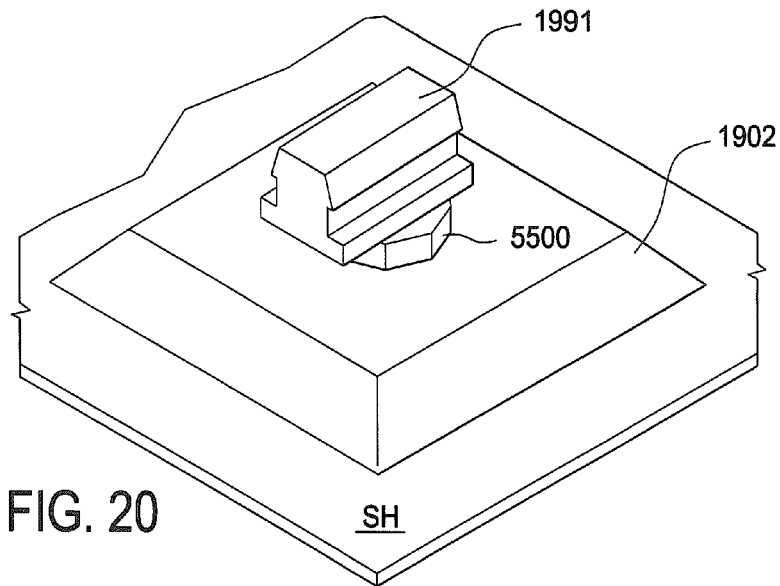


FIG. 20

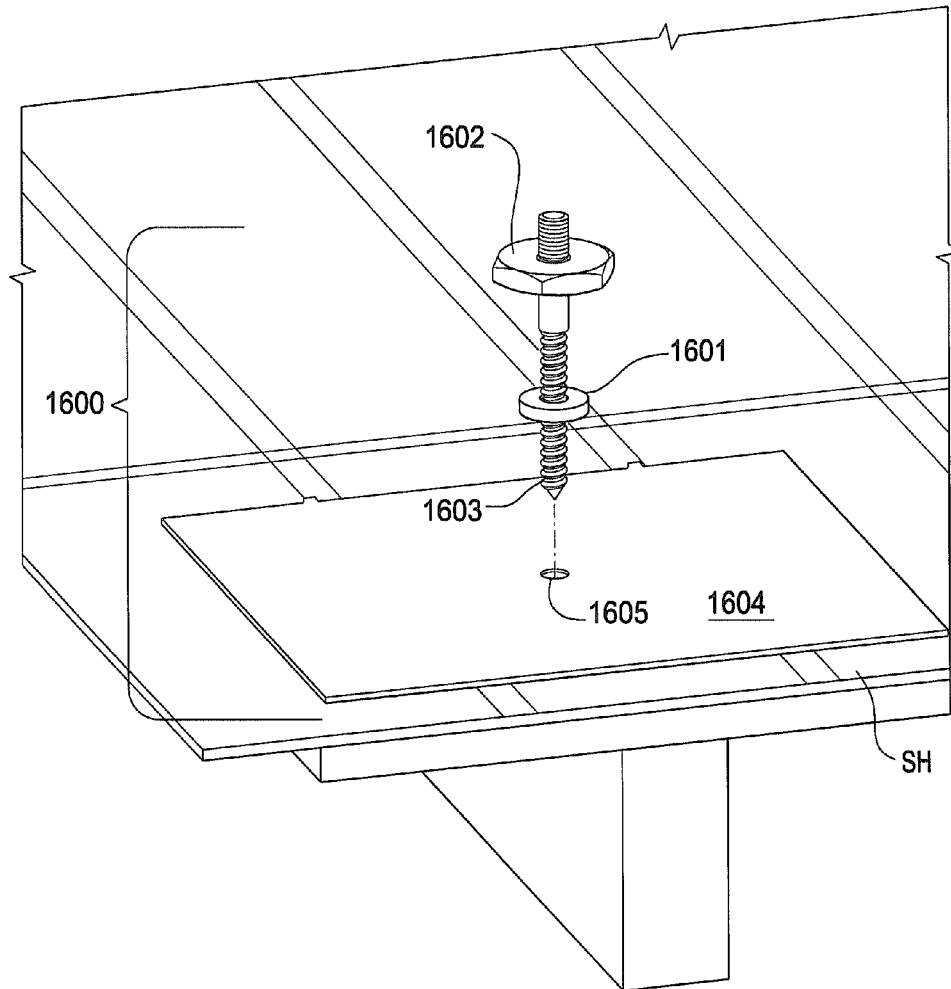


FIG. 21

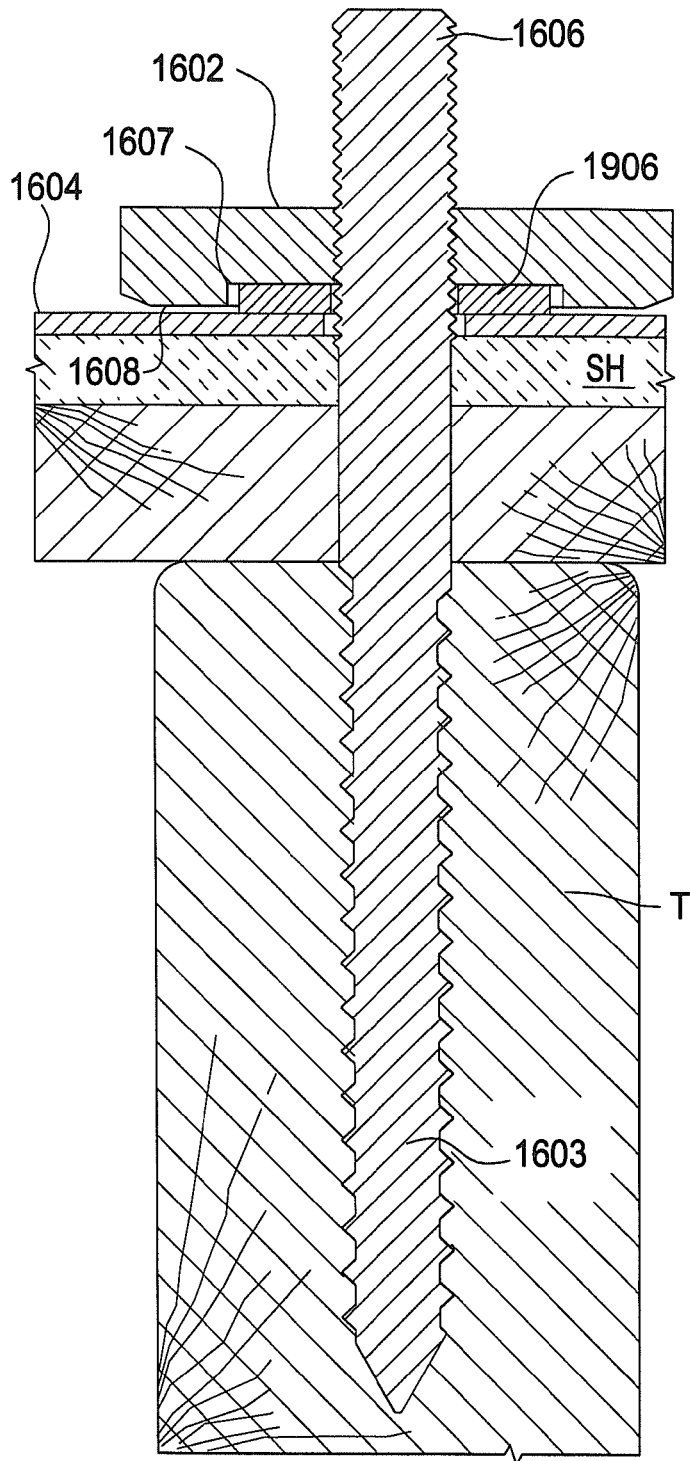


FIG. 22

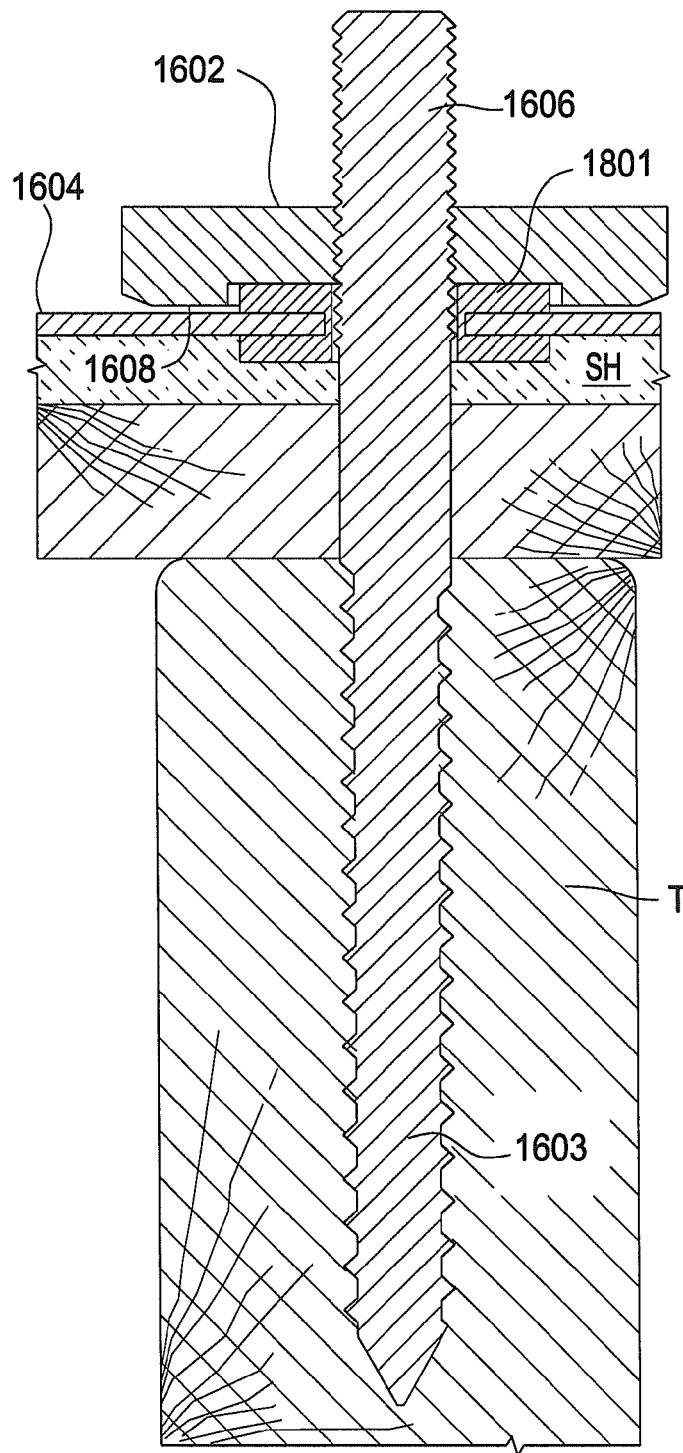
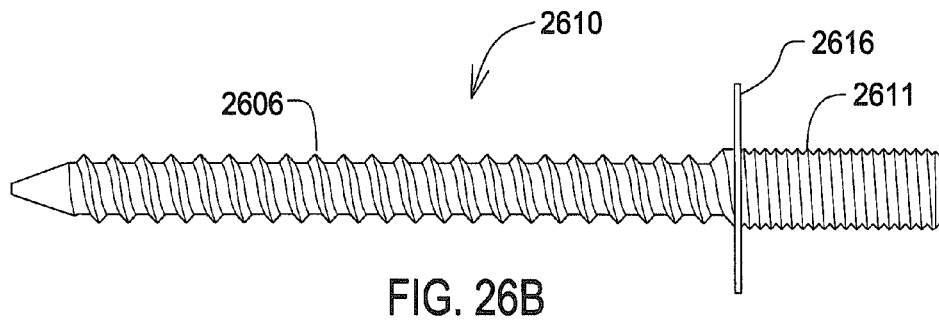
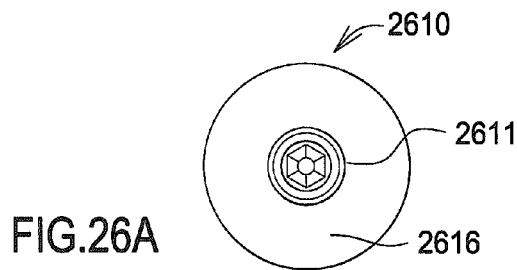
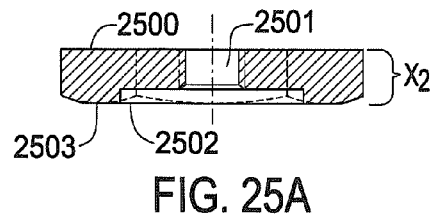
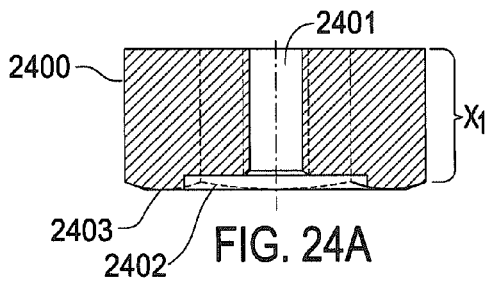
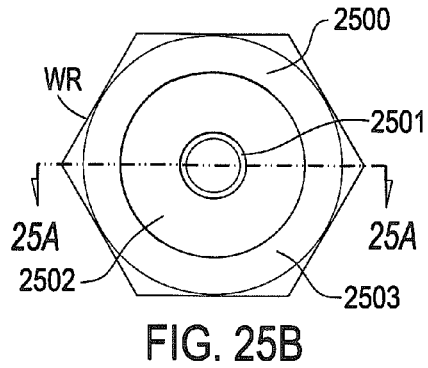
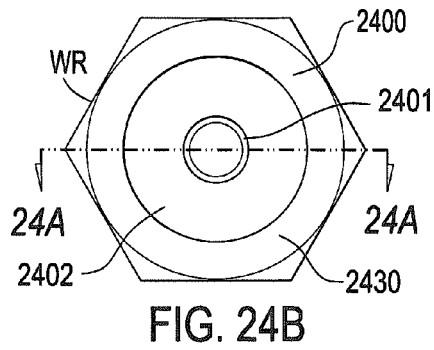
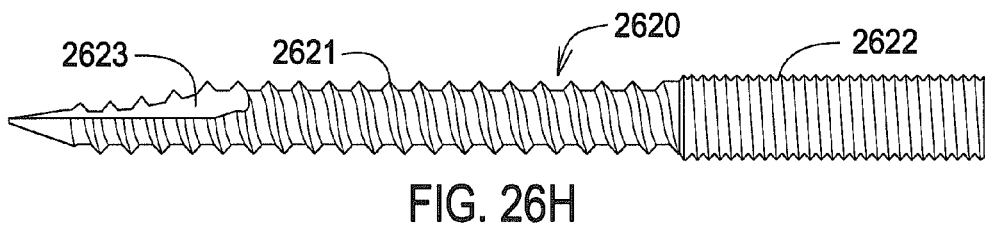
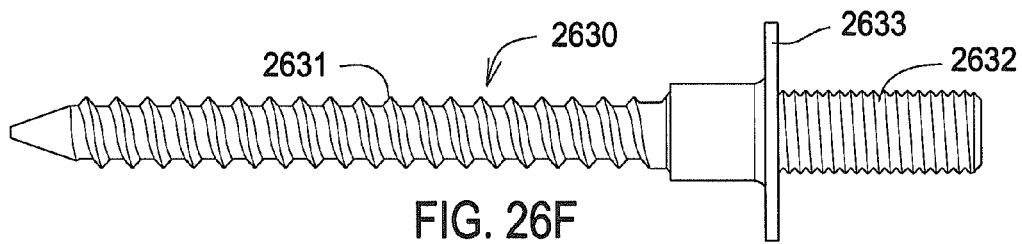
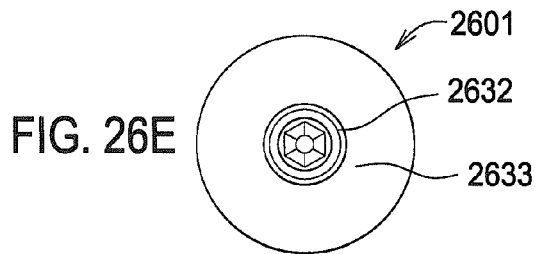
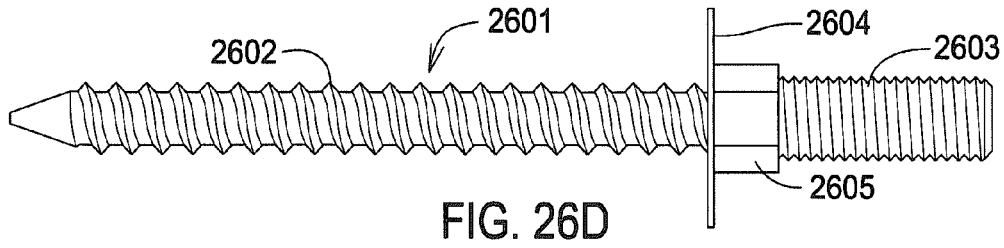
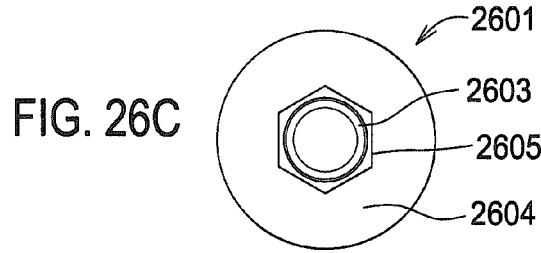


FIG. 23





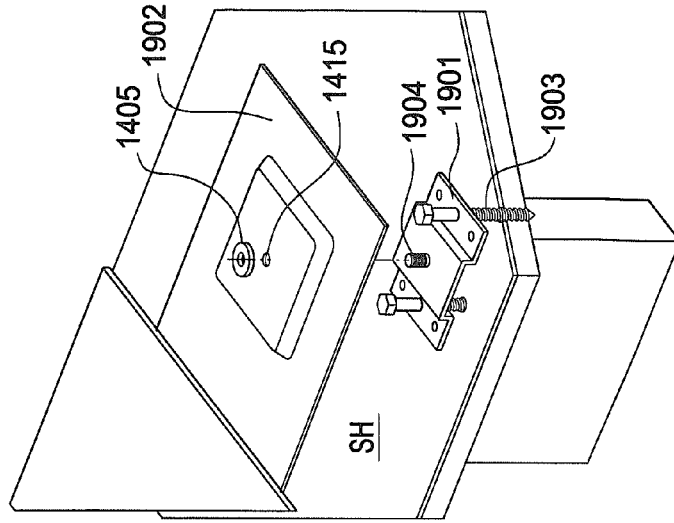


FIG. 27C

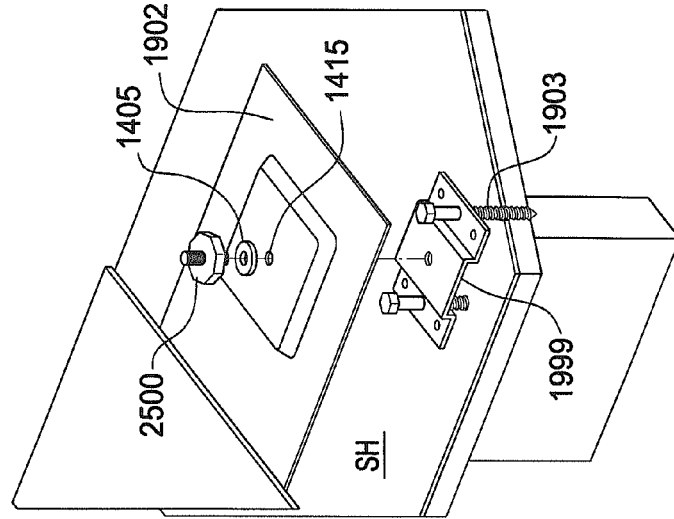


FIG. 27B

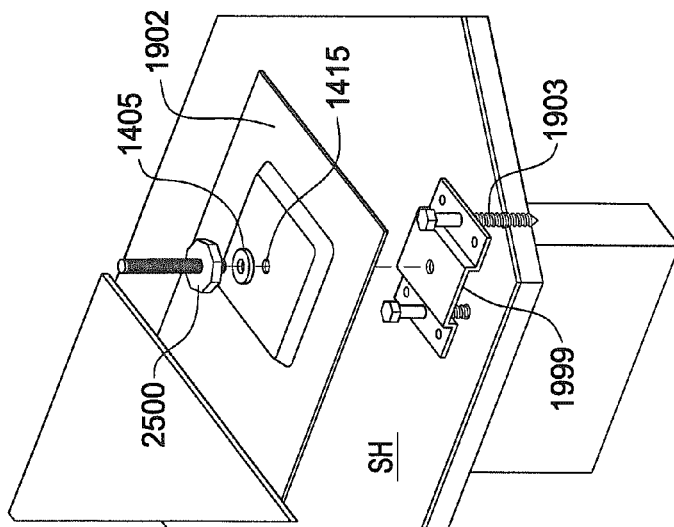


FIG. 27A

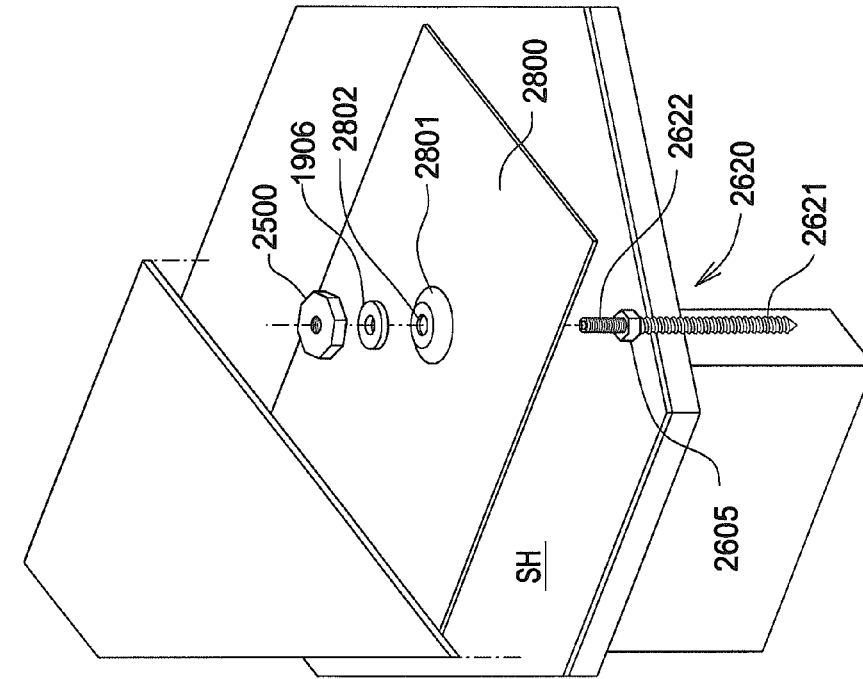


FIG. 28B

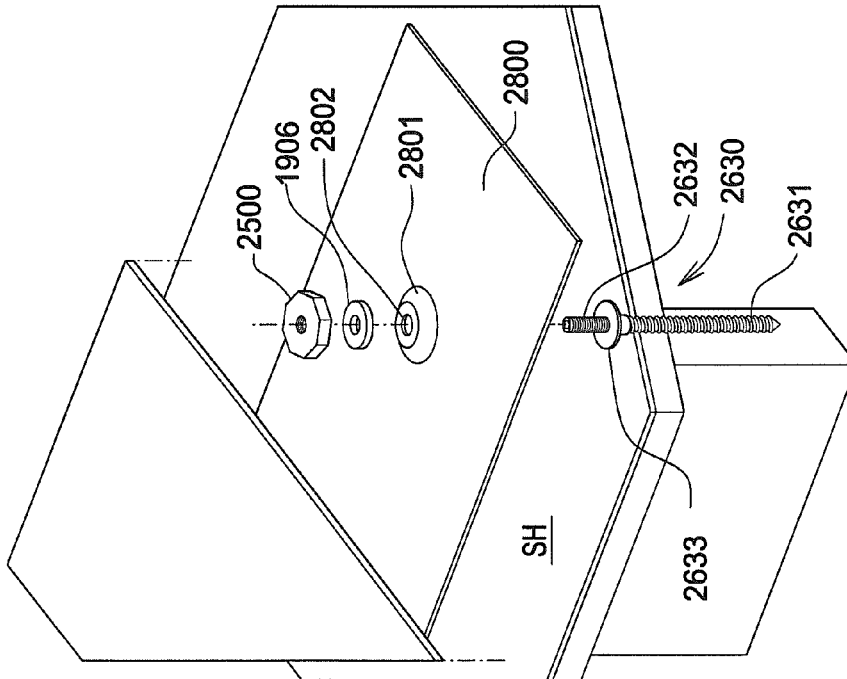


FIG. 28A

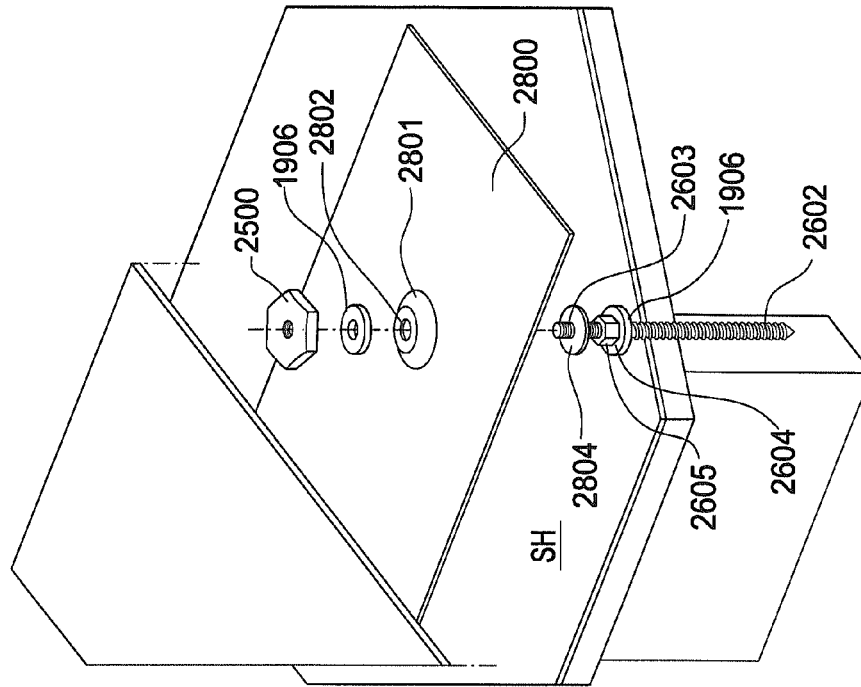


FIG. 28C

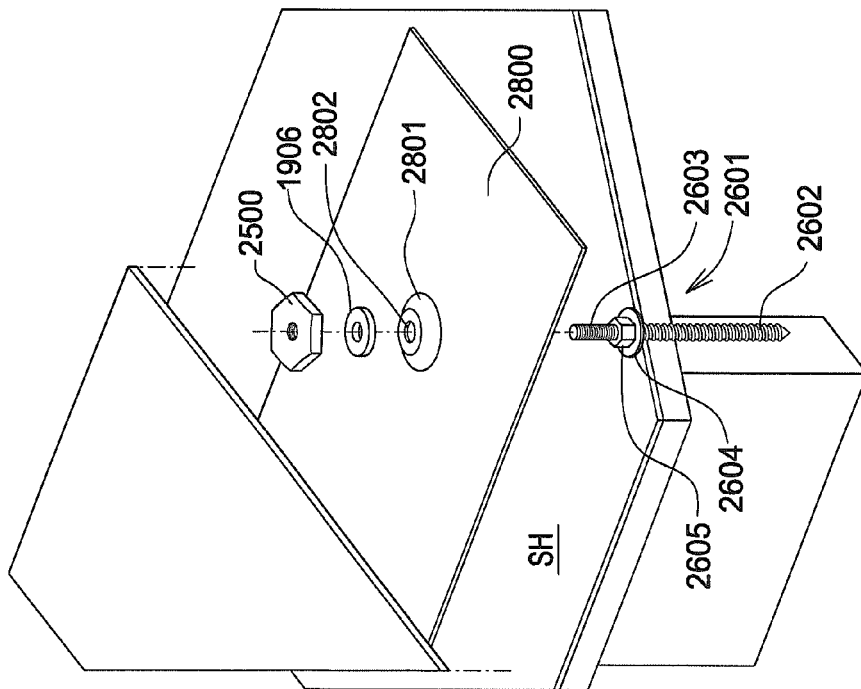


FIG. 28D

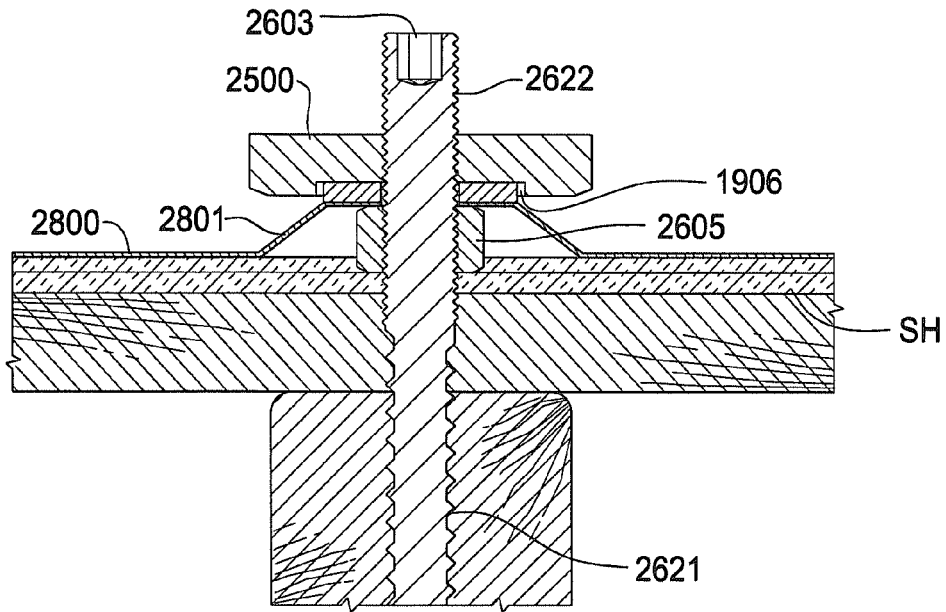


FIG. 29

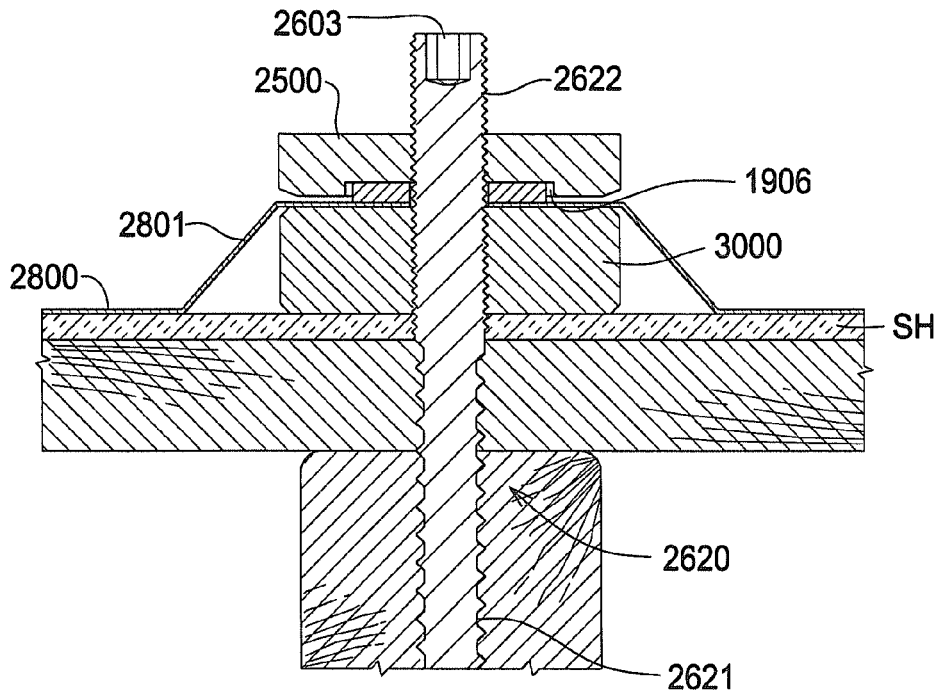


FIG. 30

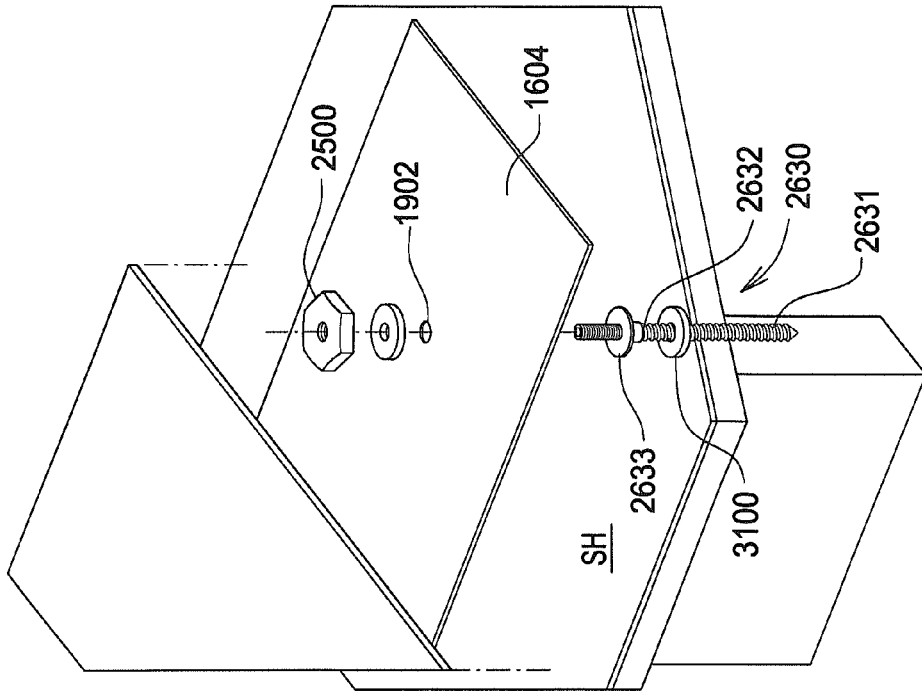


FIG. 31B

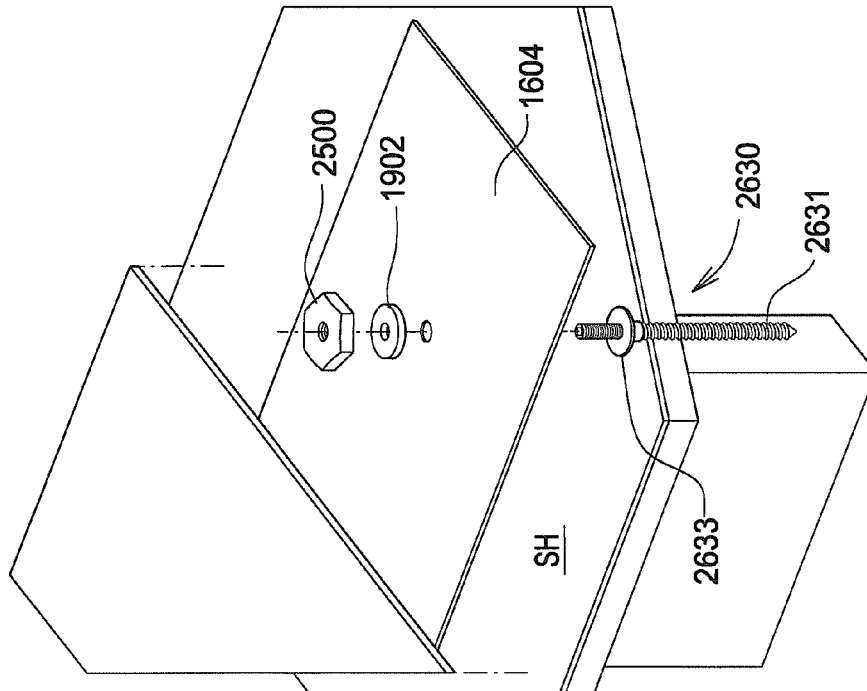


FIG. 31A

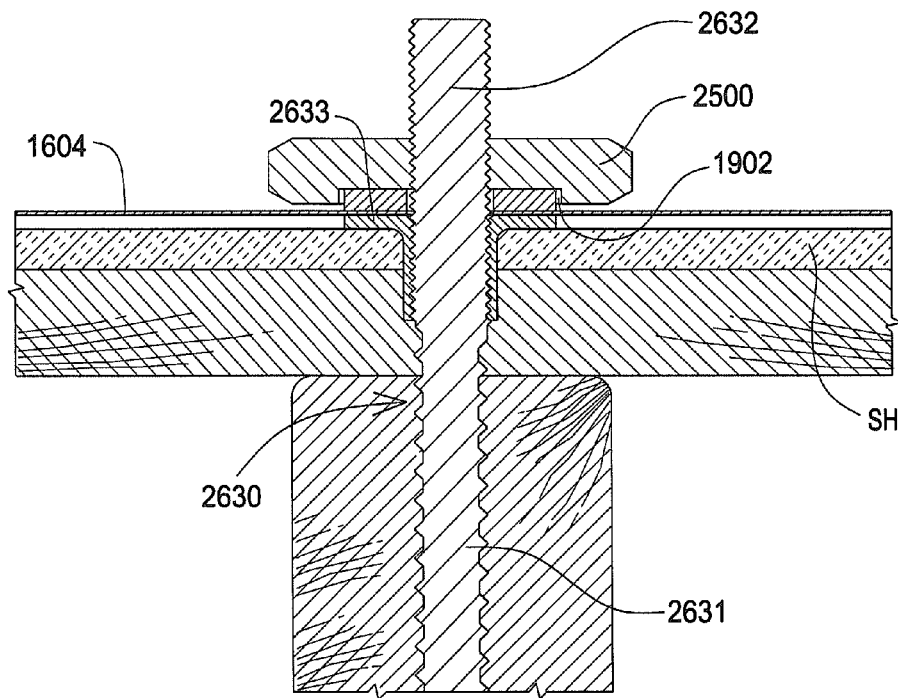


FIG. 32

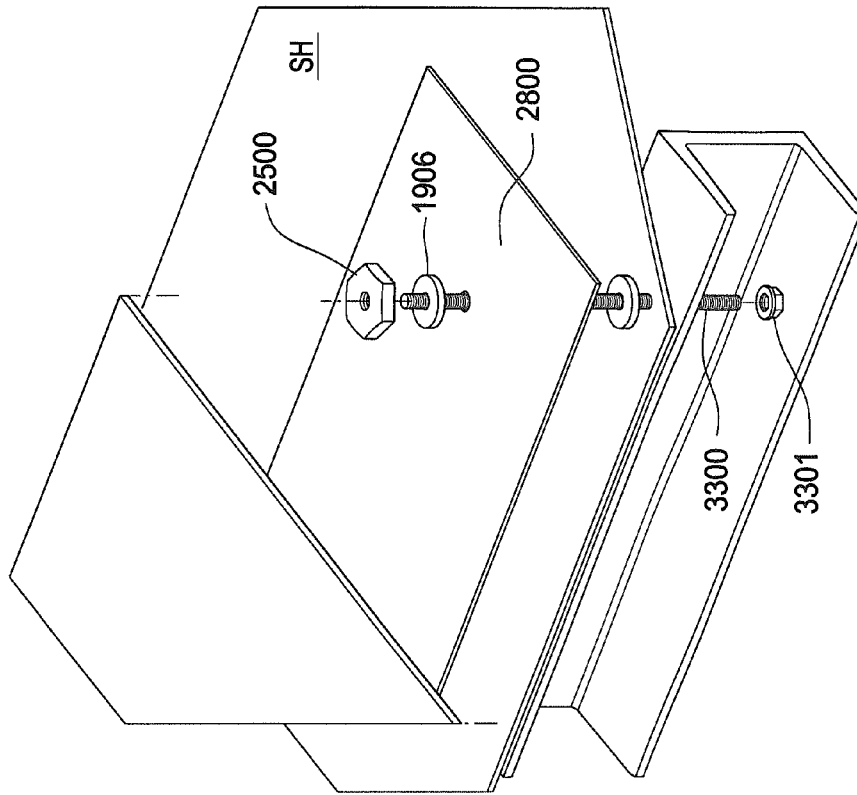


FIG. 33B

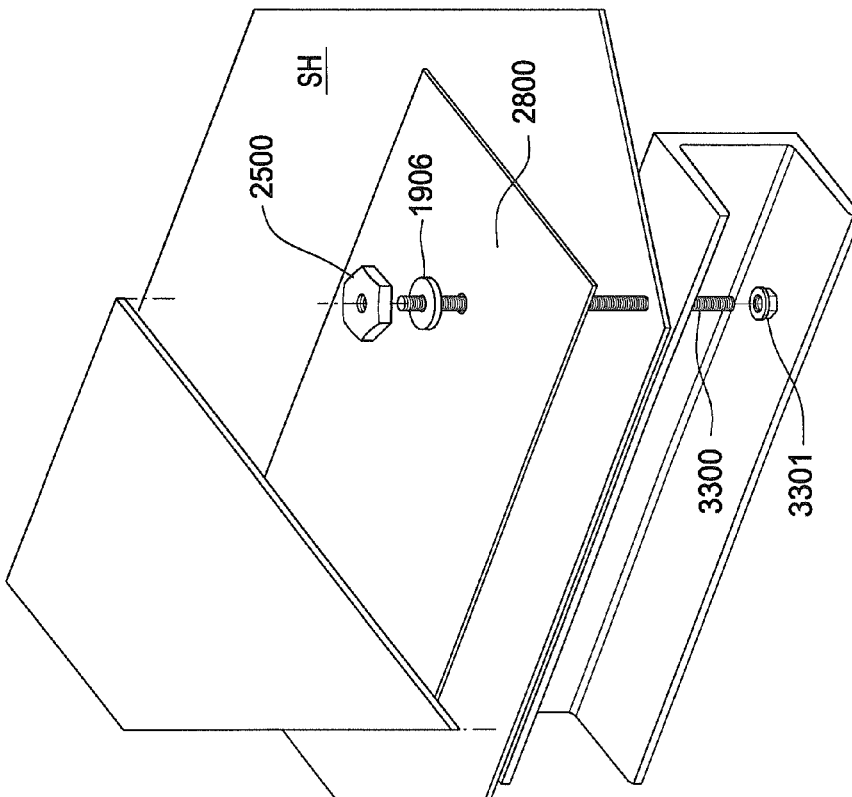


FIG. 33A

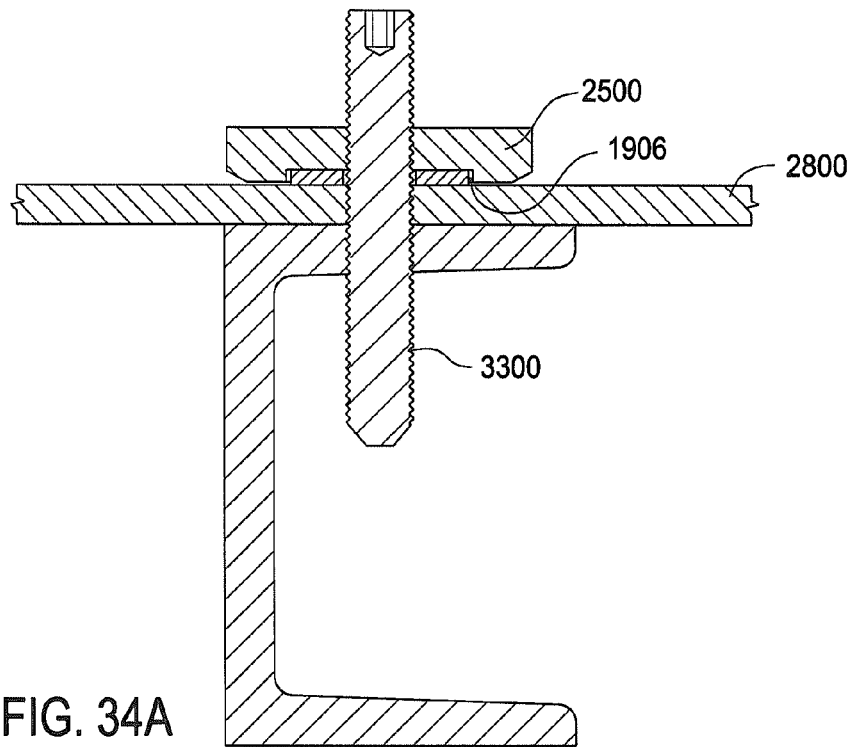


FIG. 34A

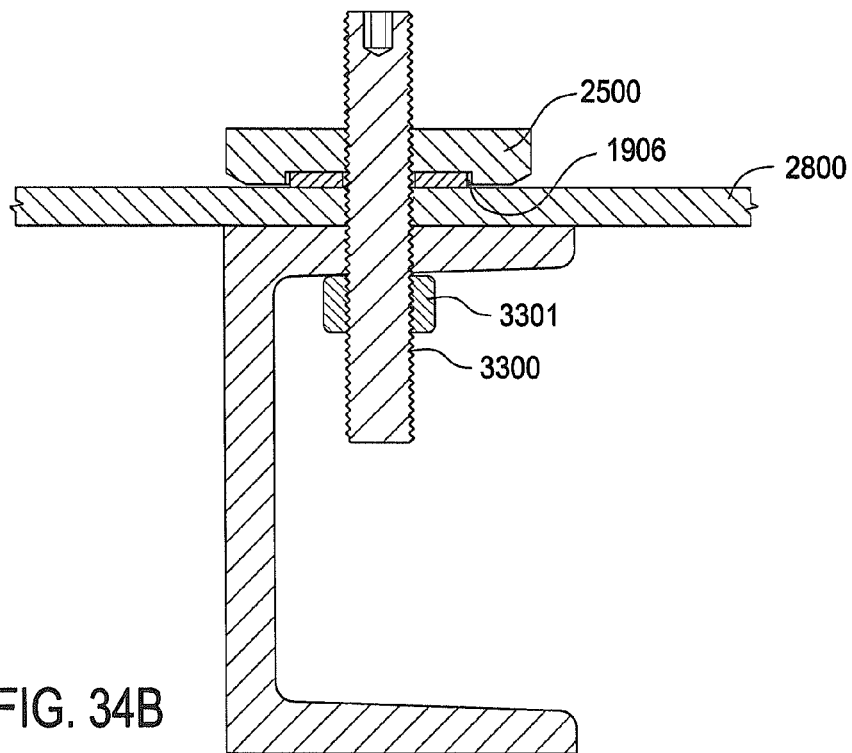


FIG. 34B

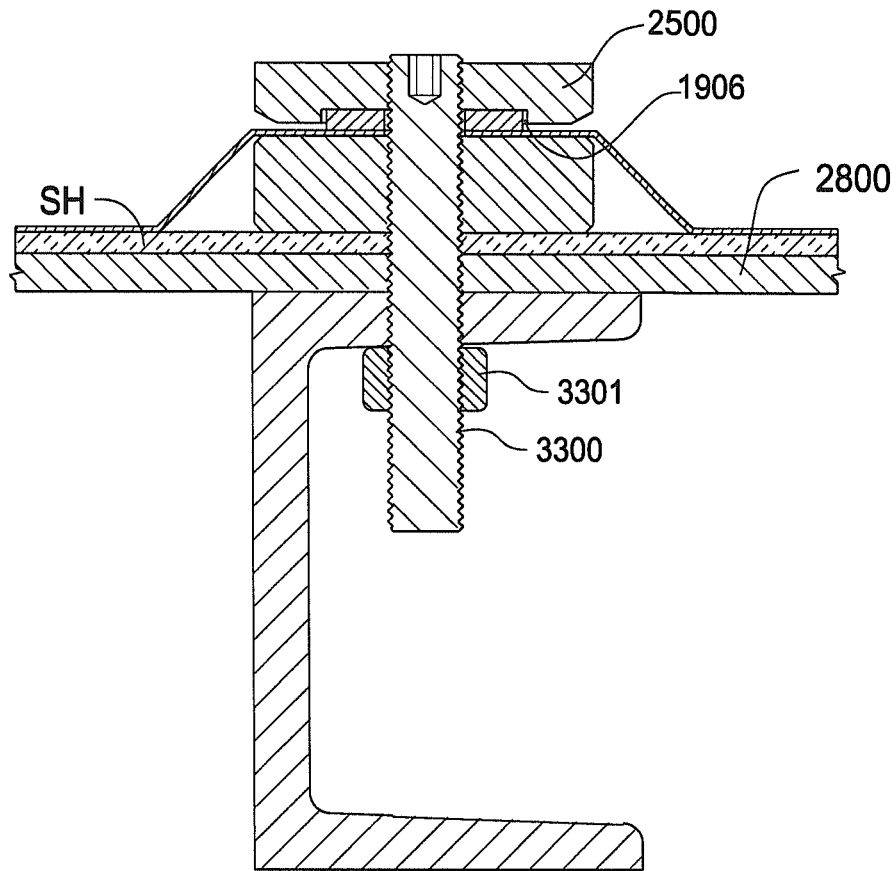


FIG.35

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ROOF MOUNT SEALING ASSEMBLY

CROSS REFERENCE APPLICATIONS

This application is a continuation of Ser. No. 13/799,359 ⁵ filed Mar. 13, 2012, which is a continuation of application Ser. No. 13/368,332, filed Feb. 8, 2012, now U.S. Pat. No. 8,448,405, which claims the benefit of provisional application 61/440,847, filed Feb. 8, 2011; the Ser. No. 13/368,332 application, now U.S. Pat. No. 8,448,405, is also a continuation in part of non-provisional application Ser. No. 12/700,667 filed ¹⁰ Feb. 4, 2010, pending, which claims the benefits of provisional application No. 61/255,082 filed Oct. 26, 2009 and provisional application No. 61/150,301 filed Feb. 5, 2009. All of these applications are hereby incorporated by reference for ¹⁵ all purposes.

BACKGROUND

Roof pipe and electrical flashings exist to seal penetrations ²⁰ on roofs. Prior art pipe and electrical flashings provide elastic seals which utilize a combination of metal and rubber pieces. These rubber pieces are exposed to the elements and eventually degrade, allowing elements such as moisture in the home.

The foregoing example of the related art and limitations ²⁵ related therewith are intended to be illustrative and not exclusive. Other limitations of the related art will become apparent to those of skill in the art upon a reading of the specification and a study of the drawings.

SUMMARY

The following embodiments and aspects thereof are ³⁰ described and illustrated in conjunction with systems, tool and methods which are meant to be exemplary and illustrative, not limiting in scope. In various embodiments, one or more of the above described problems have been reduced or eliminated, while other embodiments are directed to other improvements.

One aspect of the roof mounting assembly described herein ³⁵ is a waterproof assembly mounting devices such as solar panels and signs on roofs. Another aspect of the device described herein is to provide a flashing assembly which requires no caulking or exposed rubber. If desired, caulking or other weather stripping can be added without changing the nature of the assembly.

One application uses the watertight standoff system to ⁴⁰ support interlocking racks which hold solar panels and/or other panels off the surface of a roof.

In the disclosed embodiments, a body is used to encapsulate ⁴⁵ a flexible washer to protect the washer from ultra violet light and other environmental factors that degrade the flexible washer. This also allow the flexible washer to be put under pressure to create a more water resistant seal.

Another aspect is the fact that the washer is or can be ⁵⁰ compressed between elements of the roof mounting system and not between elements of the roof or other surface. Therefore, as the roof components age (wood dries out, shingles age) the water proof nature of the disclosed roof mounting systems does not change. Known prior systems rely on the roof structure to maintain pressure of the waterproof seal, which may be degraded as the roof elements age, i.e. a rafter may dry out and split.

Another advantage of the disclosed roof mounting system ⁵⁵ is that dissimilar materials can be used without causing dielectric effects. The washer (or washers) can be used to separate elements made of dissimilar metals. Given the mate-

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rials above the roof are in environmental conditions that are ⁶⁰ uncontrollable and can cause severe damage to many products, the washer separates and prolongs the life of the metal embodiments of the roof mounting assembly components due to the nature that they are dielectrically separated by the silicone rubber (or other material) washer.

In addition to the exemplary aspects and embodiments ⁶⁵ described above, further aspects and embodiments will become apparent by reference to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

⁷⁰ FIG. 1 is an exploded view of a standoff and flashing to attach a support member to a roof or other surface.

FIG. 2 is a cross section of the standoff and flashing of ⁷⁵ FIG. 1.

FIG. 3 is a cross section of another standoff and flashing.

FIG. 4 is an exploded view of the standoff of FIG. 3.

FIG. 5 shows the FIG. 3 standoff initially installed.

FIG. 6 shows the FIG. 3 standoff ready to accept a support ⁸⁰ post.

FIG. 7 shows the FIG. 3 standoff attached to a support post.

FIG. 8 is a top perspective view of a standoff being ⁸⁵ installed.

FIG. 9 is a top perspective view of a row of standoffs on a ⁹⁰ roof.

FIG. 10 is a side elevation view of a roof anchor.

FIG. 11 is a partial sectional view of the roof anchor ⁹⁵ installed through a metal roof.

FIG. 12 is a partial sectional view of the roof anchor installed ¹⁰⁰ through a roof tile.

FIG. 13 is bottom perspective view of a bolt embodiment of ¹⁰⁵ the roof anchor of FIG. 10.

FIG. 14 is a bottom perspective view of a threaded hole ¹¹⁰ embodiment of the roof anchor of FIG. 10.

FIG. 15 is a cross sectional exploded view of a standoff ¹¹⁵ with a double bolt stud.

FIG. 16 is a bottom perspective view of the double bolt ¹²⁰ stud.

FIG. 17 is an exploded view of the double bolt stud assem- ¹²⁵ bly being installed.

FIG. 18 is a cross sectional view of an installed double bolt ¹³⁰ stud assembly.

FIG. 19 is a top perspective view of the standoff of FIG. 18 ¹³⁵ supporting a W spring base.

FIG. 20 is a top perspective view of the standoff of FIG. 18 ¹⁴⁰ supporting a T slide.

FIG. 21 is an exploded view of an alternate embodiment of ¹⁴⁵ a double stud bolt being installed.

FIG. 22 is a cross sectional view of the double stud bolt of ¹⁵⁰ FIG. 21 installed n a roof.

FIG. 23 is a cross sectional view of the double stud bolt of ¹⁵⁵ FIG. 22 with an alternate embodiment of a washer.

FIGS. 24 *a* and *b* are views of one embodiment of the body ¹⁶⁰ of the double stud bolt.

FIGS. 25 *a* and *b* are views of a second embodiment of the ¹⁶⁵ body of the double stud bolt.

FIGS. 26 *a* through *h* are views of four possible bolt bodies.

FIGS. 27 *a* through *c* are exploded views of various possible ¹⁷⁰ configurations of the body being used with a base and raised flashing.

FIGS. 28 *a* through *d* are exploded views of various possible ¹⁷⁵ combinations of a body and bolt body being used with a bump flashing to encapsulate the washer.

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FIG. 29 is a cross sectional view of the embodiment of FIG. 28a when installed.

FIG. 30 is a cross sectional view of a double stud assembly installed with a bump flashing with a spacer.

FIGS. 31 a and b are exploded views of a double stud assembly installed with a flat metal flashing.

FIG. 32 is a cross sectional view of the embodiment of FIG. 31a when installed.

FIGS. 33 a and b are exploded views of a double stud assembly installed on a roof with a metal support beam.

FIGS. 34 a and b are cross sectional views of double stud assemblies installed in a metal support beam.

FIG. 35 is a cross sectional view of another embodiment of the double stud assembly.

Before explaining the disclosed embodiment of the present invention in detail, it is to be understood that the invention is not limited in its application to the details of the particular arrangement shown, since the invention is capable of other embodiments. Exemplary embodiments are illustrated in referenced figures of the drawings. It is intended that the embodiments and figures disclosed herein are to be considered illustrative rather than limiting. Also, the terminology used herein is for the purpose of description and not of limitation.

DETAILED DESCRIPTION OF THE DRAWINGS

FIGS. 1, 2 show a flashing and standoff 2200 that can be used when mounting a frame or rack on a roof or similar surface. Base 1901 attaches to the roof truss T or other surface with screws 1903, two screws in the depicted embodiment. Known flashing 1902 (preferably sheet metal) is placed over the base 1901 to prevent water from getting to the holes created by the screws. Flashing 1902 has raised area 1988 to allow the flashing 1902 to enclosed base 1901. With prior art standoffs, there are problems with water getting into the standoff and causing corrosion of the standoff. The present standoff 2200 solves this issue with a roof mount sealing assembly.

Threaded bolt 1904 extends up from base 1901, through hole 1415 in flashing 1902. Core 1908 has a threaded hole 1909 which threads onto bolt 1904. A soft flexible washer 1906 having hole 1405 is placed between the core 1908 and flashing 1903 in circular recess 1930 to provide a water-tight or near water-tight seal with ridge R creating a metal to metal joint against flashing 1902 in the depicted embodiment. As core 1908 is solid other than threaded hole 1909 and recess 1930, once core 1908 is screwed down on to bolt 1904 with the flexible washer 1906, a watertight, or nearly water tight, seal is formed over the hole 1415 in flashing 1902, forming a roof mount sealing assembly 2000. This helps to prevent water from getting under the flashing 1902. The soft flexible washer 1906 is compressed between the top surface 1931 of the flashing 1902 and the recess 1930. In the depicted embodiment the washer is a soft flexible material. Rubber/synthetic rubber/silicone or other suitable compressible washer material using any known or later discovered polymer with similar properties could be used as well.

Core 1908 has an outer surface with threads 1910. Cover 1911 has a threaded recess 1912, seen in FIG. 2, which corresponds to threads 1910, allowing the cover 1911 to be threaded down on to core 1910. The cover 1911 has a top threaded hole 1913, which does not connect to threaded recess 1912. The height of the stand-off is adjusted by choosing how far down cover 1911 is threaded on to core 1908. This allows for very precise and replicable height adjustments. Bolt 412 can be threaded into hole 1913 to allow desired

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objects to be attached to the top of cover 1911 as will be discussed in greater detail below.

FIGS. 3 to 7 show the roof truss T with a roof surface TP on top of truss T with another type of standoff. A shingle SH is exposed to the environment. Base 1999 serves as an anchor for the entire standoff assembly 2222 and is attached to the roof truss T with screws 103 as above. Base 1999 differs from base 1901 in that it has a threaded hole 1920, instead of bolt 1904. Water is prevented from reaching screws 1903 by flashing 1902 as above. The flashing 1902 is made waterproof at its periphery E in known manners including glue, tar, overlay shingles. Hole 1920 has threads to accept bolt 1926 which secures the core 1924 to the base 1999, forming roof mount sealing assembly 4000 as shown in FIG. 4. The soft flexible washer 1906 fits into donut recess 1928 at the bottom of the core 1924. Rim 1928 is circular and seals the flexible washer 1906 inside the metal to metal joint of members 1929 against 1902 in the depicted embodiment. Thus flexible washer 1906 is protected from the elements, particularly ultraviolet light, and little or no water can get into hole 1405.

The threads 1925 receive the cover 1922. After the cover 1922 is set to the desired height the mounting bolt 1921 is set to a desired height as shown by gauge G in FIG. 4 forming height D8 in FIG. 6. Bolt 412 threads into hole 1923.

A series of assemblies 2222 can be mounted on a roof in a straight line ready to support a support post 100 as shown in FIGS. 8 and 9. The jaw 104 is slid down a series of aligned bolts 412. Then each cover 1922 is tightened (turned counterclockwise CC) thereby locking bolt 412 against lip 108, shown in FIGS. 6 and 7. No tools are needed.

FIG. 8 shows a method to affix the FIG. 3 embodiment 2222 on a shingle roof. Shingle SHU is lifted to cover the edge 1902e of flashing 1902.

FIG. 9 shows the support post 100 mounted at a uniform height UH above a curving roof SH. Each bolt 412/cover 1922 combination is raised up or down shown by arrows U, D to level post 100.

Referring next to FIGS. 10-14 a roof anchor 6500 has a cylindrical body 6501 with a threaded upper section 6502 in the depicted embodiment. The external threads 6052 are optional, and are not required in all embodiments. A threaded hole 6503 can receive a bolt so as to act like bolt 412 in FIG. 2. Alternately an Allen head or screw head or the like could be on the top to allow the roof anchor 6500 to be attached. Solar racks can be built atop the bolt (not shown) that would be threaded into hole 6503. The screw 6504 is threaded into mounting hole 6505 at the bottom of body 6501. A recess 6999 receives flexible washer 1906 similar to FIG. 2, wherein ridge R protects the washer from the sun and can provide a metal to metal seal and forming the roof mount sealing assembly. FIG. 11 shows a metal roof 6666 using ridge R for a metal to metal seal. A cover 1911 (FIG. 2) could also be put on threads 6502, thus providing height adjustment for a bolt 412. Wrench face WR allows a socket SOC or wrench W to screw the screw 6504 into a truss T.

FIG. 12 shows a tile roof TR having the tile TR drilled with a hole 6700 to allow anchor 6500 to be placed down atop a truss T. Usually a plywood roof layer PY is present. So even on a tile roof the anchor 6500 provides the support for a solar panel rack and forms the roof mount sealing assembly.

In FIGS. 13, 14 nominal dimensions are D68=0.38 inch, D69=1.0 inch, D70=1.5 inch. The threaded hole 6505 serves as a mount for attaching to various stand offs including the embodiments of FIG. 2 and FIG. 10. The hole 6505 would receive bolt 1904 (FIG. 2). The FIG. 13 embodiment with bolt

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6801 can be used to insert into boss **5400** of FIG. 3. All the embodiments protect the flexible washer **1906** from the sun via a recess such as **6999**.

In all embodiments the user has the option to tighten the threads until the ridge is in contact with the flashing, creating a metal to metal seal. Alternatively, the body is tightened down until the flexible washer is compressed to seal the hole, but the metal to metal contact is avoided. In either situation, the combination of the flashing and the recess substantially enclosed the washer, and encapsulate it, preventing ultraviolet light and other environmental factors from degrading the washer. The flexible washer thickness and the metal recess depth allow the flexible washer to compress and completely fill the recess void when desired. The physical properties of the flexible washer will hold also a space between the flexible washer body and the flashing, but this can be adjusted for the desired result.

In all embodiments, the flashing can be made of aluminum, copper, stainless steel, metal, coated metal plastic, fiberglass, composites, plastic, ceramic, rubber, polymer, concrete, cementitious or any other material that is sufficiently rigid and durable to provide the flat surface for compression of the flexible washer and, if desired the contact between the ridge and the flashing. The roof mount sealing assembly and stand-off components can be made of aluminum, mild steel, stainless steel, copper, nickel or any other material with the necessary physical characteristic. In some applications the roof mount sealing assembly and/or standoff will need to be conducting, in order to allow for grounding of the components mounted on the system. In all embodiments, if desired the installer can put caulk or other sealant around all joins as a further assurance of water proof joins. This is not necessary under normal usage conditions, but may be desired in harsh environments and/or remote locations.

Referring next to FIGS. 15, 16 a standoff **1907** is attached to a base **5430** screwed into a roof truss T via screws **1903**. The base **5430** has a threaded boss **5400**. A flashing **1902** with hole **1415** is placed atop the boss **5400**. A soft flexible washer **1906** has hole **1405** aligned with hole **1415**. The double bolt stud **5401** has a body **5555**, a lower bolt **5403** and an upper bolt **5402**. The lower bolt **5403** extends through hole **1425** and screws into boss **5400** in base **5430**. The flexible washer **1906** is received in recess **5501** in body **5555**. The ridge **5570** protects the flexible washer **1906** from the sun and forms a watertight or nearly watertight seal, against flashing **1902**, forming another embodiment of the roof mount sealing assembly **1500**. If desired, the body **5555** can be tightened down until a metal to metal contact between the ridge **5570** and the flashing **1902** is achieved. The body **5555** has wrench surfaces WR to allow a wrench to tighten the stud **5401** as desired in the depicted embodiment. The wrench surfaces WR could be configured in a wide variety of shapes and configurations to use with different tightening devices. In alternate embodiments the double bolt stud can be tightened with screw drivers (strait and Phillips) Allen wrenches and other such tightening devices by forming appropriate recesses in upper bolt **5402** (not shown). Additionally, other types of wrench surfaces could be formed on the upper surface of double bolt stud **1501**. In this embodiment, the upper bolt **5402** receives the core **1924** of a standoff **1907** via threaded hole **1927**. The core outer threads **1925** receive the cover **1922**. A mounting bolt **412** is screwed into the top of the cover **1922** to provide an anchor for support posts and any desired attachment. The double bolt stud/washer assembly is denoted **5500**.

Referring next to FIG. 17, the double stud/washer assembly **5500** is shown exploded with the flashing **1902**, base **5430**

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and screws **1903**, which combined form one embodiment of the roof mount sealing assembly **1500**. The upper bolt **5402** can be attached to a wide variety of items that one could wish to mount on a roof. The recess **5501** and flexible washer **1906** combine to make a water tight, or near water tight seal that can be used for a wide variety of applications.

FIG. 18 is a cross section of the double stud assembly **5500** mounted on a truss T. The flexible washer **1906** is enclosed in the body **5555** and ridge **5570** and protected from elements. Also, the configuration of the flashing **1902** and the body **5555** allow the washer to be compressed between two substantially flat surfaces while being prevented from deforming outward by ridge **5570**. This protects the flexible washer **1906** and allows for better seals than other arrangements.

Referring next to FIGS. 19, 20 the double stud assembly **5500** can anchor a bracket **1700** or a T slide which has a hole on its bottom (not shown). A vast array of racks can be built atop the protective flashing **1902**.

FIGS. 21 and 22 show one type of an alternate embodiment of a double stud assembly **1600** formed of a body **1602** and a bolt body **1601**. The variations of this embodiment allow the body **1602** to be attached to a large number of types of materials. The bolt body **1601** has a lower bolt section **1603** and an upper bolt section **1606**. The lower bolt body is chosen to allow insertion and attachment to the desired material/surface and the upper bolt body is chosen for what is to be attached to the surface. The height, threading and diameter of both the lower bolt body and the upper bolt body can be varied as desired. The embodiment depicted in FIGS. 21 and 22 allows the body **1602** to be attached more directly to a roof using a lag bolt as the lower bolt body **1603**. Flat flashing **1604** is placed atop shingles SH with hole **1605** in the desired attachment location. Lag bolt **1603** is the screwed into truss T, as seen in FIG. 21. The upper bolt **1606** is sized to accept whatever attachment is desired. The relative diameter of lag bolt **106** and upper bolt **1606** shown in the depicted embodiment is not required. The upper bolt **1606** could have a much larger diameter. As in prior embodiments body **1602** has recess **1607** and ridge **1608** that encapsulate flexible washer **1906** and form a water tight or near water tight seal around bolt body **1601**. If desired, body **1602** can be tightened down onto flashing **1604** to achieve a metal to metal seal.

FIG. 23 shows an alternate embodiment of the washer **1801**. In this embodiment the washer brackets the flashing **1604**, reducing or preventing electrically conductive contact between the bolt body **1601** and the flashing **1604**. This can also be used to reduce and/or eliminate contact between dissimilar metals.

FIGS. 24a-b and 25a-b shows two possible alternate embodiment of the body. FIGS. 24a-b shows a body **2400** of the double stud assembly with a chosen thickness X_1 , which in depicted embodiment is about $\frac{3}{8}$ of an inch. In this embodiment the body **2400** is formed as a separate piece from the bolts and permanently affixed thereto by a chosen adhesive. The body **2400** has a central hole **2401** that is sized to closely fit the chosen bolt body (not shown). On one side the body has recess **2402** and ridge **2403** for the washer as described above. Body **2400** also can have wrench faces WR to allow the double stud assembly to be screwed down. As before, the configuration and/or location of the wrench faces WR can be chosen to allow any number of known tools to be used. No limitation to the depicted embodiment is intended, or should be inferred.

FIG. 25a-b, shows a body **2500** with a chosen thickness X_2 , which in the depicted embodiment is larger than X_2 . Thickness of the body is chosen based on several parameters, including being thick enough to allow adequate number of

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threads for bolt size for good attachment and if additional height is wanted to give more clearance between flashing and whatever is mounted on top. In this embodiment the body **2500** is formed as a separate piece from the bolts and permanently affixed thereto by a chosen adhesive. The body **2500** has a central hole **2501** that is sized to closely fit the chosen bolt body (not shown). Alternatively, central hole **2501** could be threaded and the body threaded on to the bolt body. Further the double stud assembly could be molded or machined as a single piece. On one side the body has recess **2502** and ridge **2503** for the washer as described above. Body **2500** also can have wrench faces WR to allow the double stud assembly to be screwed down. As before, the configuration and/or location of the wrench faces WR can be chosen to allow any number of known tools to be used.

As seen in some of the other embodiments of the roof mount sealing assemblies, the body **5555**, **1900**, **2000**, **2400**, **2500** can have a threaded hole on the top surface instead of the upper bolt **5402** to allow a greater number of possible attachments. In all embodiments the washer could be formed as an O ring with suitable changes to the size of the recess. In all embodiments of the body the central hole can be threaded and the body attached to the bolt body by the threads or the central hole can be smooth and the body is attached to the bolt body by adhesives. Further the bolt body and the body could be molded and/or machined as a single unit.

Referring next to FIGS. **26a-b**, four possible variations of the bolt body are shown. Bolt body **2601** has a lower bolt body **2602** that is formed with a lag thread bolt. This type of lower bolt body **2601** works well on wood. Bolt body **2601** has an upper bolt body **2603** with machine threads. In all embodiments upper bolt body and lower bolt body have external threads. The spacing and configuration of the threads will vary depending on the desired use of the double stud assembly. Choosing appropriate threading for the desired application is well known in the art and will not be further discussed. Washer **2604** and nut **2605** are provided between the upper bolt body **2603** and the lower bolt body **2602**. The nut **2605** allows the lower bolt body **2602** to be driven into the wood of the roof and the washer **2604** serves as a stop to control the depth that the bolt body **2601** is driven. The washer also assists in ensuring a good support for the flexible washer **1902** to ensure a good compression. In this embodiment the bolt body and washer would most likely be cast or machined. Bolt body **2601** would require a raised flashing (**2800**).

Bolt body **2610** has a lower bolt body **2602** and an upper bolt body **2611** with a metal washer **2612**. As can be seen in FIG. **26a**, the upper bolt body **2611** of bolt body **2610** has a tool space **2616** formed into its top end. In the depicted embodiment the tool space is formed to receive an Allen wrench. Other configurations of the tool space (not shown) could be used as well, such as tool spaced configured for standard screw drivers and Phillips head screw drivers.

Bolt body **2620** has an upper bolt body **2622** and a lower bolt body **2621**. Lower bolt body **2621** has a self tap section **2623**. The self tap section can be used on any of the depicted bolt bodies. Upper bolt section **2622** is depicted with optional tool space **2624**. This bolt body **2620** might be used on metal roof application or tile where the body **2500** could be provided at roof level and the upper bolt section **2622** would stick up the appropriate length. The lower bolt section **2631** of this application could be machine or lag.

Bolt body **2630** has lower bolt body **2631** and upper bolt body **2632** and metal washer **2633** placed between. Washer **2633** is a combination washer with a lower internally threaded body attached to the washer, commonly known as a weld nut. The washer threaded onto upper bolt body **2632** and

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serves as a stop to prevent over threading lower bolt body **2631** into the roof. The washer **2633** also serves as a base for the flashing and prevents pushing/deforming the flashing into the roof/shingle when threading an attachment onto the upper bolt body **2632**. The washer **2633** facilitates the compression of the flexible washer between the flashing and the body with recess when installed without a base plate. The washer **2633** is attached to the bolt either chemically, welded, or mechanically crimped. In the depicted embodiment a thread locking compound (chemically) locks the weld nut onto the bolt. The washer **2633** has no external threads which facilitates going into the plywood of most roofing assemblies and not lifting the plywood from the rafter due to threads not lining up properly upon installation. Also given the larger shaft diameter, it helps friction fit the predrilled hole and provide additional horizontal support. It also provides a semi-impermeable seal in asphalt shingle roofing applications, and tile underlayment applications, should water penetrate the roofing from other locations (not our flashing). This is a the one location that caulk would be recommended in certain applications providing another "safety" barrier to moisture or water from roofing failures above

The washer **2633** facilitates the body **2500** to be tightened in a metal to metal compression zone to achieve the waterproofing. As stated above if the structural member splits, degrades or ever the roofing material under the flashing the waterproofing is not affected. Bolt configuration **2630** is the most common one used for wooden roof installations. It has a lag bottom that needs to be predrilled in most applications. **2623** is a self drilling version no pilot hole. Lower bolt body **2632** can be driven in to a wooden stud with just a hanger bolt driver but such driver cannot back out the bolt body should removal (reroof or bad attachment). The bolt body can be backed out with two standard nuts tightened against one another. In some applications this is very difficult and the top hex, Allen, torc, nut or tool spaces facilitate the installation or removal of the bolt bodies. The tool spaces could be configured for a slot or Phillips screw driver.

FIGS. **27a-c** show a body **2701** being used with base **1901** and base **1999** and flashing **1902** as described previously. In all embodiment the body **2701** (**1602**, **2400**, **2500**) with its recess and ridge encapsulated washer **1405** as seal hole **1415** in flashing **1902**. As mentioned previously the body can have many different configurations, depending on its desired function. The necessary features are the recess and the sealing ridge to encapsulate the washer **1405** or and O-ring (now shown) to seal the exterior of the roof mounting assembly against water.

FIG. **28a** is an exploded view of bolt body **2630** being mounted on a roof with a bump flashing **2800** and a body **2500**. Any of the disclosed bodies could be used as well; no limitation to the depicted body **2500** is intended or should be inferred. The bump flashing **2800** has a smaller raised area **2801** than flashing **1902** with hole **2802** in raised area to allow the upper bolt body **2632** to extend there through. The smaller raised area **2801** of flashing **2800** is useful when no metal to metal contact of the flashing and the body is **2500** is desired. Additionally, the bump may assist in diverting water around the penetration in the roof, which may assist in keeping the mount sea. In installations of photovoltaic panels, the added height above the roof allows for greater heat dissipation. In the depicted embodiment the central hole **2501** of body **2500** is threaded and screws on the threads of upper bolt body **2632**. Flexible washer **1906** is placed over upper bolt body **2632** and then body **2500** is threaded down onto upper bolt body **2632**, encapsulating the flexible washer **1906** and forming the seal discussed above.

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FIG. 28*b* is an exploded view of a bolt body 2620 with nut 2605. Bump flashing 2800, flexible washer 1906 and body 2500 as attached as above. FIG. 28*c* shows the same with metal washer 2604 added under nut 2605. FIG. 28*d* adds another flexible washer 1906 between the metal washer 2604 and the single SH and another metal washer 2804 above the nut.

FIG. 29 is a cross sectional view of the assembly of FIG. 28*b* installed on a roof. The lower bolt body 2621 is drilled into the wooden stud, the plywood sheathing and the shingle SH.

FIG. 30 is a cross sectional view of a roof mount sealing assembly with bolt body 2620 and body 2500. Bump flashing 2800 is used with spacer 3000 placed between the raised area 2801 and shingle SH.

FIG. 31 is an exploded view of a double stud assembly being mounted with a flat metal flashing 1604. In this embodiment bolt body 2630 has weld nut 2633 and the flexible washer 1906 is placed between the flashing and the body 2500. FIG. 31*b* an additional metal washer 3100 is placed between the weld nut and the shingle SH. FIG. 32 is a cross section of the embodiment of FIG. 31 mounted on a roof.

When the body with the recess is screwed onto the bolt body in the field, it utilizes thread compound on the threads for waterproofing threaded connection. This thread compound also can provide dielectric separation as the body can be aluminum, stainless, steel, or other material that may be different from the bolt body.

One example, a bolt body is going into wood and has hanger bolt bottom with weld nut. Bolt body is carbon steel zinc plated as the weld nut. Flashing is steel but body is aluminum as is the device that will be attached to the upper bolt section. In this case the dielectric properties facilitate a proper connections with economical options i.e. not having to utilize all stainless components

A wide variety of objects could be attached to the roof mount sealing assembly by attaching to the upper bolt section, the threaded hole on the body and/or on to one of the depicted standoffs. No limitation should be implied as to the objects that can be attached to a building by on the disclosed embodiments.

FIGS. 33 *a* and *b* are exploded views of a embodiment of the double stud assembly being mounted on the roof of a building with metal structural members. Bolt body 3300 is used with a flat flashing 2800, a flexible washer 1906 and body 2500. Nut 3301 can be used to secure the bolt body 3300 in place. The size of the bolt body is not necessarily to scale in this figure.

FIGS. 34 *a* and *b* are cross sectional views of a double stud sealing assembly mounted in a metal support beam. In FIG. 34*b* nut 3301 is added. FIG. 34*a* has a self tapping metal screw to attach in into beam where access to the beam may or may not be possible. FIG. 34 *b* has a standard bolt nut application where the beam is accessible to place a nut on the underside. The illustration is for a finished metal roof surface or siding. FIG. 35 shows a bump flashing being used on a metal support beam.

While a number of exemplary aspects and embodiments have been discussed above, those of skill in the art will recognize certain modifications, permutations, additions and sub-combinations therefore. It is therefore intended that the following appended claims hereinafter introduced are interpreted to include all such modifications, permutations, additions and sub-combinations are within their true spirit and scope. Each apparatus embodiment described herein has numerous equivalents.

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The terms and expressions which have been employed are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed. Thus, it should be understood that although the present invention has been specifically disclosed by preferred embodiments and optional features, modification and variation of the concepts herein disclosed may be resorted to by those skilled in the art, and that such modifications and variations are considered to be within the scope of this invention as defined by the appended claims. Whenever a range is given in the specification, all intermediate ranges and subranges, as well as all individual values included in the ranges given are intended to be included in the disclosure. When a Markush group or other grouping is used herein, all individual members of the group and all combinations and subcombinations possible of the group are intended to be individually included in the disclosure.

In general the terms and phrases used herein have their art-recognized meaning, which can be found by reference to standard texts, journal references and contexts known to those skilled in the art. The above definitions are provided to clarify their specific use in the context of the invention.

What is claimed:

1. A roof mount, comprising:

a bracket adapted for attachment to a roof surface, said bracket further including a first threaded attachment element;

a sheet member having a top surface and a bottom surface for disposition facing the roof surface, said sheet member further including:

a raised section defining a protrusion on said top surface and a recess in said bottom surface and having an aperture extending there through, wherein said aperture is configured for alignment with said first threaded attachment element of said bracket;

a flange extending about a periphery of a base of said raised section, wherein, when disposed over said base bracket on the roof surface, said recess in said bottom surface of said sheet member receives and surrounds said base bracket and said bottom surface of said flange rests on the roof surface; and

a body having an end with a second threaded attachment element configured to engage said first threaded attachment element, wherein at least a portion of said bottom surface of said raised section of said sheet member is compressed against a top surface of said bracket when said first and second threaded attachment elements are threadably engaged.

2. The apparatus of claim 1, wherein at least a portion of said raised section surrounding said aperture comprises a planar surface.

3. The apparatus of claim 1, wherein said top surface of said bracket at least partially surrounds said first threaded attachment element and a bottom surface of said bracket is configured to rest on the roof surface, wherein a thickness between said top surface and said bottom surface is substantially equal to a depth of said recess.

4. The apparatus of claim 3, wherein a bottom surface of said recess is juxtaposed on said top surface of said bracket when said bracket is disposed on the roof surface and said recess of said sheet member is disposed over said bracket.

5. The apparatus of claim 1, wherein said flange extends about an entirety of said base of said raised section.

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6. The apparatus of claim 1, wherein said first threaded attachment element comprises a threaded aperture in said bracket, wherein said threaded aperture is aligned with said aperture in said raised section of said sheet member when said bracket is disposed on the roof surface and said recess of said sheet member is disposed over said bracket.

7. The apparatus of claim 1, wherein said first threaded attachment element comprises a threaded stud attached to said bracket, wherein said treaded stud extends through said aperture in said raised section of said sheet member when said bracket is disposed on the roof surface and said recess of said sheet member is disposed over said bracket.

8. The apparatus of claim 1, further comprising:
a soft washer disposed between said bracket and a bottom surface of said recess, wherein said soft washer at least partially surrounds said aperture in said raised section of said sheet member.

9. The apparatus of claim 1, wherein said end of said body comprises a contact surface that contacts said top surface of said raised section of said sheet member when said first and second threaded attachment elements are threadably engaged.

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10. The apparatus of claim 9, wherein said contact surface further comprises:

a recess surrounding said second threaded engagement element;

a ridge surrounding said recess; and

a soft washer disposed in said recess, wherein said soft washer is at least partially compressed when said first and second threaded attachment elements are threadably engaged.

11. The apparatus of claim 1, wherein said body comprises a third attachment element, wherein said third attachment element is adapted to attach an object to said body.

12. The apparatus of claim 11, wherein said third attachment element comprises at least one of:

an internally threaded aperture; and

a set of external threads.

13. The apparatus of claim 11; wherein said body comprises an elongated core body.

* * * * *

EXHIBIT “C”



US009068339B2

(12) **United States Patent**
Schaefer et al.

(10) **Patent No.:** **US 9,068,339 B2**
(45) **Date of Patent:** **Jun. 30, 2015**

(54) **ROOF STANDOFF DEVICE**

2/5203 (2013.01); F24J 2/5211 (2013.01);

(71) Applicant: **D Three Enterprises, LLC**, Lafayette, CO (US)

F24J 2/5245 (2013.01); F24J 2/5254 (2013.01); F24J 2/526 (2013.01); F24J 2/5264 (2013.01);

(72) Inventors: **Richard F. Schaefer**, Fort Lupton, CO (US); **David Kreutzman**, Louisville, CO (US); **Don N. Tamm**, Denver, CO (US)

(Continued)

(73) Assignee: **D THREE ENTERPRISES, LLC**, Lafayette, CO (US)

(58) **Field of Classification Search**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

CPC E04D 13/10; E04D 1/34; E04H 12/2276; E04G 21/142; E04G 5/16; E04G 5/162; E04G 5/18; E04B 1/4128; F16B 9/02
USPC 52/24, 25, 58, 60, 173.3, 296, 551, 704, 52/705, 710, 239, 282.1, 282.3, 647, 52/653.1, 653.2, 654, 655.1, 543, 548, 52/549; 248/237, 500, 505, 656, 669
See application file for complete search history.

(21) Appl. No.: **14/504,663**

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(22) Filed: **Oct. 2, 2014**

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(65) **Prior Publication Data**

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Primary Examiner — William Gilbert

(74) *Attorney, Agent, or Firm* — Russell T. Manning; Marsh Fischmann & Breyfogle LLP

(51) **Int. Cl.**

E04B 1/38 (2006.01)
F16B 9/02 (2006.01)

(Continued)

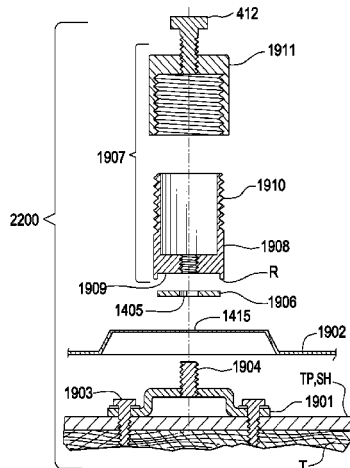
(57) **ABSTRACT**

A roof standoff having a base attached to a roof surface using one or more threaded fasteners or screws. The base has a threaded hole that is aligned with a hole in a raised flashing that overlays the base to prevent water from infiltrating the holes in the roof formed by the threaded fasteners. A bolt threadably engages the threaded hole of the base to attach a bracket to the base. Objects may engage with the bracket such that these objects are supported by the roof standoff.

(52) **U.S. Cl.**

CPC . **E04B 7/18** (2013.01); **A47B 96/14** (2013.01); **E04C 3/06** (2013.01); **E04C 2003/0421** (2013.01); **E04C 2003/0439** (2013.01); **E04C 2003/0465** (2013.01); **E04C 2003/0473** (2013.01); **E04C 2003/0478** (2013.01); **F24J**

14 Claims, 32 Drawing Sheets



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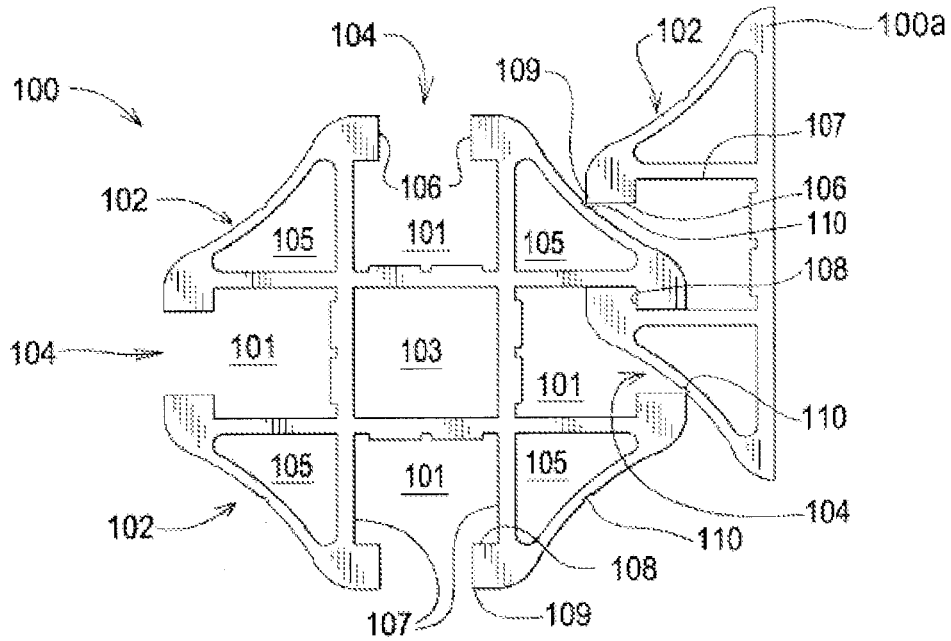


FIG. 1

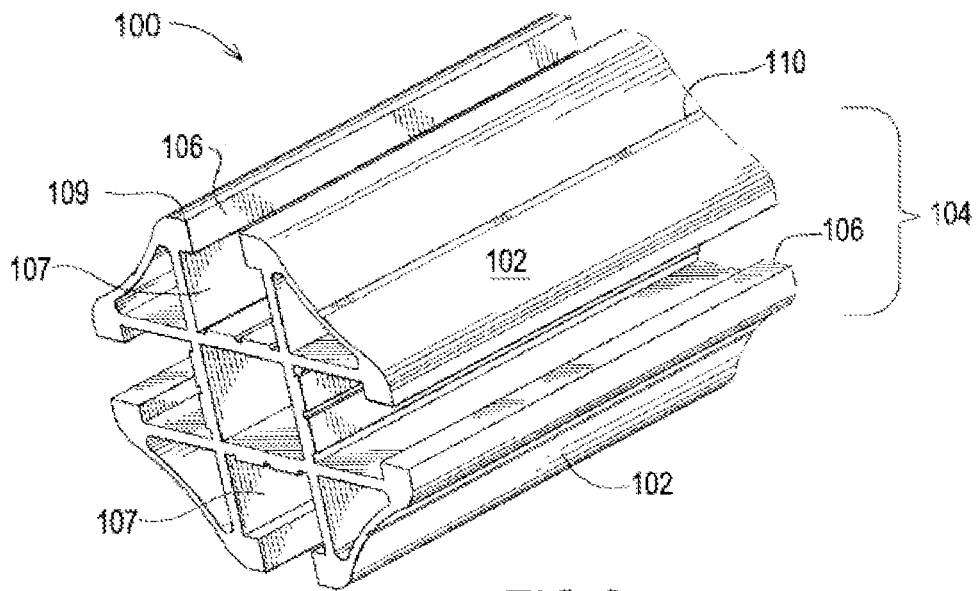


FIG. 2

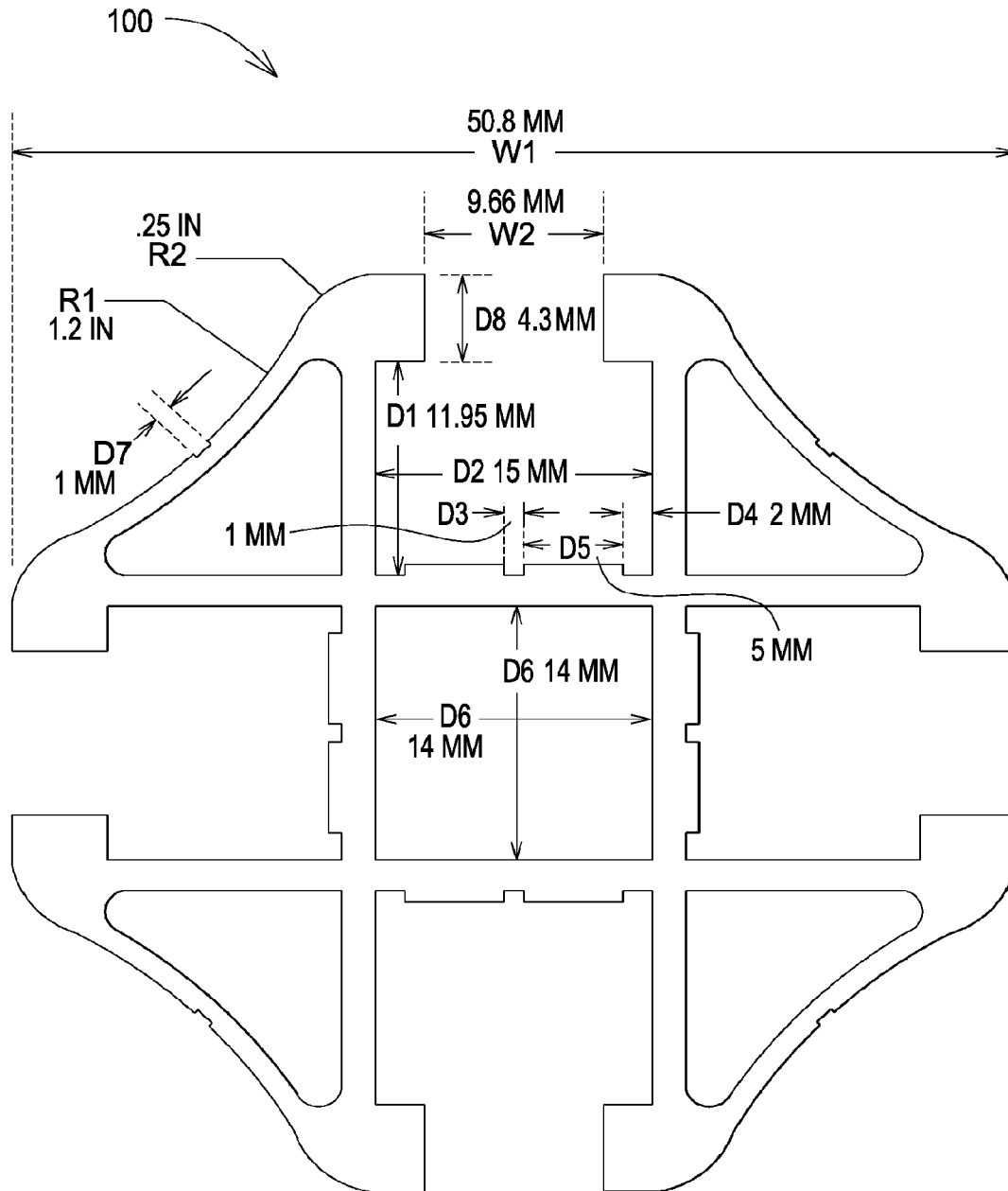


FIG.3

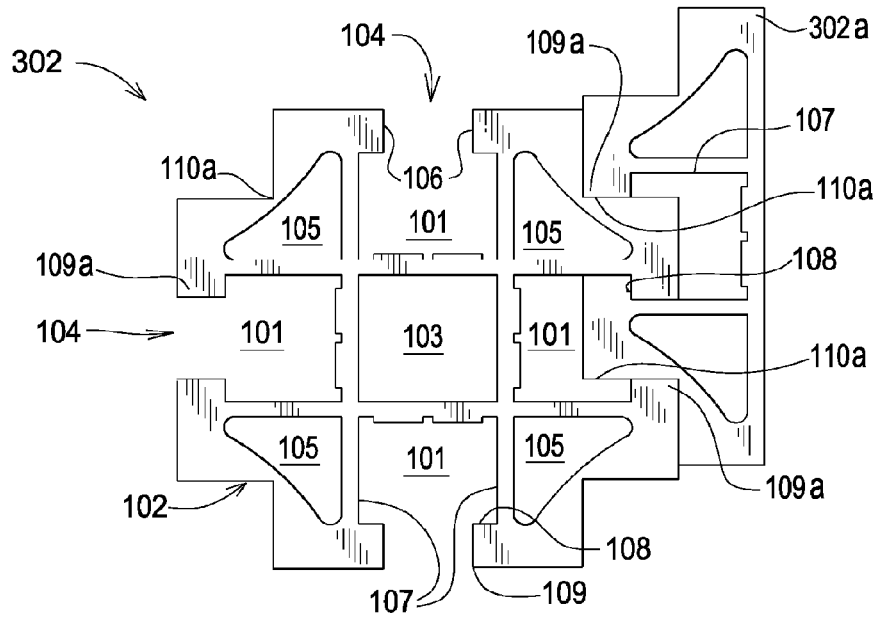


FIG. 4

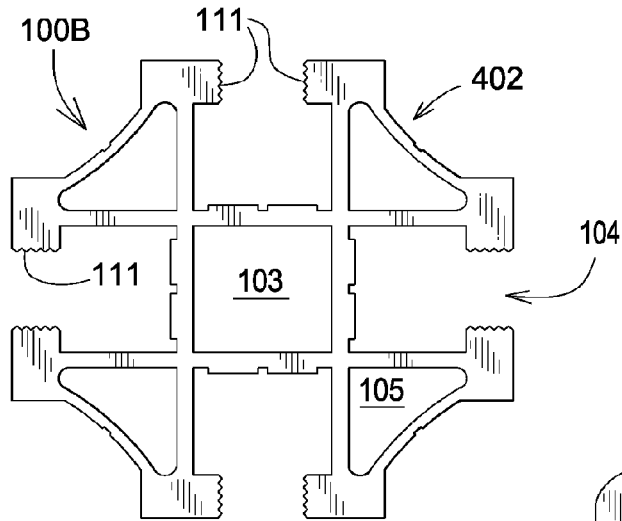


FIG. 5

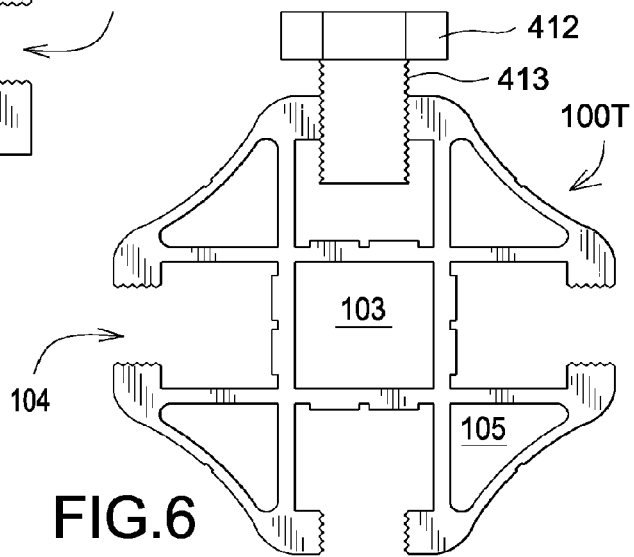
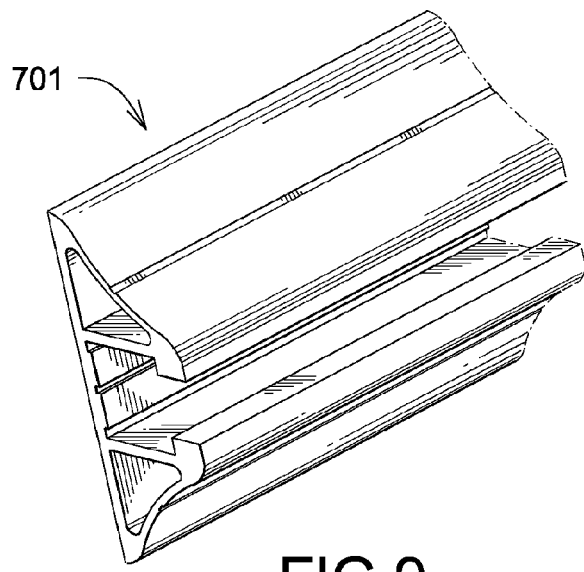
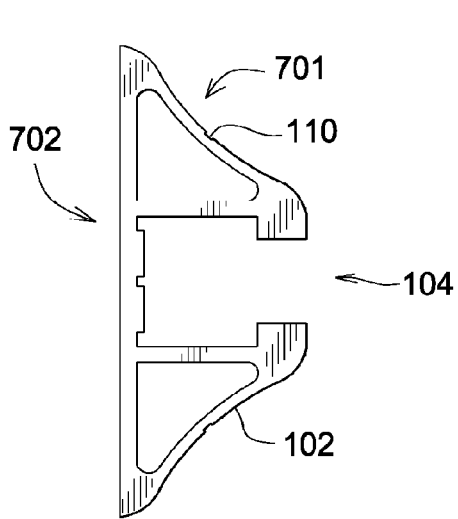
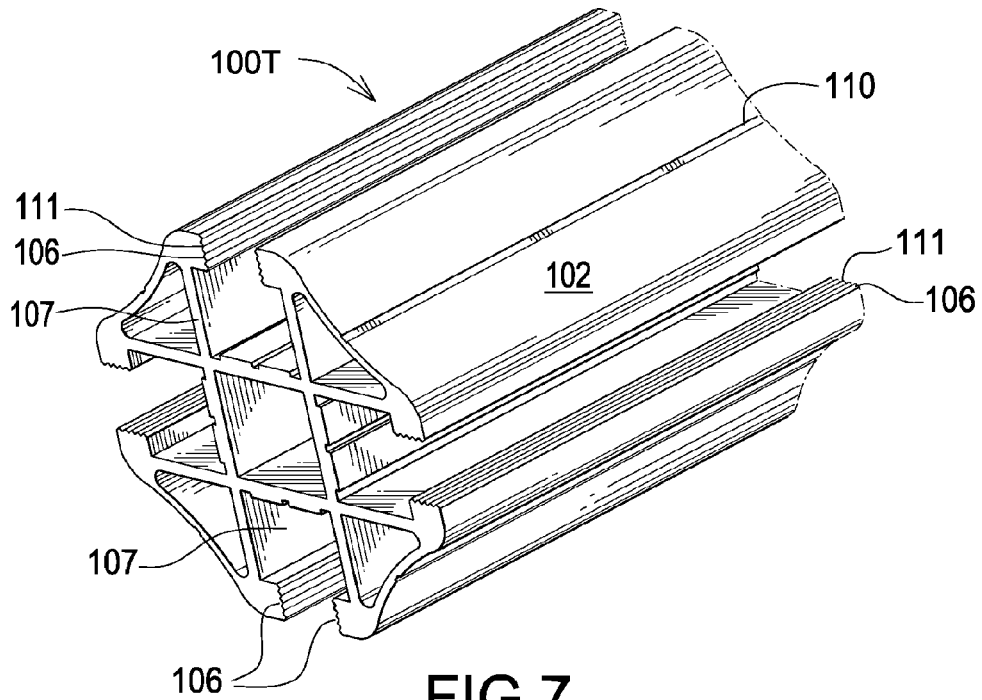


FIG. 6



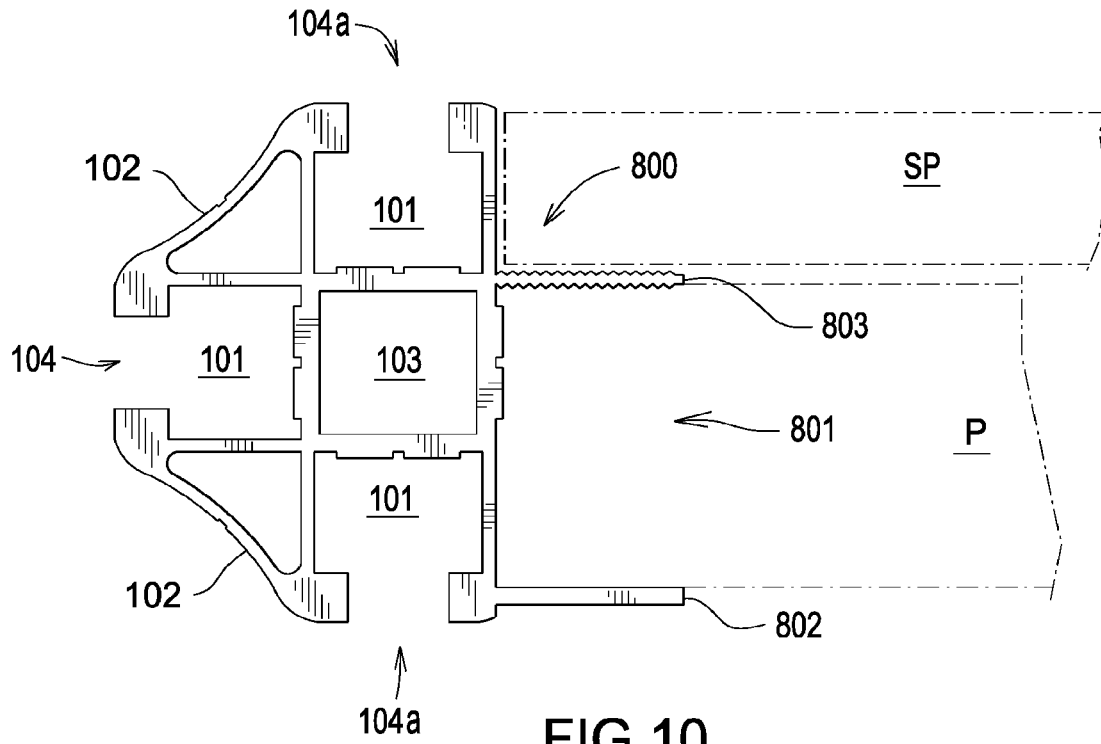


FIG. 10

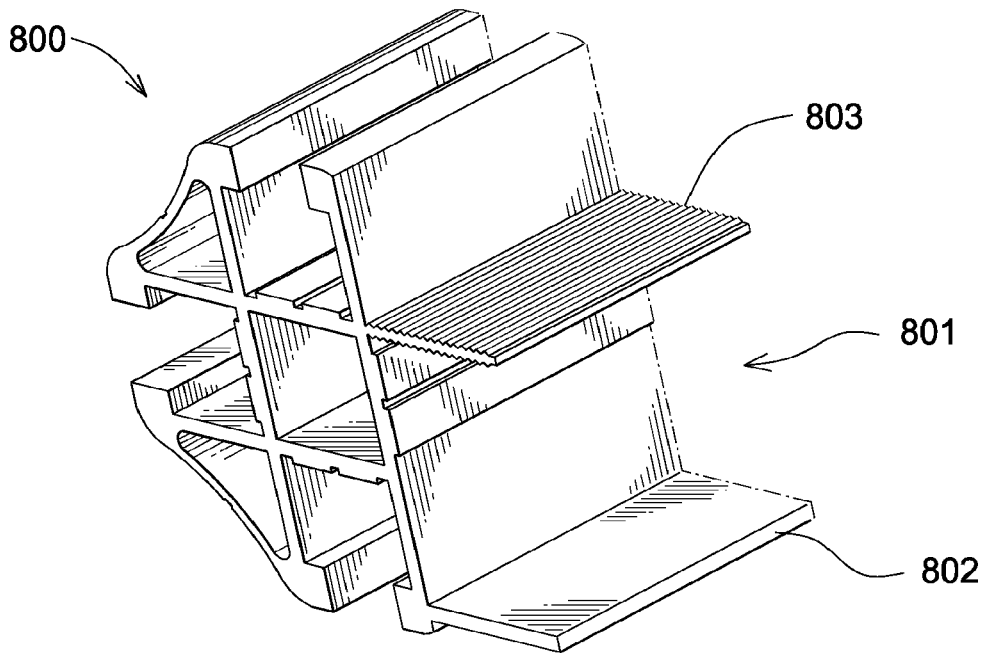


FIG. 11

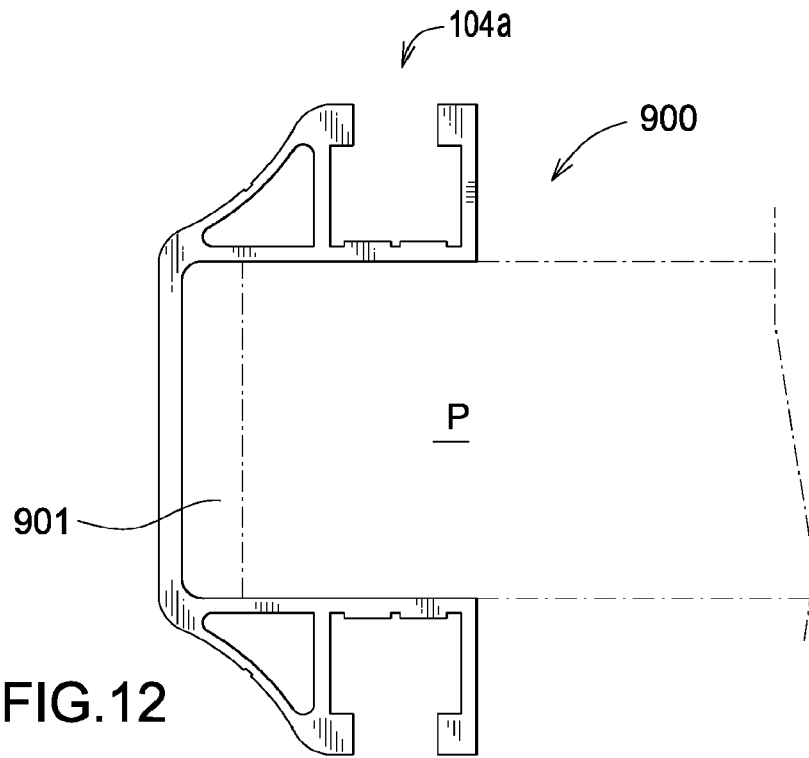


FIG. 12

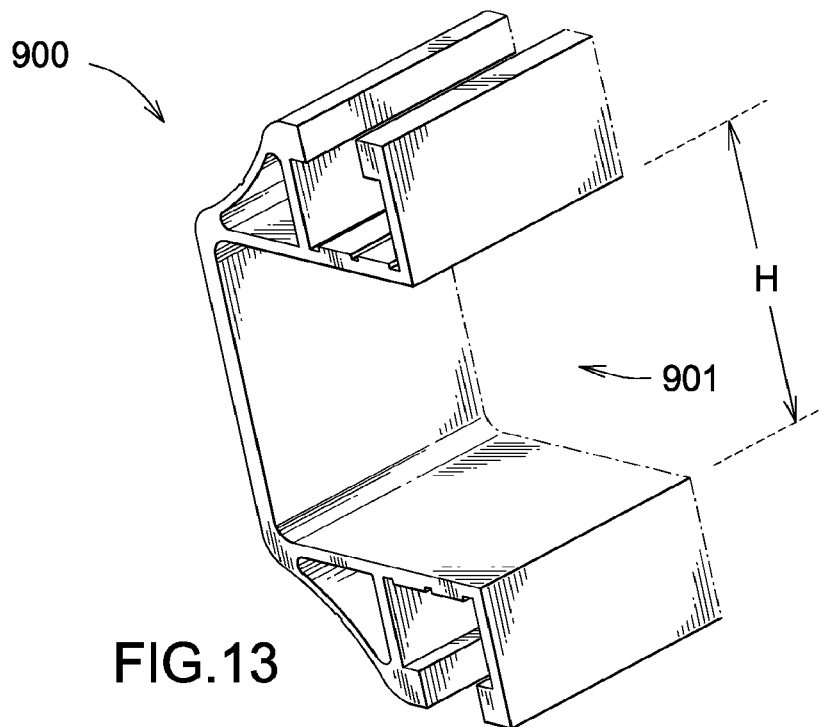


FIG. 13

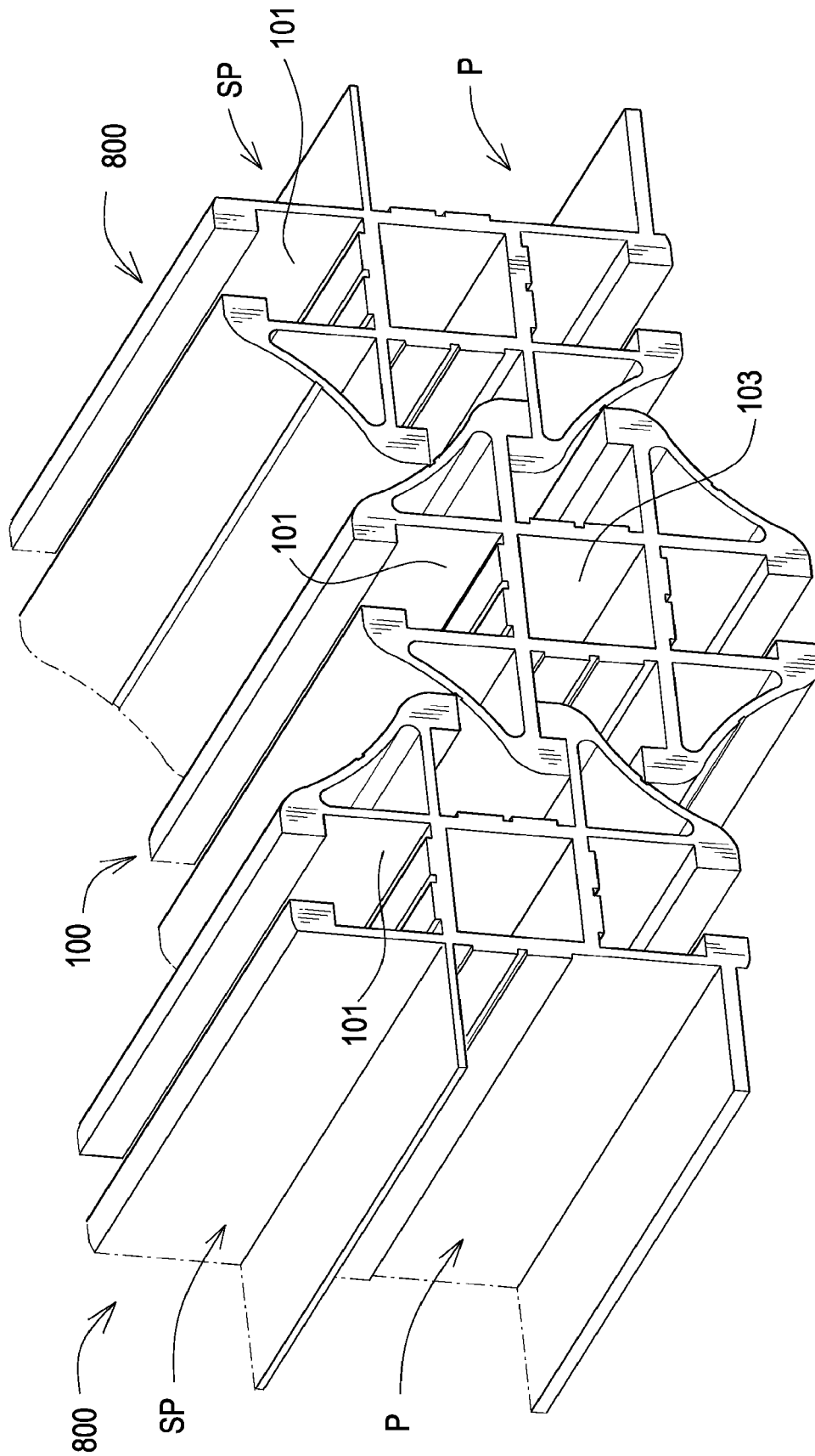


FIG.14

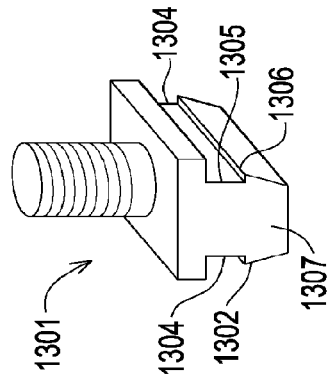
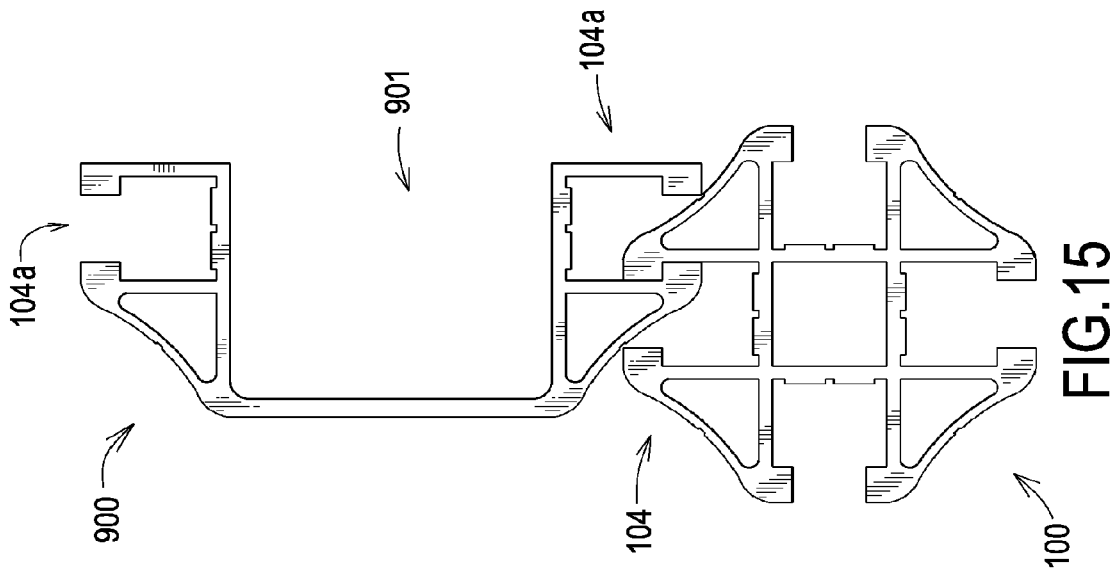


FIG. 16

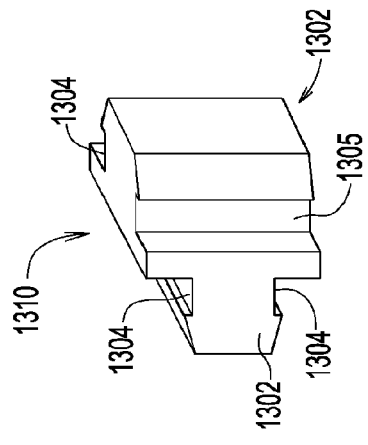


FIG. 17

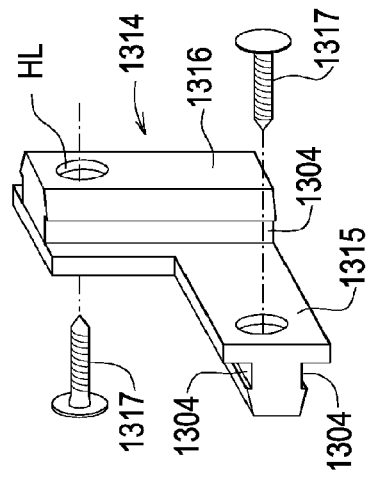
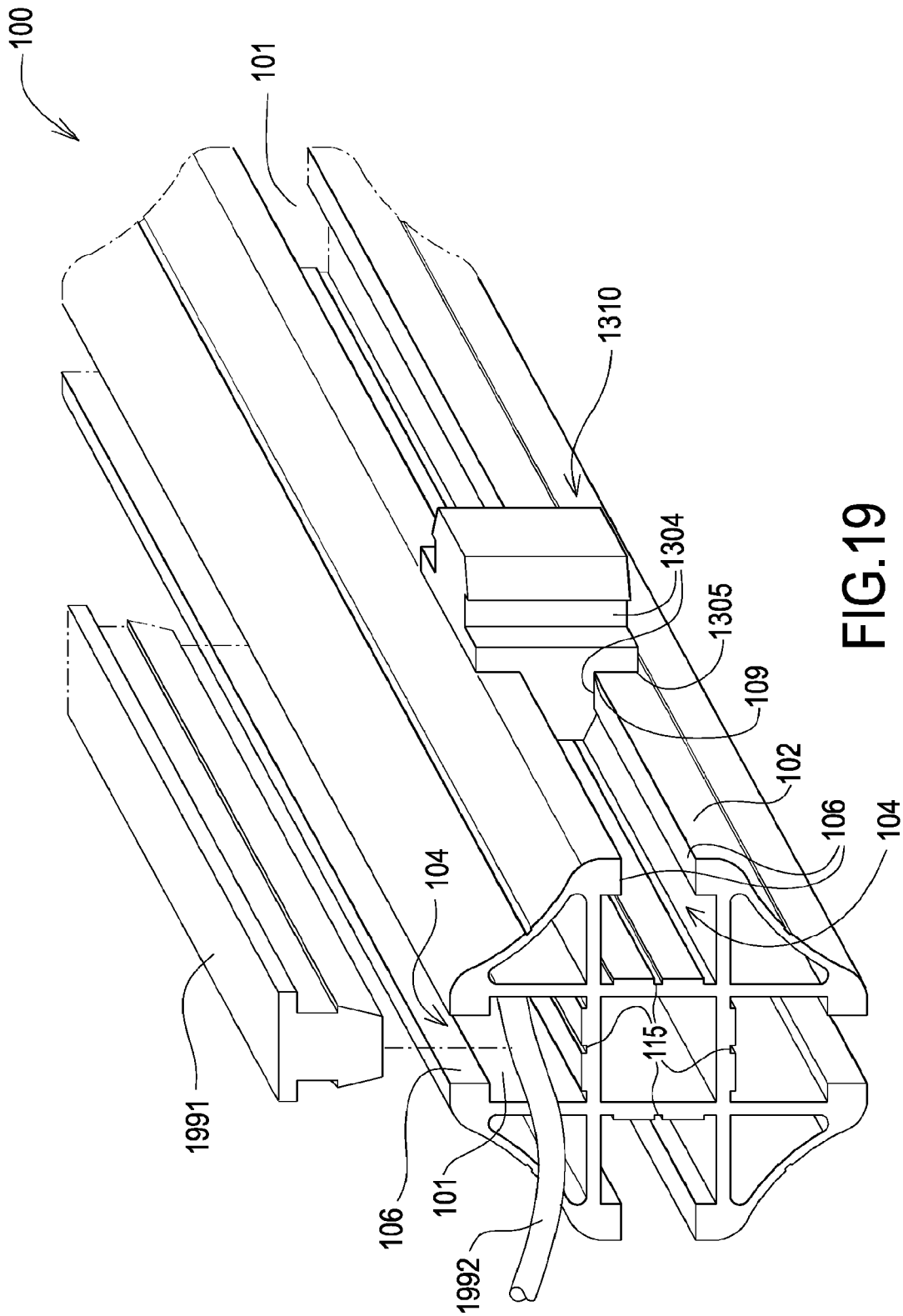


FIG. 18



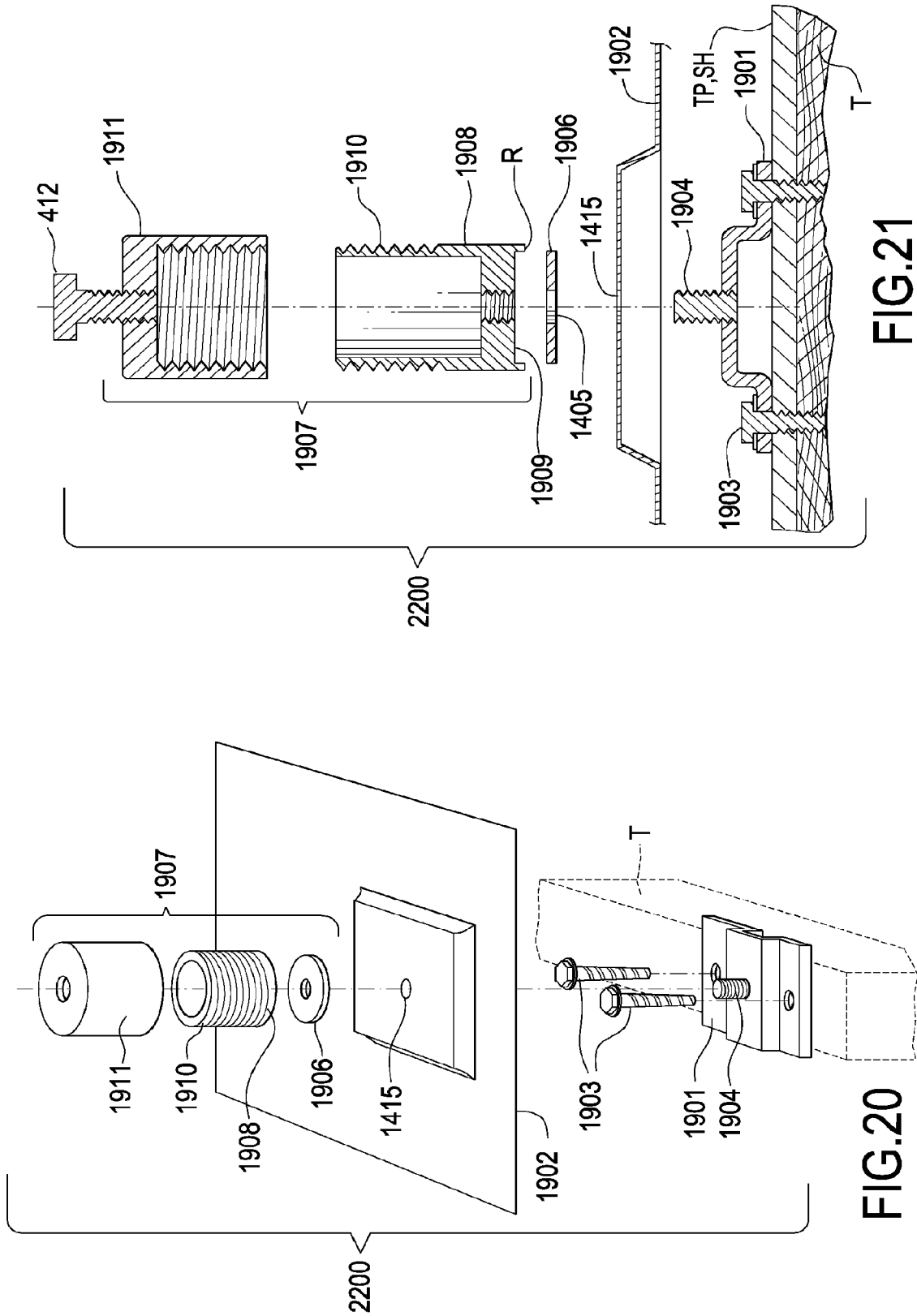


FIG.21

FIG.20

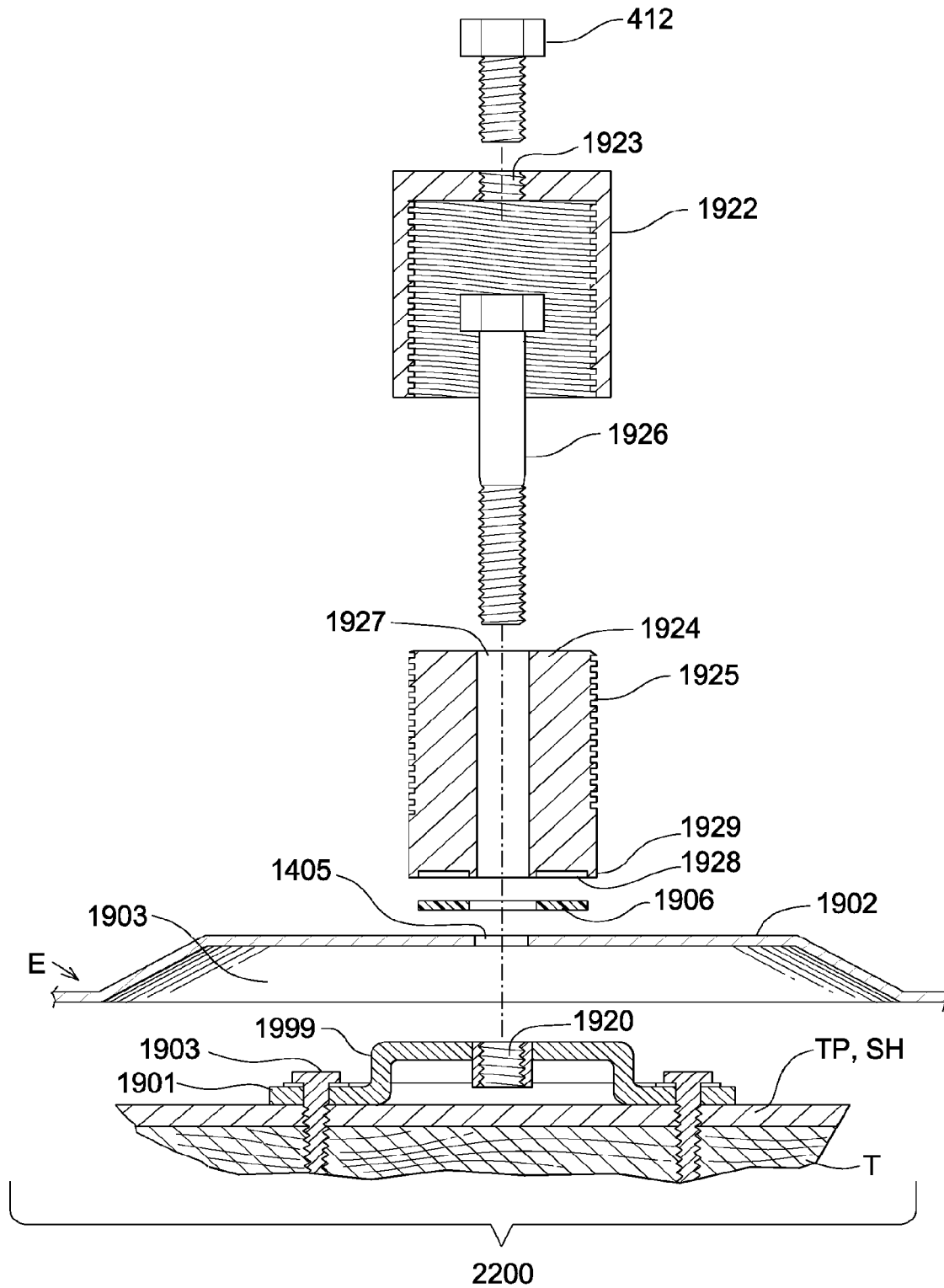


FIG.22

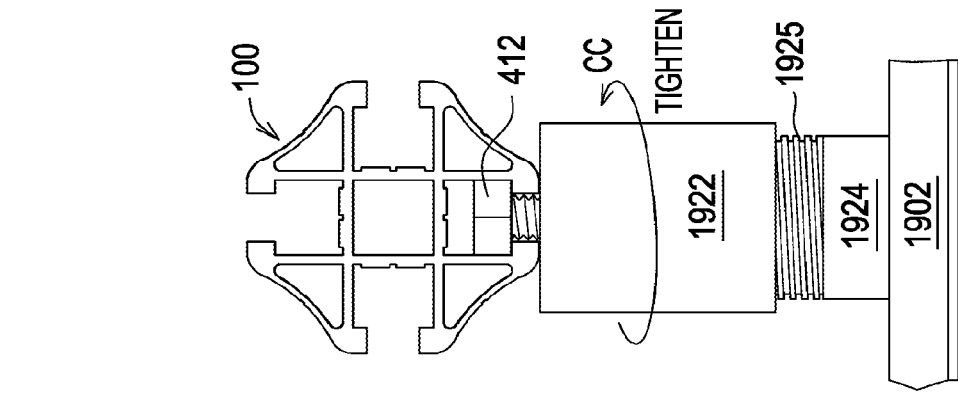


FIG. 23

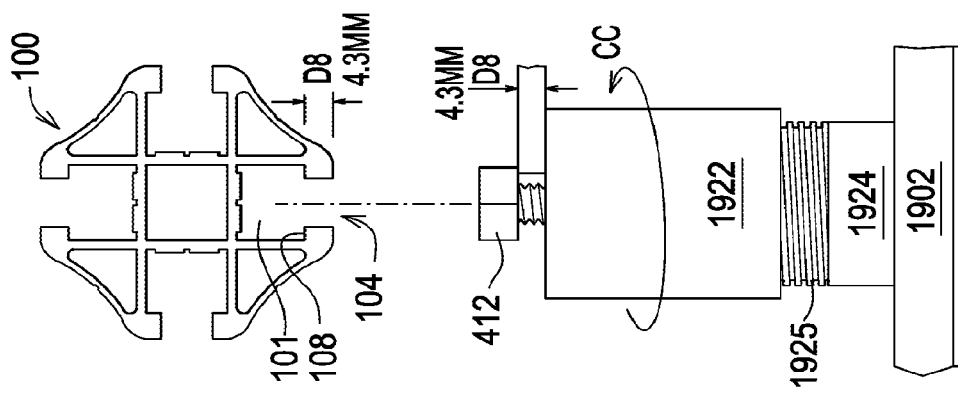


FIG. 24

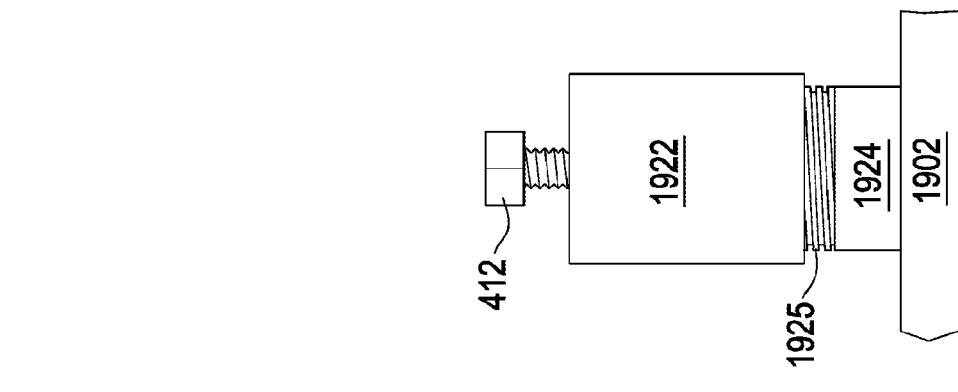


FIG. 25

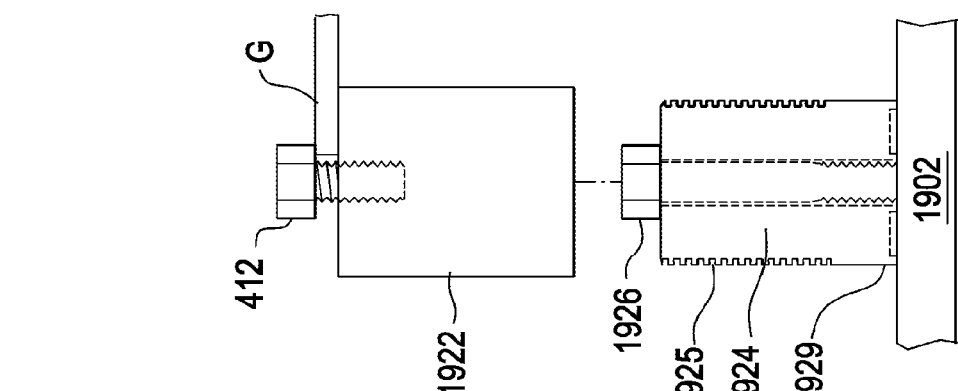


FIG. 26

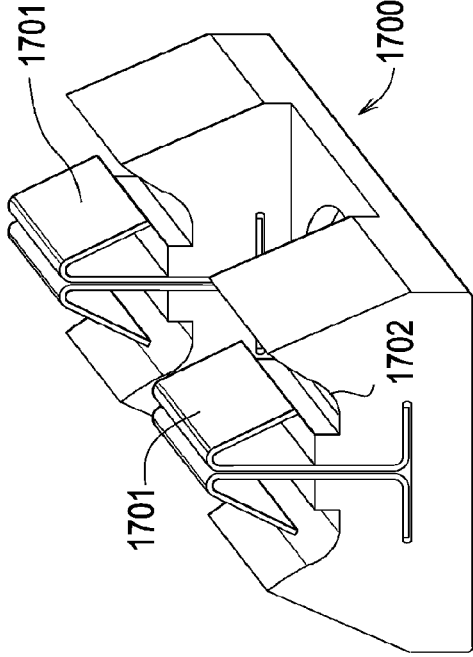


FIG. 27

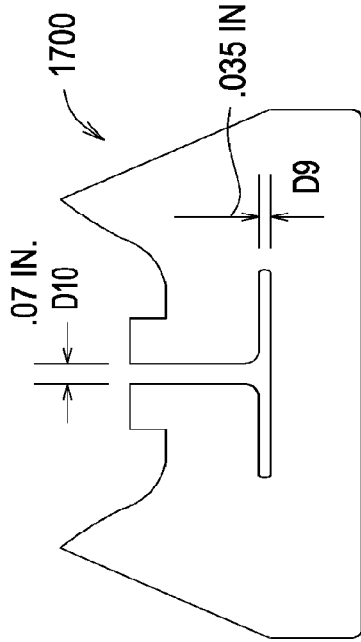


FIG. 28

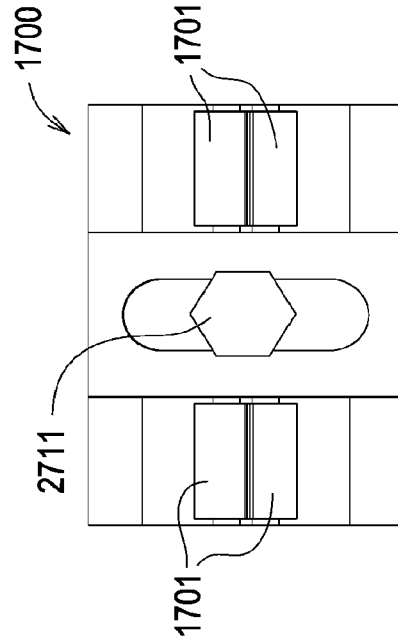


FIG. 29

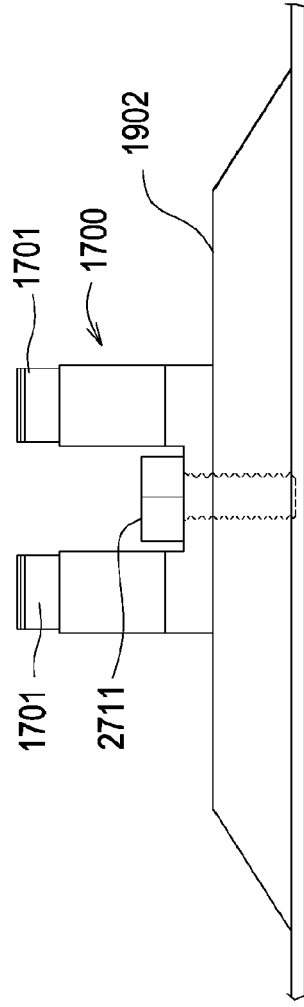


FIG. 30

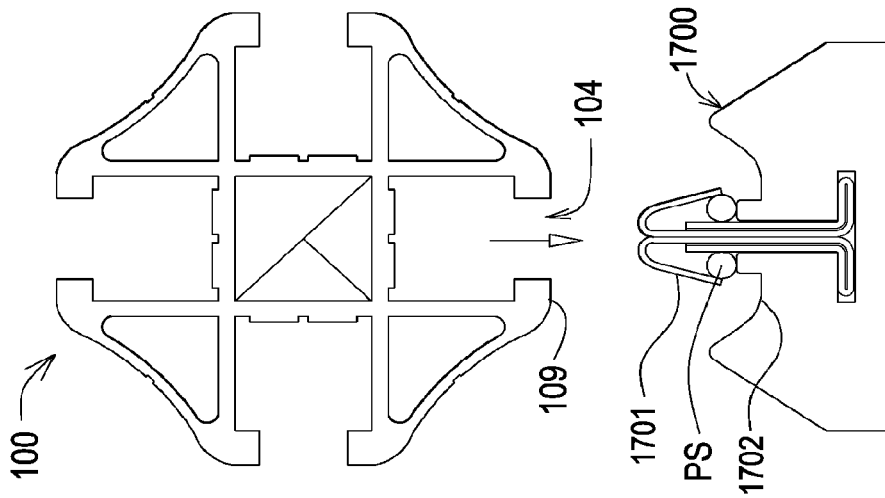


FIG. 31

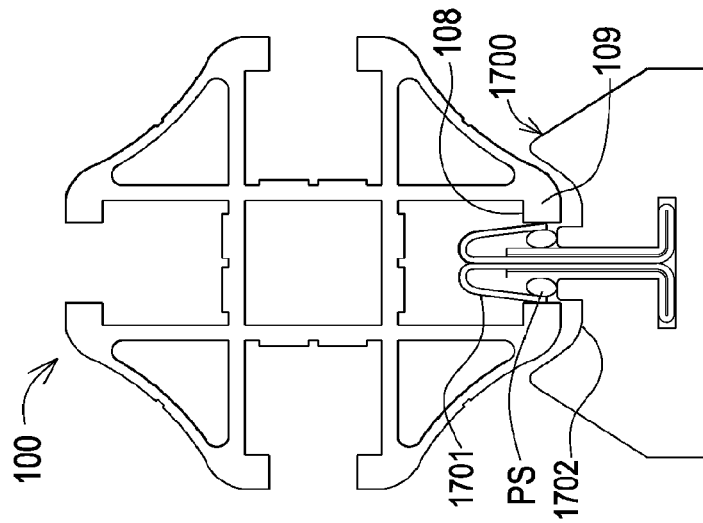


FIG. 32

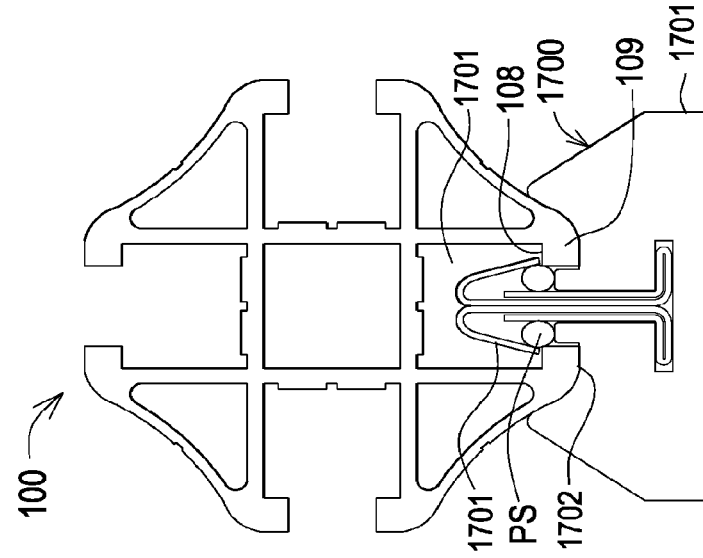


FIG. 33

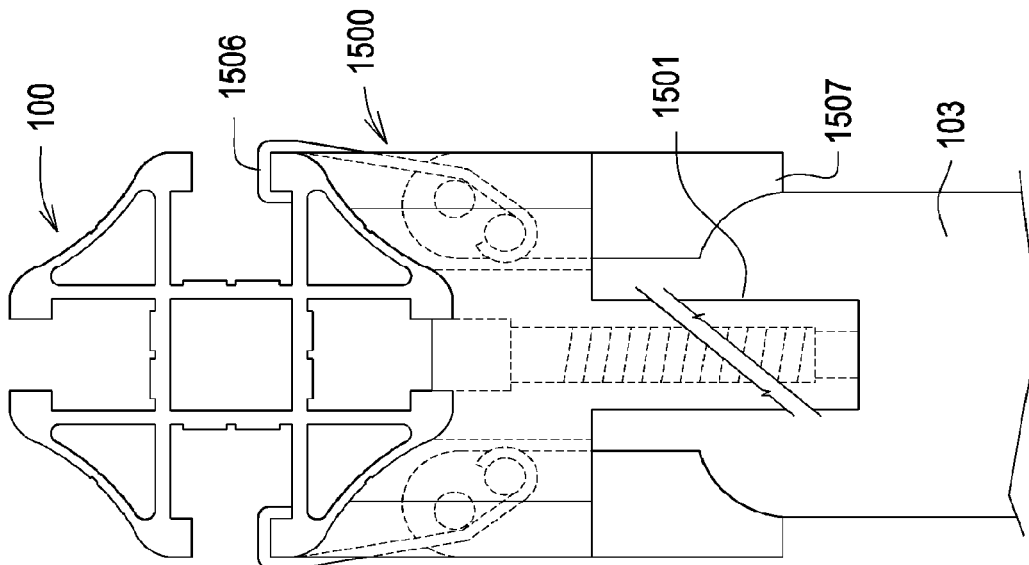


FIG. 34

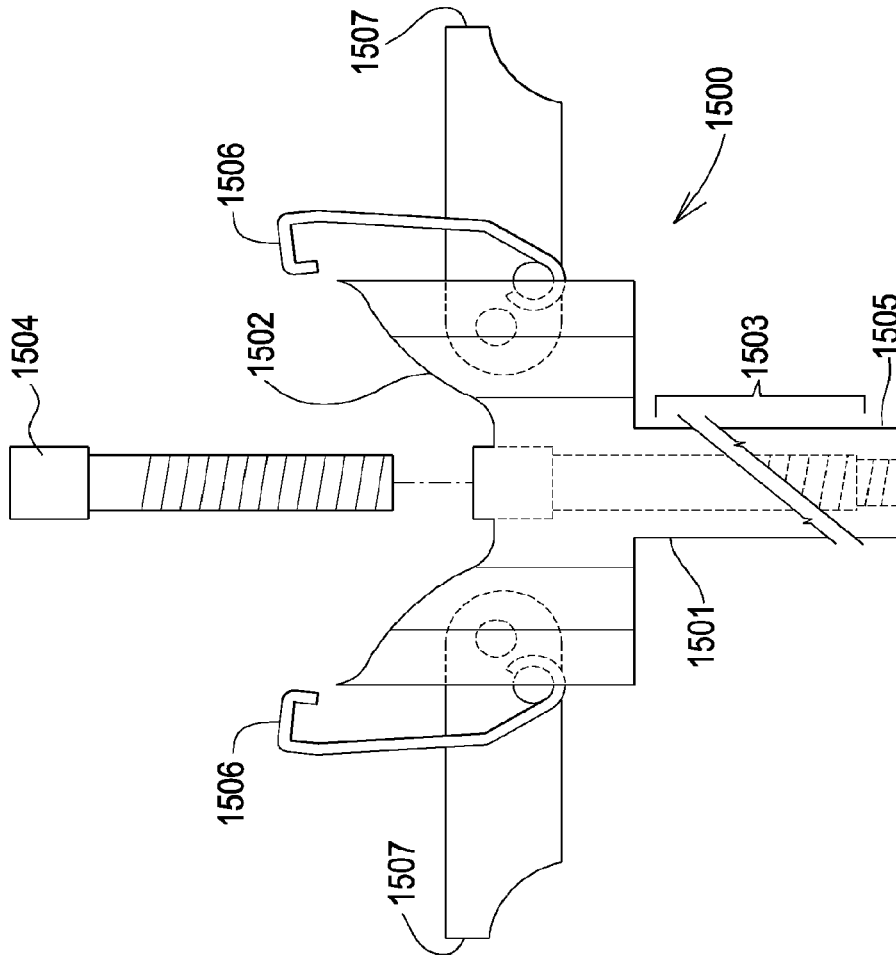


FIG. 35

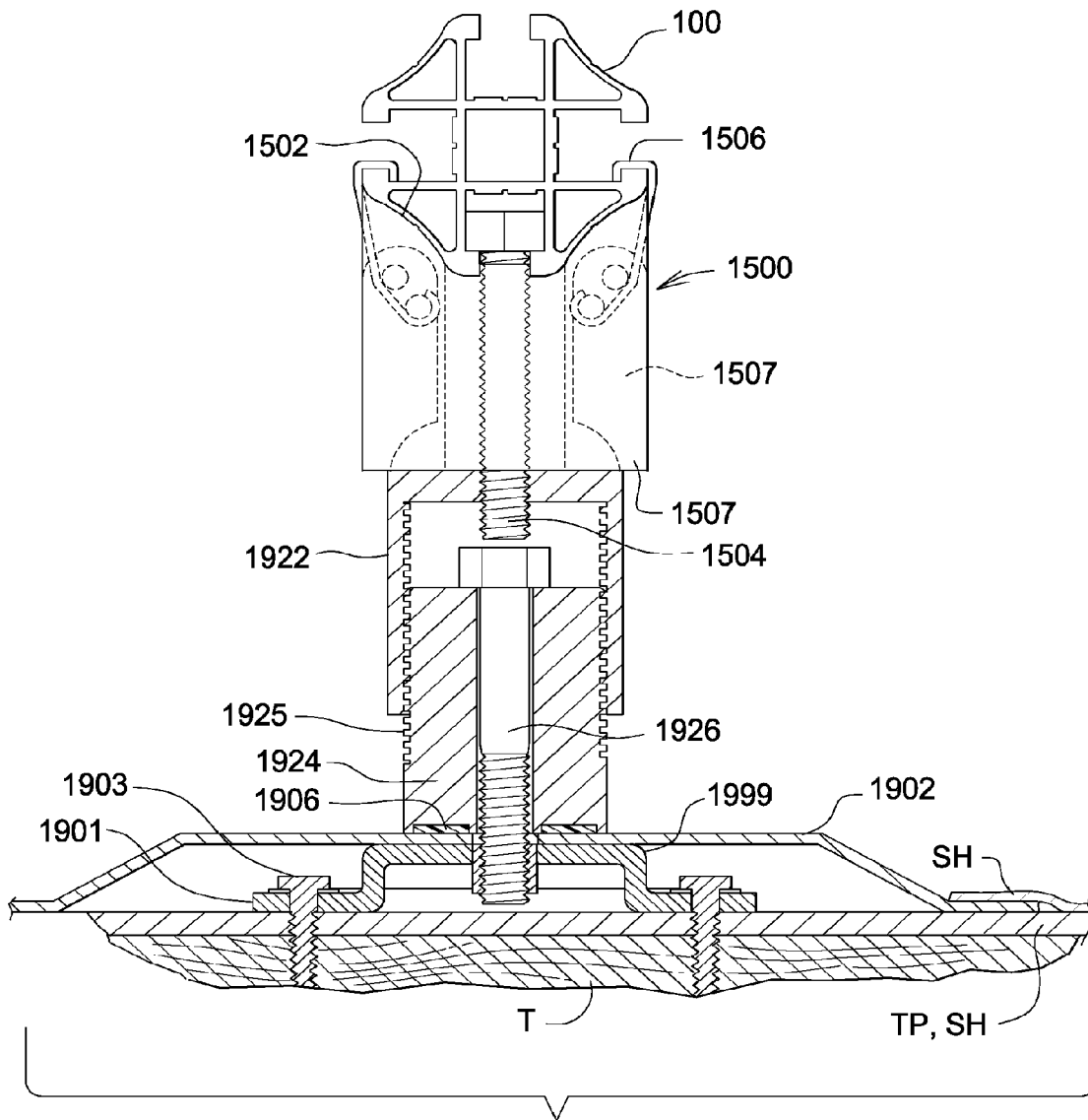
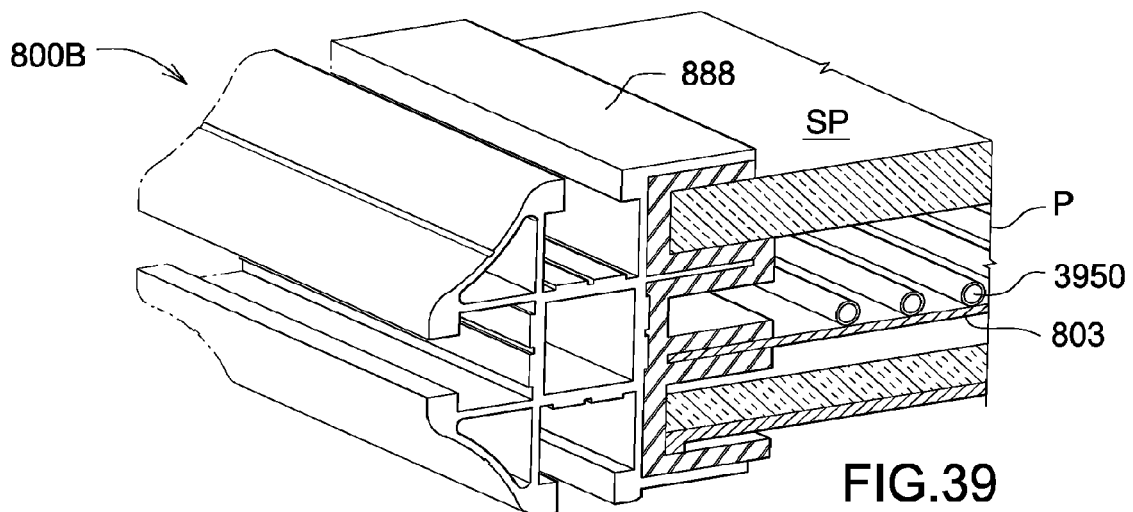
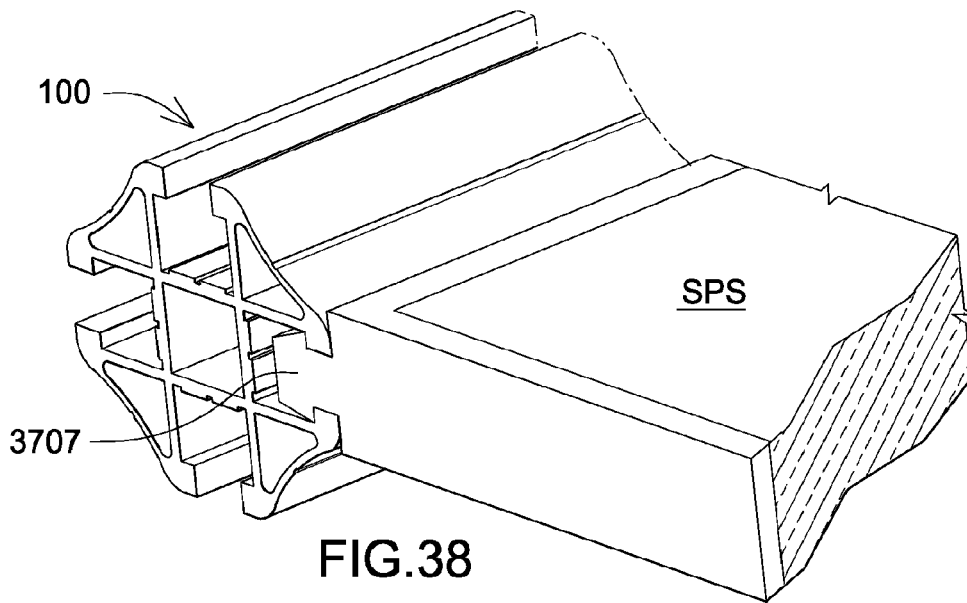
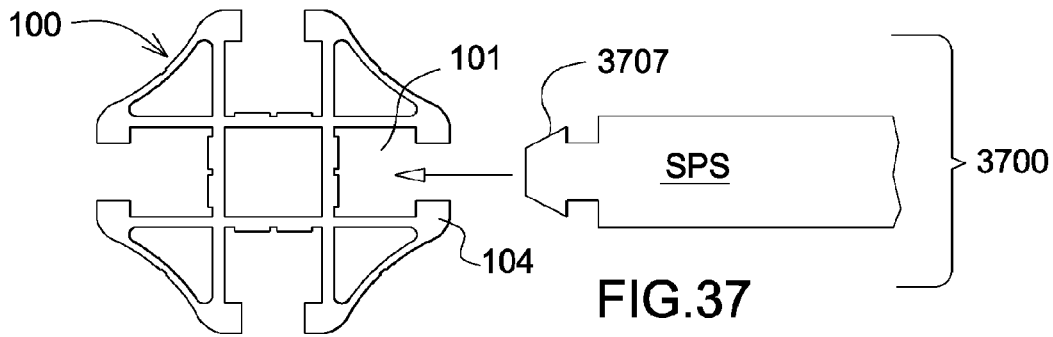


FIG.36



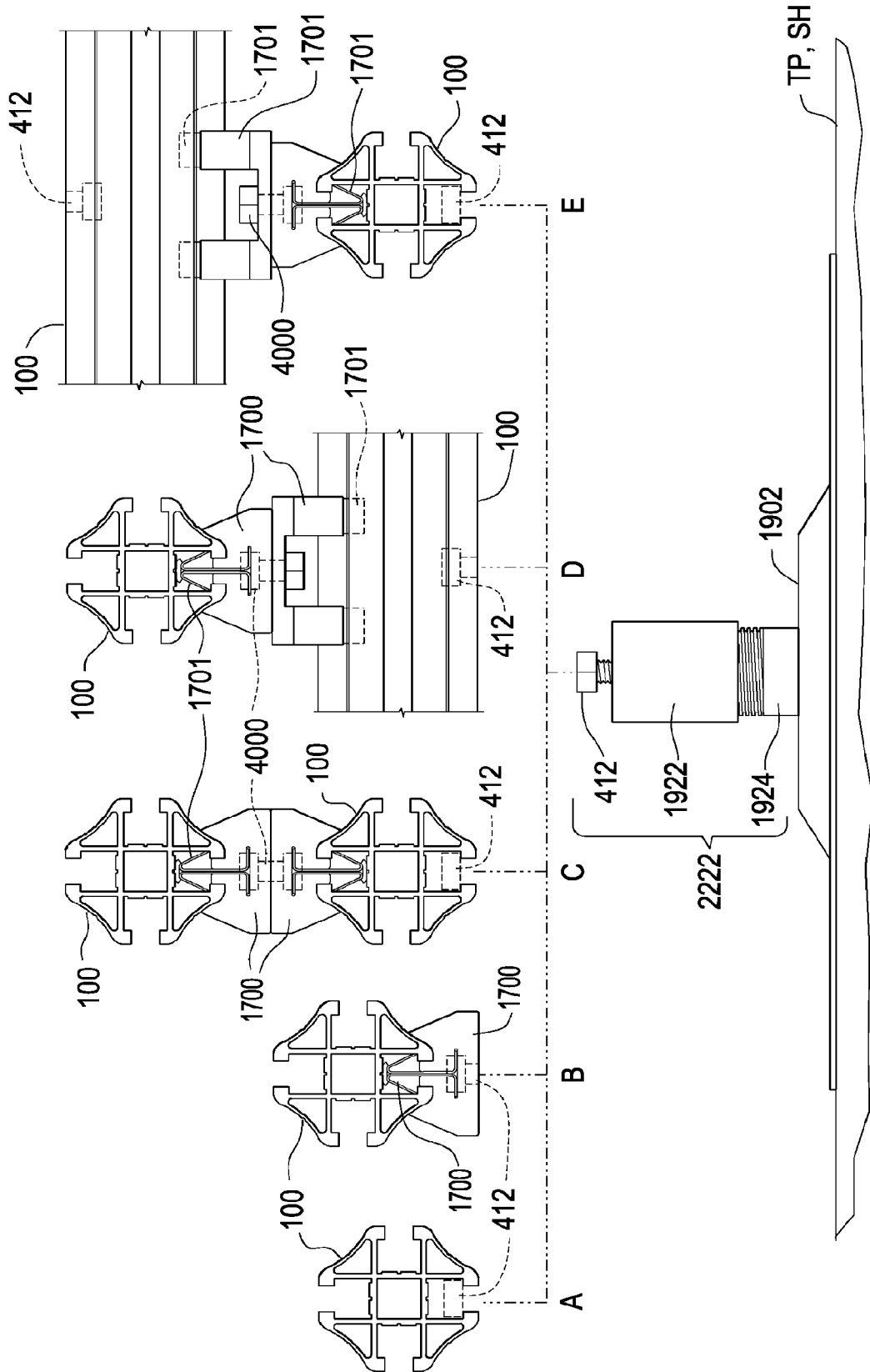


FIG.40

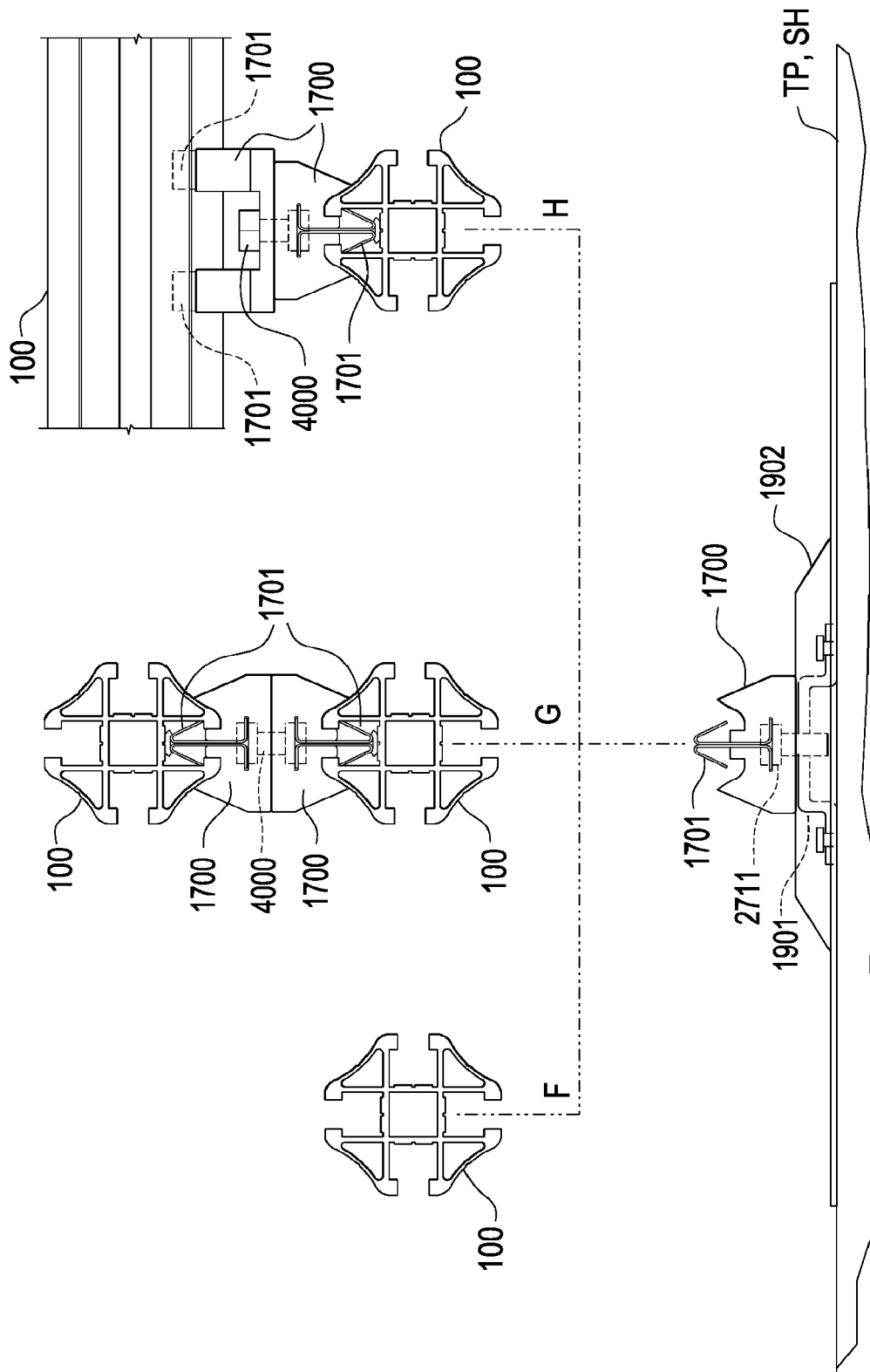


FIG. 41

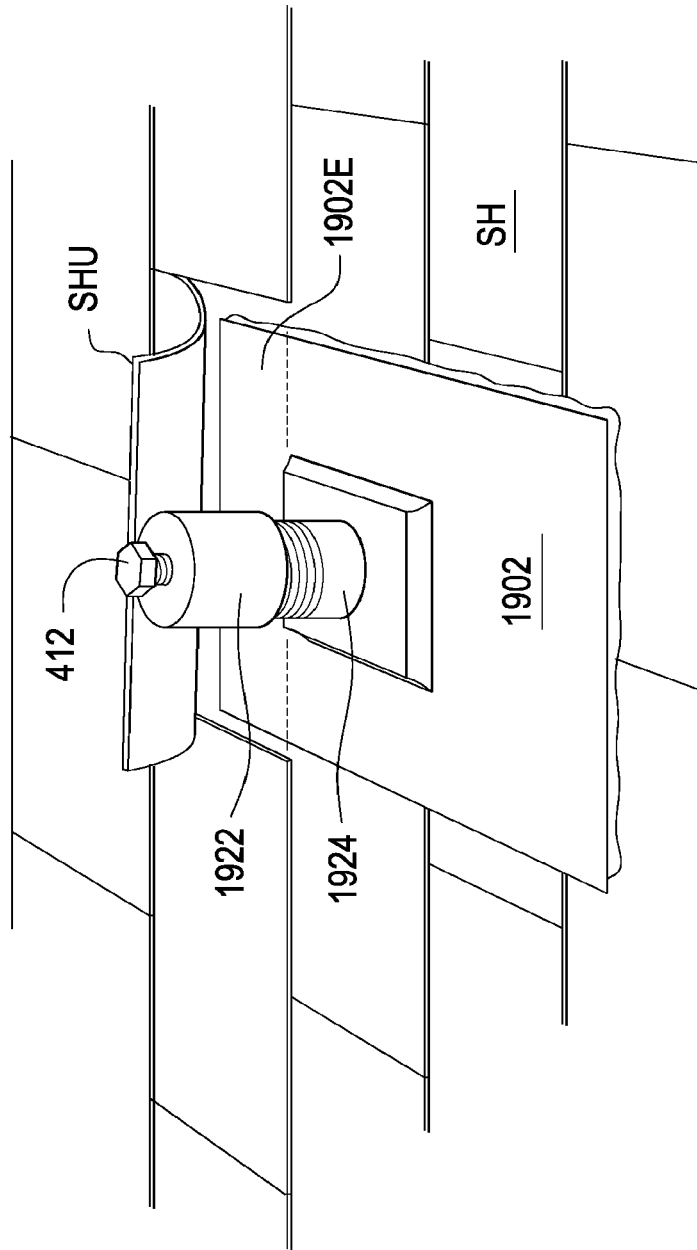


FIG.42

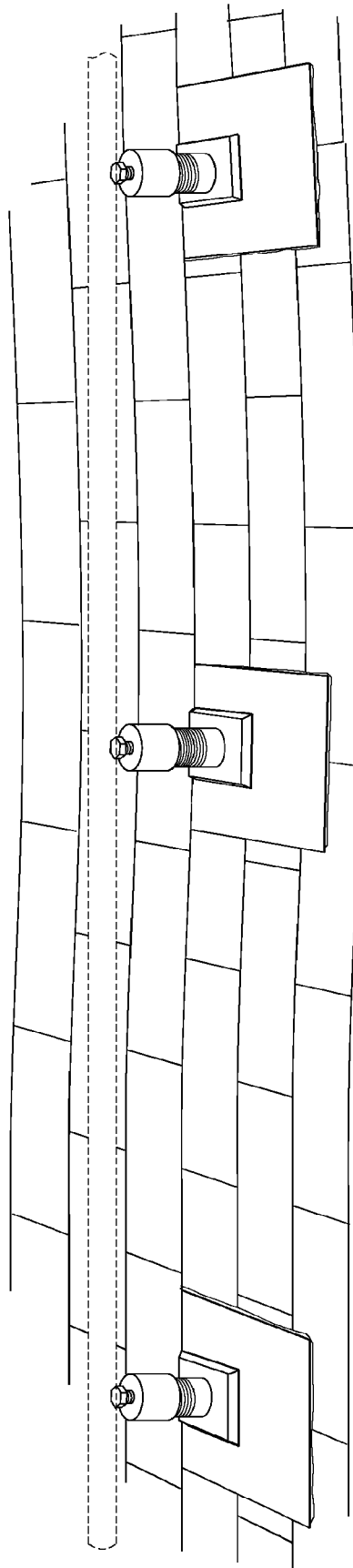


FIG.43

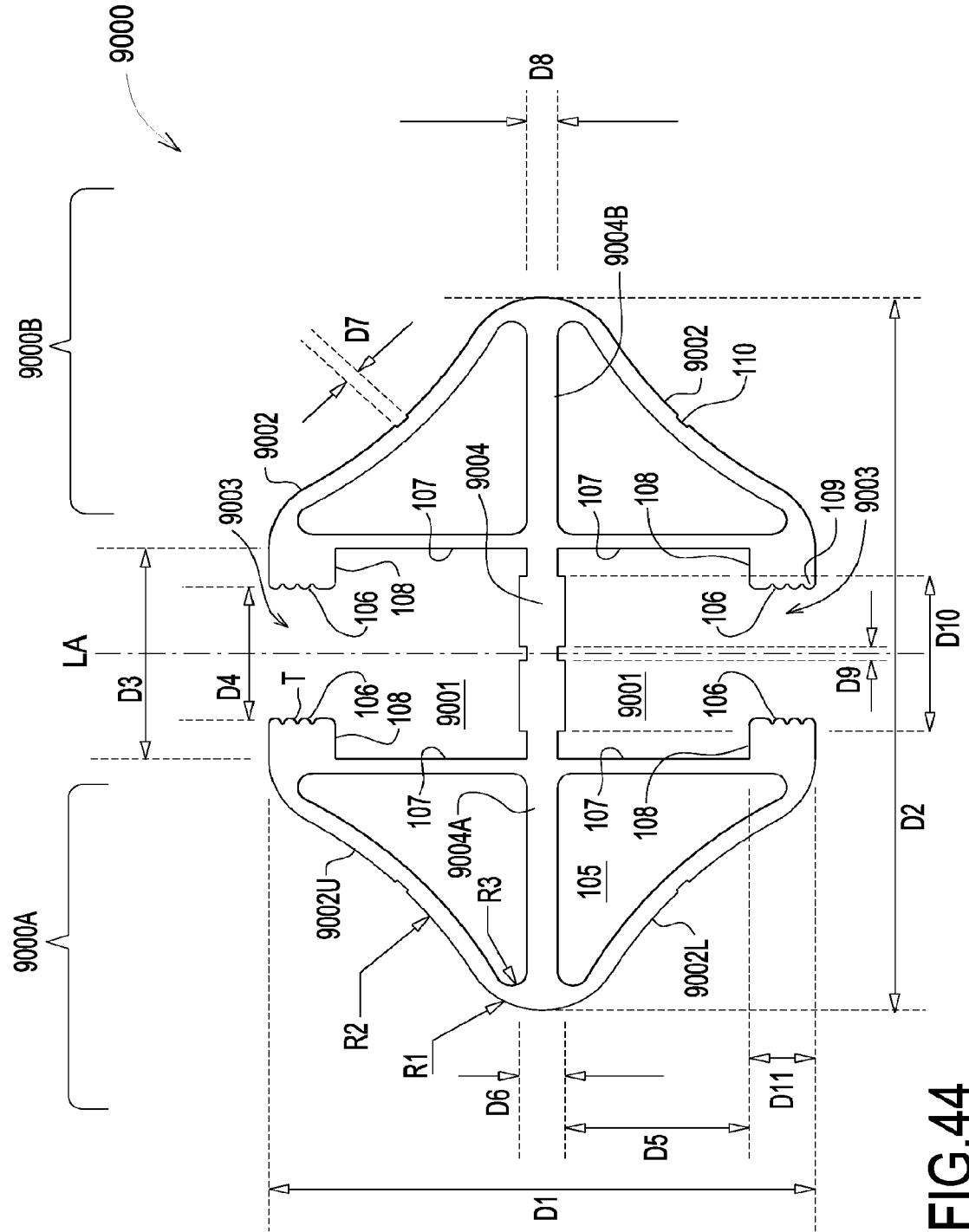


FIG.44

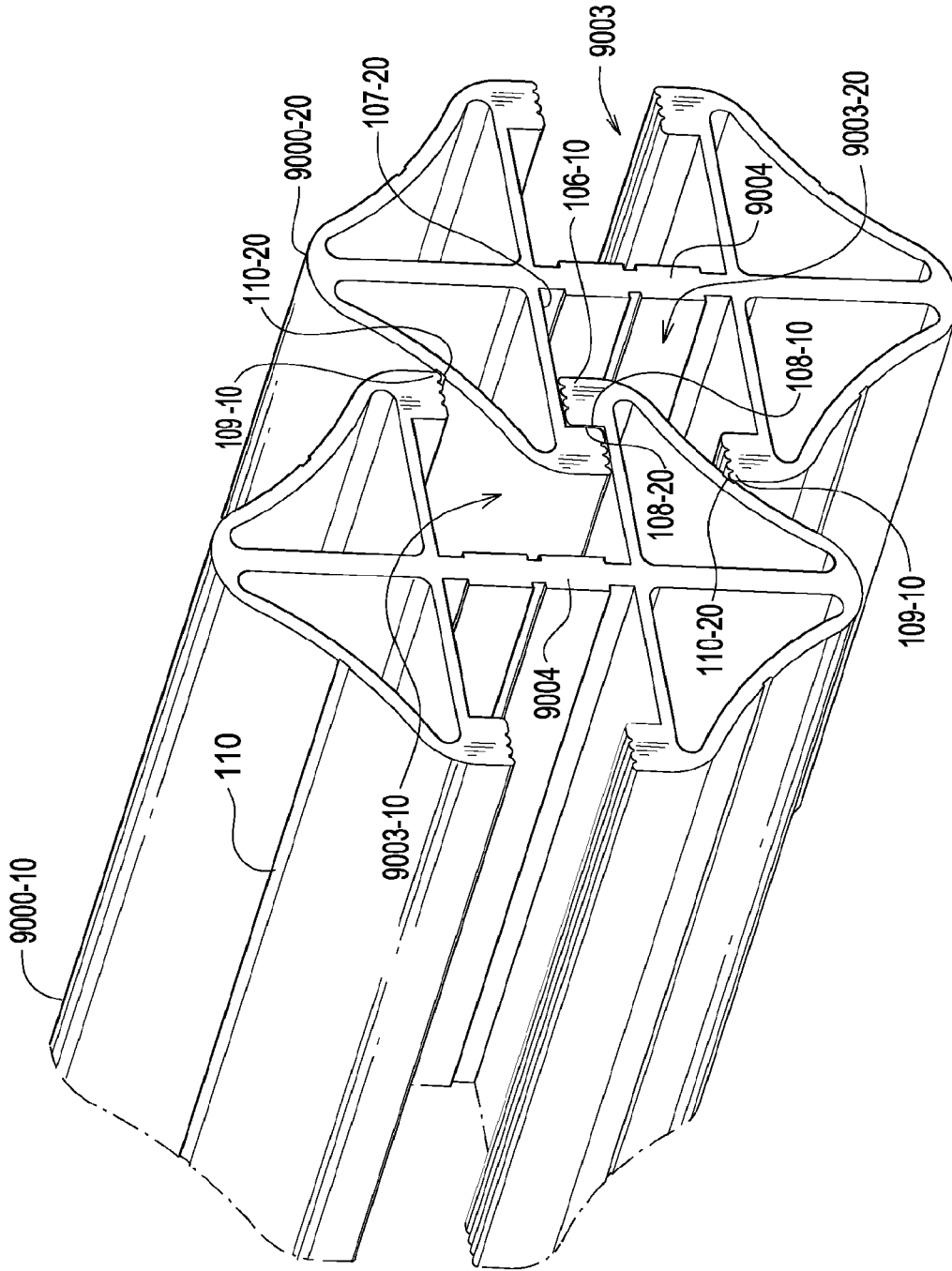


FIG. 45

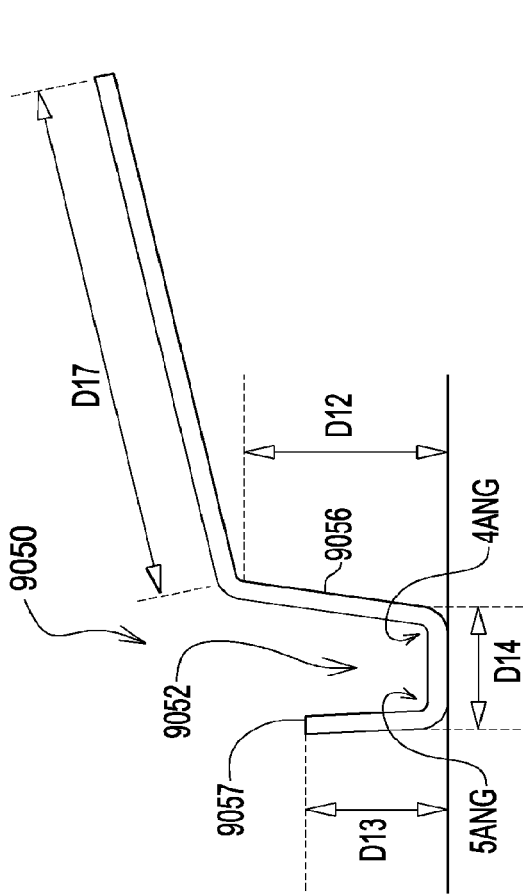


FIG.47

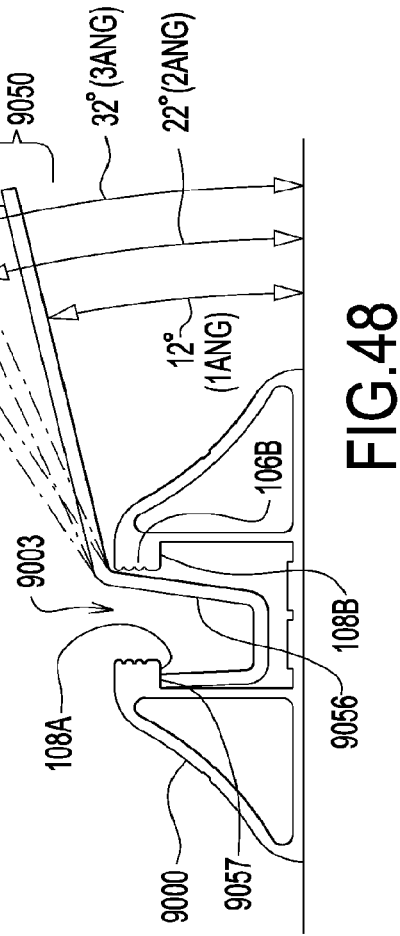


FIG.48

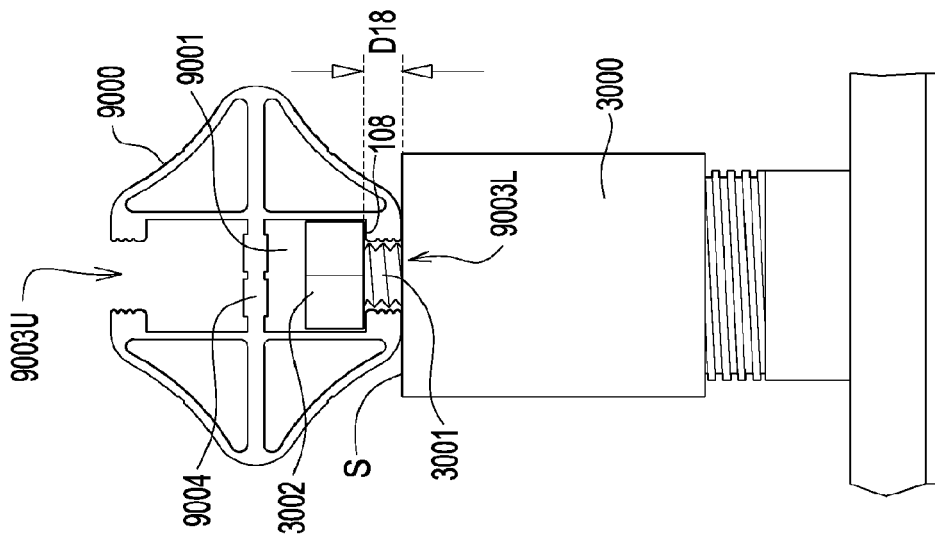


FIG.46

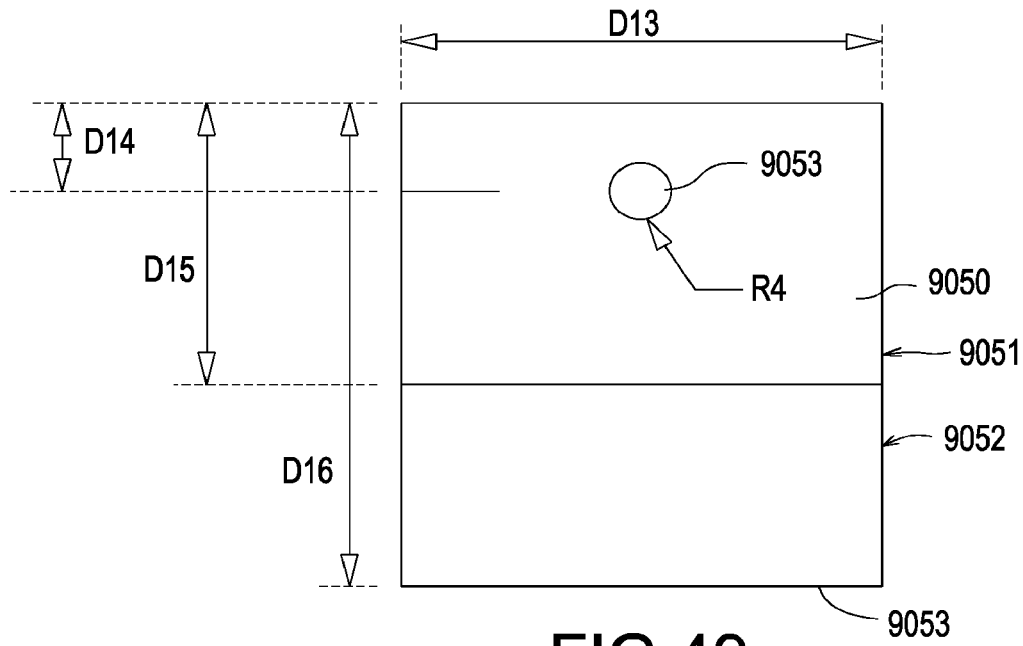


FIG. 49

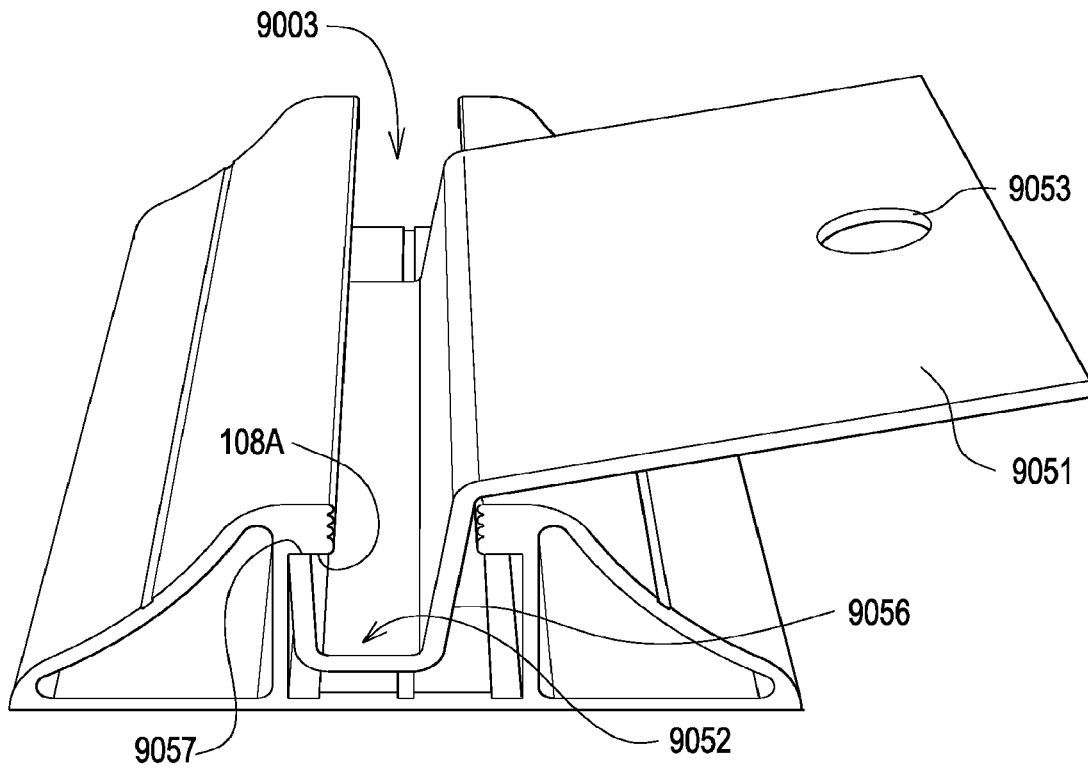


FIG. 50

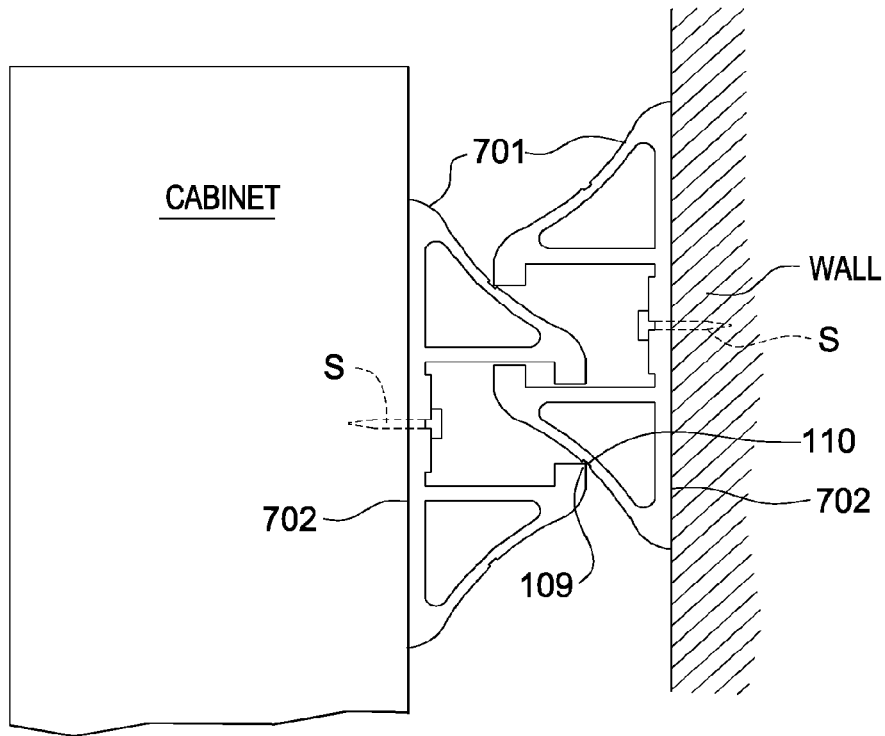


FIG. 51

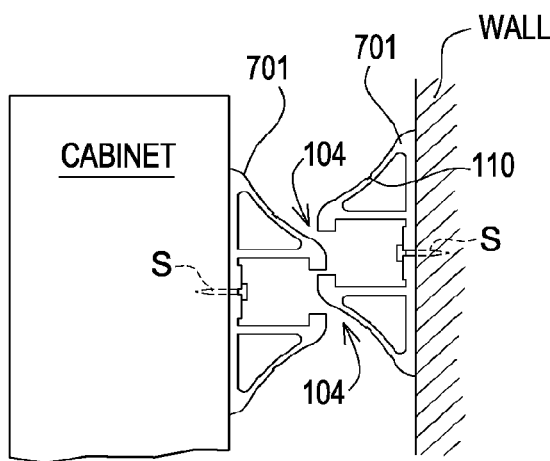


FIG. 52

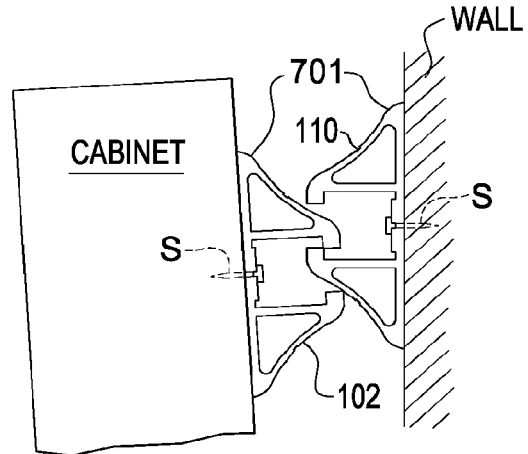


FIG. 53

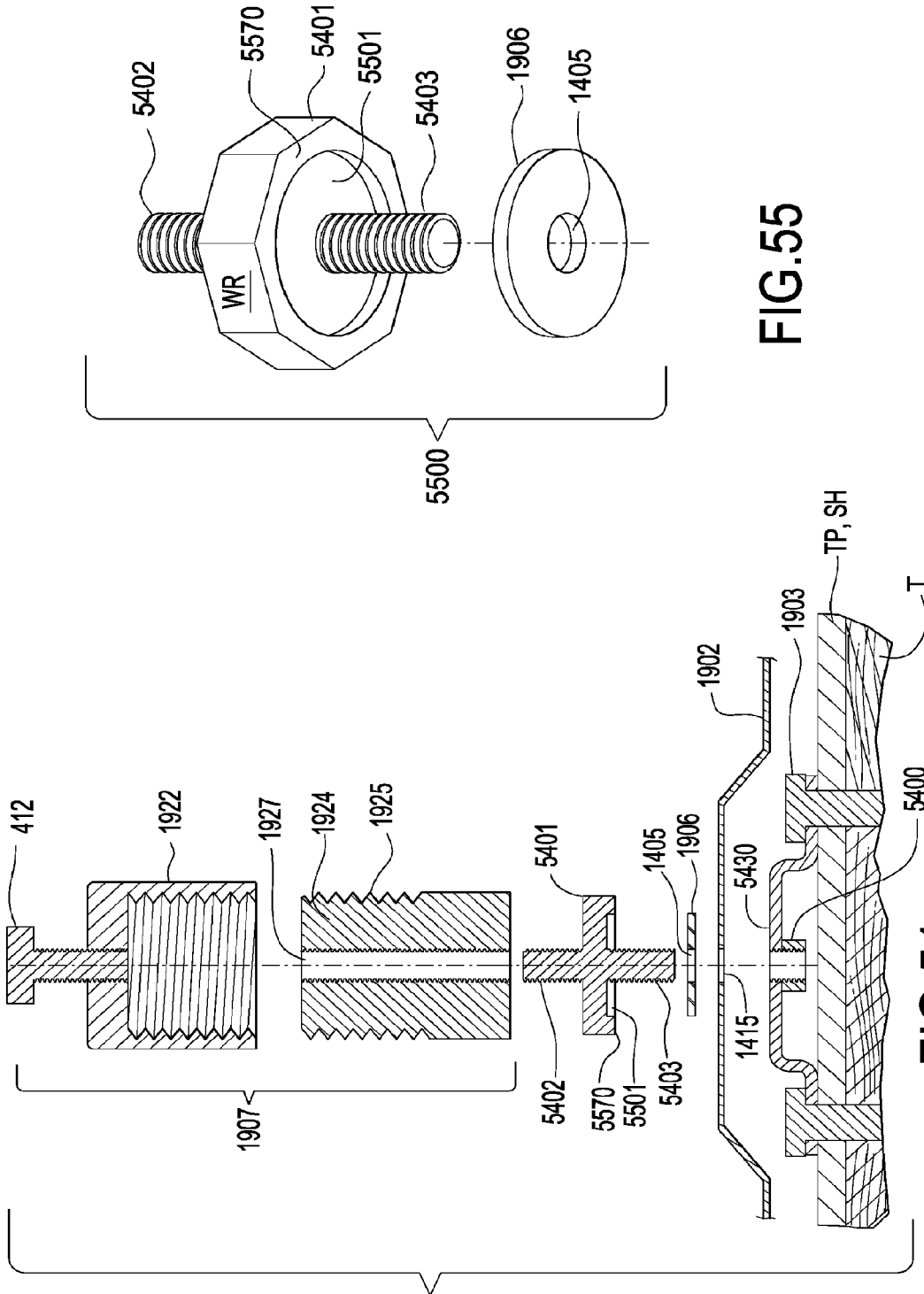
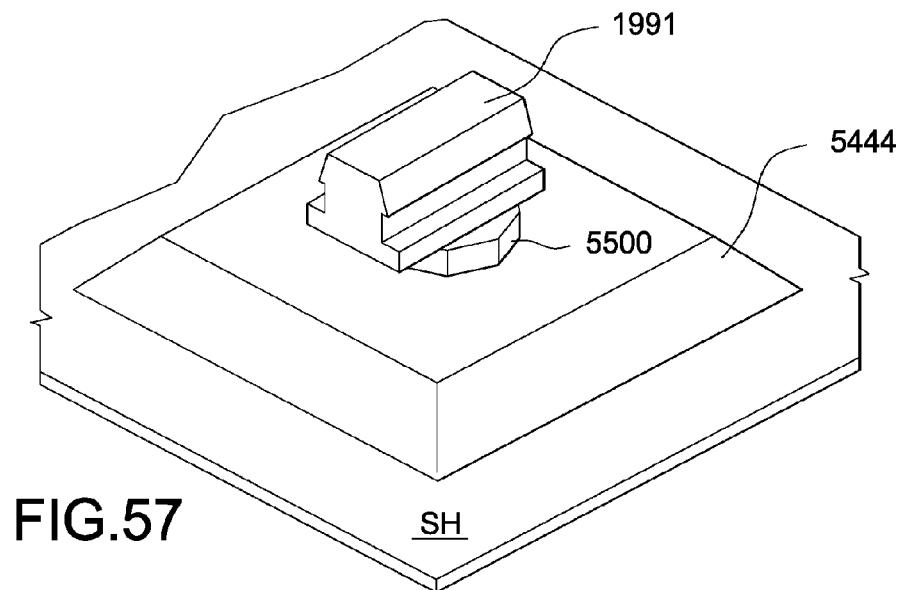
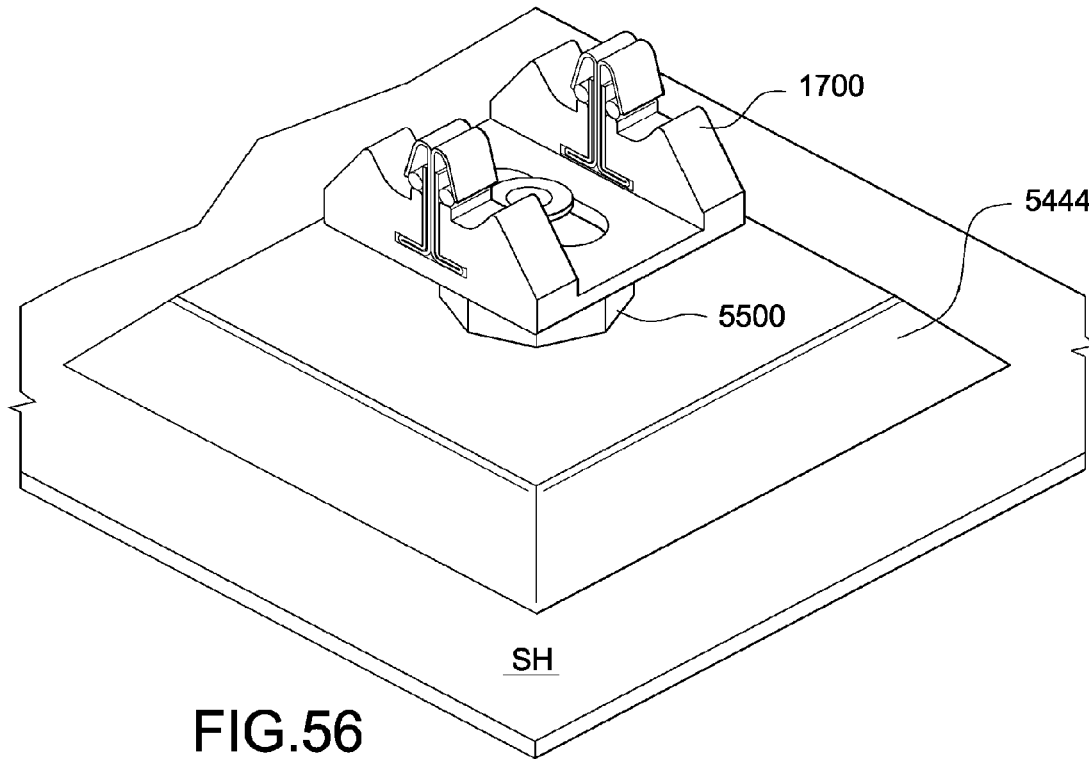


FIG. 55

FIG. 54



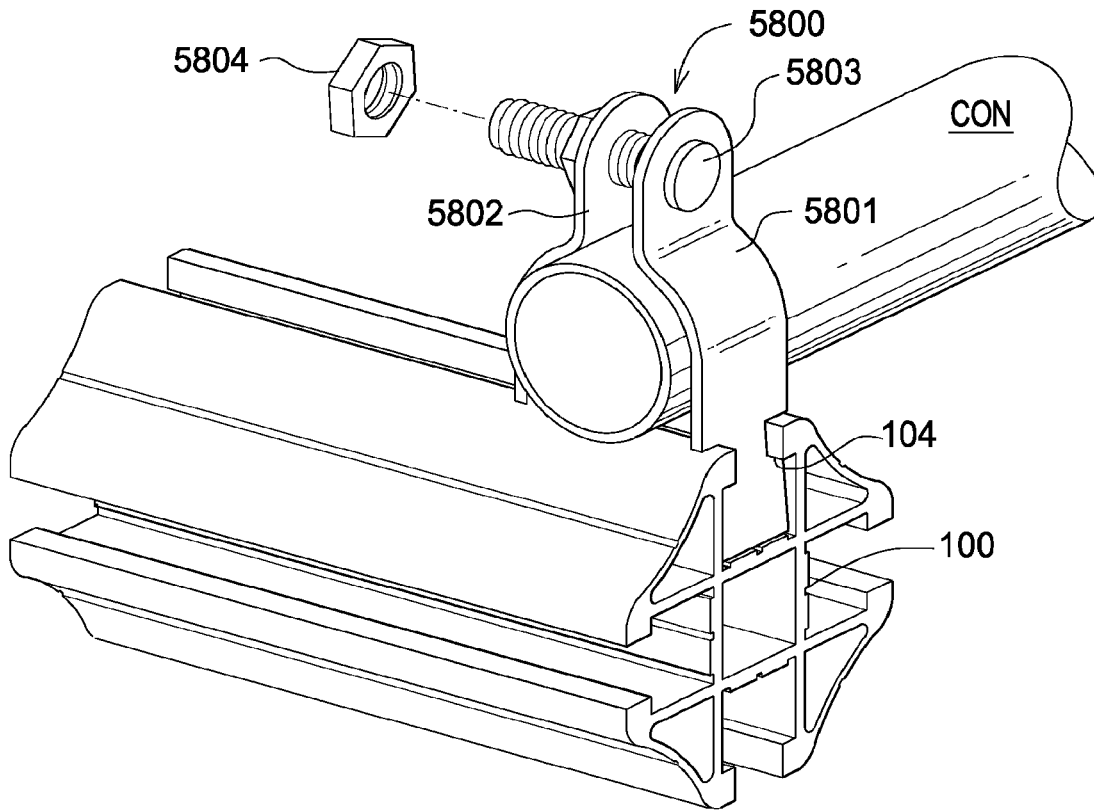


FIG.58

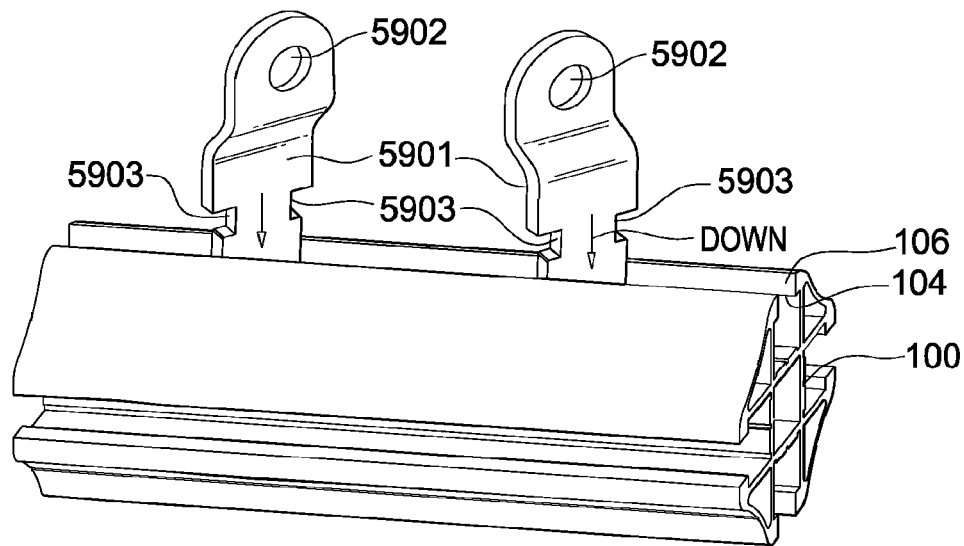


FIG.59

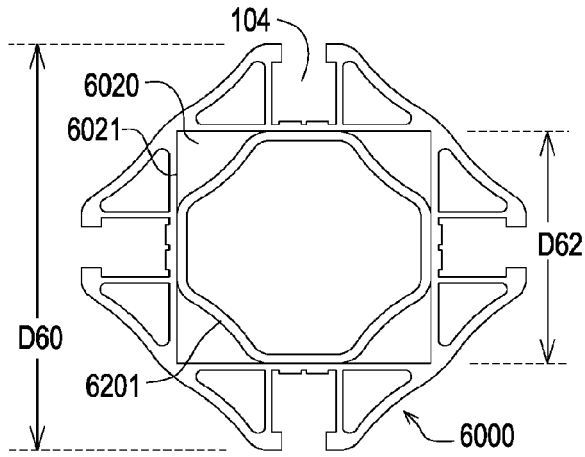


FIG. 60

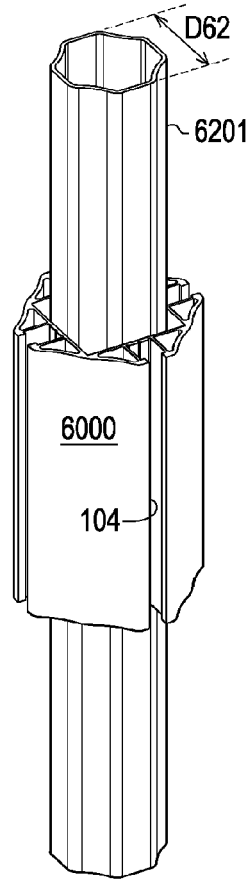


FIG. 62

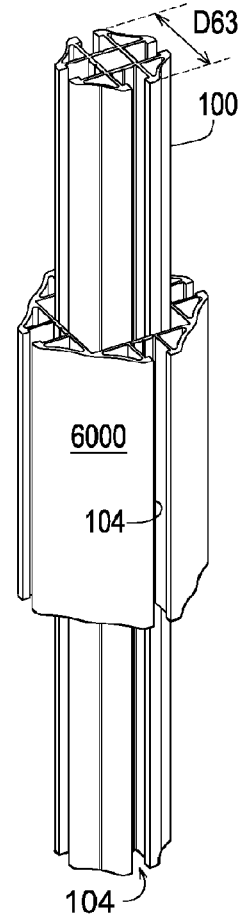


FIG. 63

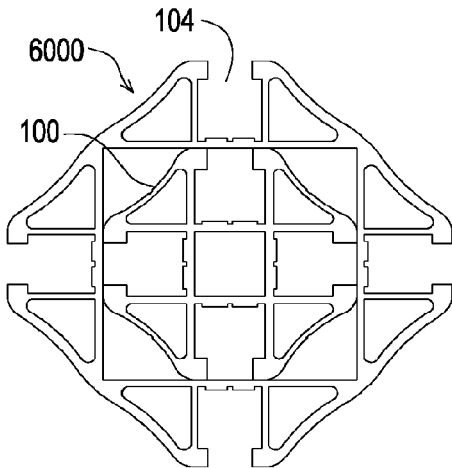


FIG. 61

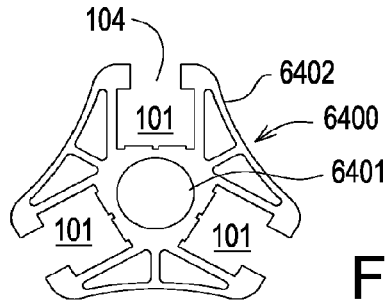


FIG. 64

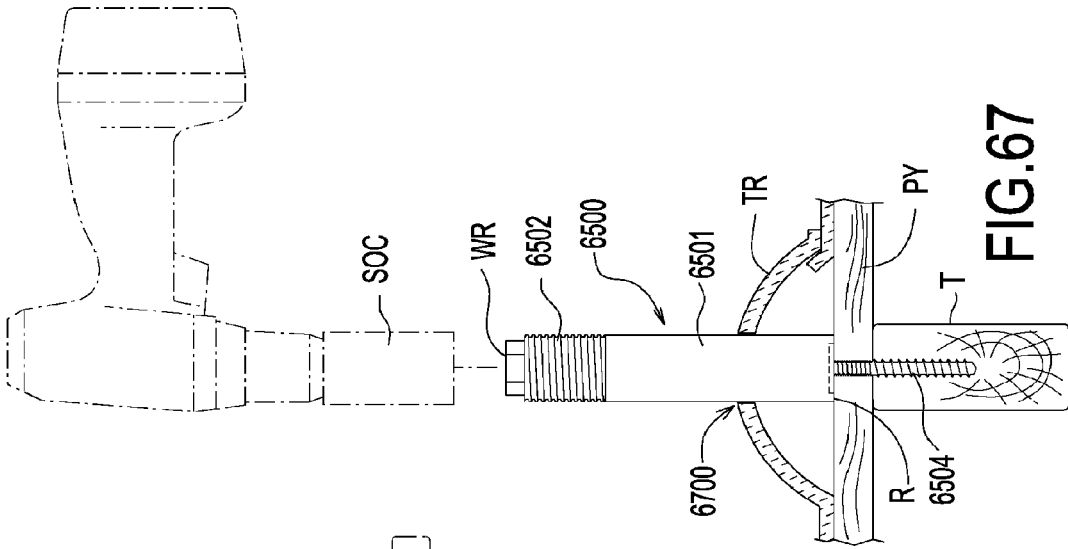


FIG. 67

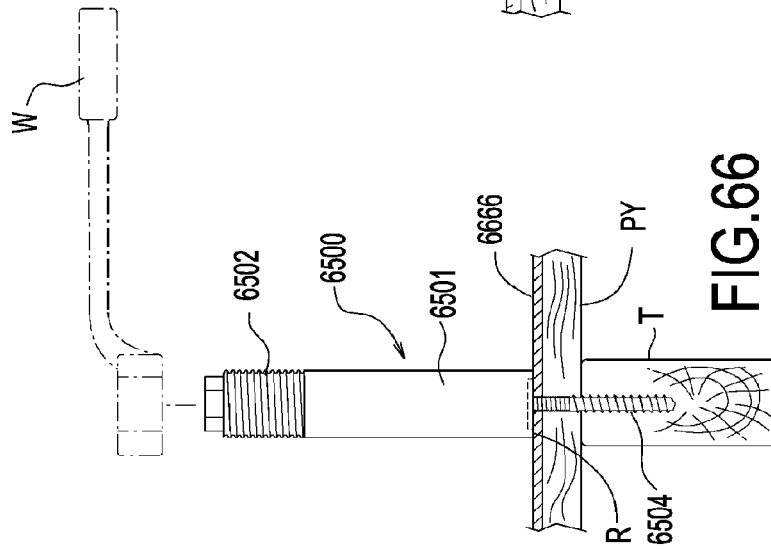


FIG. 66

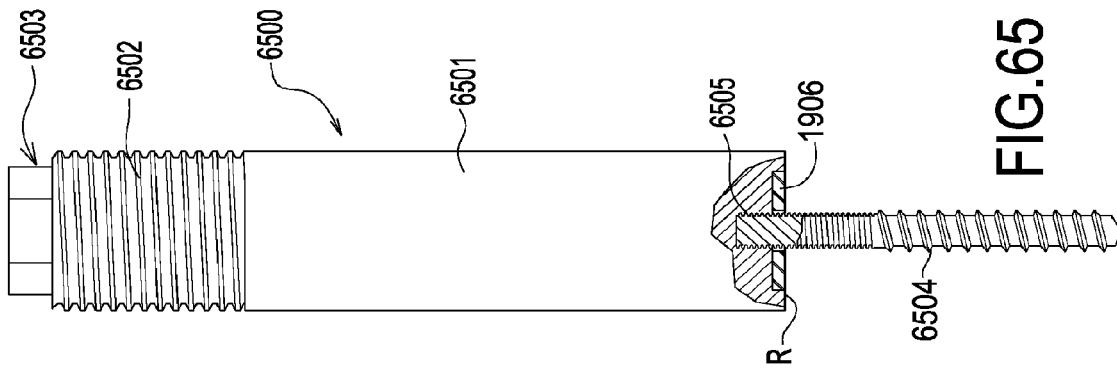


FIG. 65

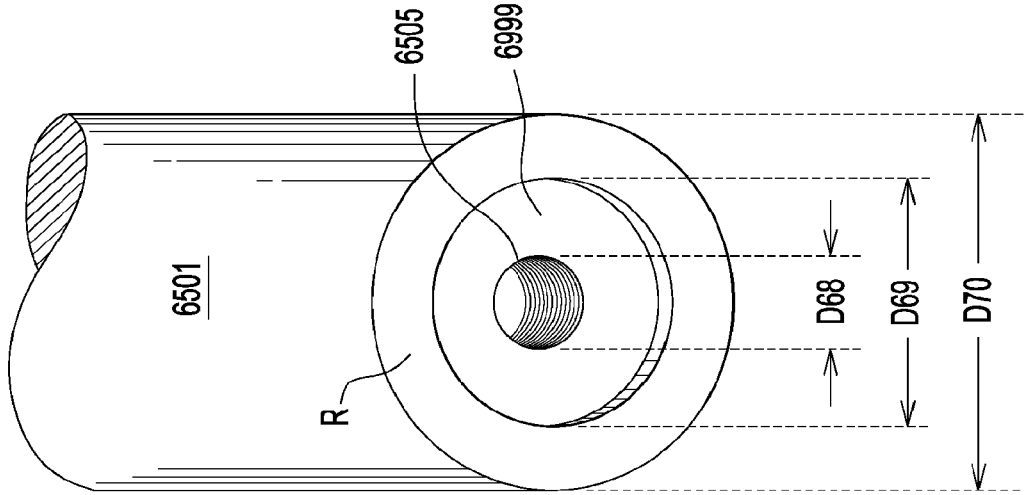


FIG. 69

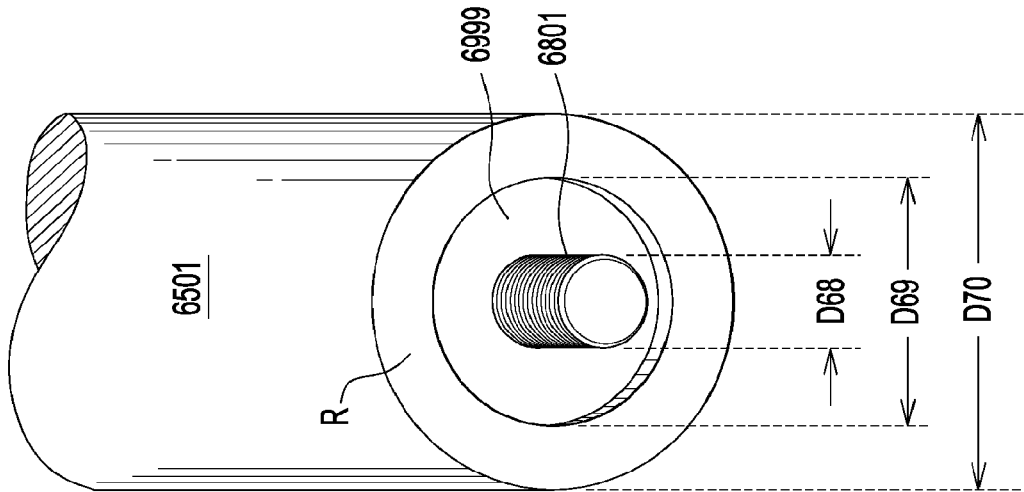


FIG. 68

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ROOF STANDOFF DEVICE

CROSS REFERENCE APPLICATIONS

This application is a continuation of application Ser. No. 14/196,867, filed Mar. 4, 2014, which is a continuation of application Ser. No. 12/700,667 filed Feb. 2, 2010, now issued as U.S. Pat. No. 8,661,765 on Mar. 4, 2014, which is a non-provisional application claiming the benefits of provisional application No. 61/255,082 filed Oct. 26, 2009 and provisional application No. 61/150,301 filed Feb. 5, 2009, each of which is hereby incorporated by reference in its entirety.

BACKGROUND

The concept of interlocking shapes is well known in the art of construction members. Most of the known interlocking shapes have two shapes that interconnect in some way such as a tongue in groove. The known types of interlocking shapes are generally male-female connections. There are a wide variety of types of these connections in a wide variety of applications and shapes. However, these known shapes have the disadvantage that two shapes are needed to form the interlock, limiting the configurations and increasing the costs for the creation of a male and a female part.

The foregoing example of the related art and limitations related therewith are intended to be illustrative and not exclusive. Other limitations of the related art will become apparent to those of skill in the art upon a reading of the specification and a study of the drawings.

SUMMARY

An aspect of the present invention is to provide a shape that can interlock with itself to form an interlocking racking system. Another aspect of the present invention is to provide a roof flashing and standoff system that can support the novel interlock racking system.

An aspect of the present invention is to provide a shape that can interlock with itself to form an interlocking racking system, wherein each bracket has two opposing recesses.

Another aspect of the present invention is to provide a mounting clip that can be attached to a solar panel and then clipped into a recess in a bracket.

The present invention discloses a set of shapes that function as both the male and female part of the interlock, allowing a single shape to interlock with its identical shape.

An embodiment of the present invention has a curved exterior for added esthetic appearance.

The shape is a face with a recess and at least one exterior surface. The recess has two upper facing surfaces and two lower facing surfaces. The exterior surface meets the upper facing surface, forming an edge. The two lower facing surfaces are set back from the upper facing surfaces, forming a lip, and interlocking the lips of the two faces form the interlock. Also disclosed is a number of devices for mounting members made with the faces on at least one surface and for attaching things to a member with the face on at least one surface.

One application uses the watertight standoff system to support interlocking racks which hold solar panels off the surface of a roof.

The bracket shape is a hexagon with a pair of opposing recesses. Each recess has two upper facing surfaces and two lower facing surfaces. The exterior surface meets the upper facing surface, forming an edge. The two lower facing sur-

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faces are set back from the upper facing surfaces, forming a lip, and interlocking the lips of the two faces forms the interlock of two brackets. Also disclosed is a mounting clip that attaches to a solar panel, then clips into a recess.

In addition to the exemplary aspects and embodiments described above, further aspects and embodiments will become apparent by reference to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top plan view of a support post with an interlocking face on all four sides and a single face of a second support post interlocked therewith.

FIG. 2 is a side perspective view of the support post shown in FIG. 1.

FIG. 3 is a top plan view of the FIG. 1 support post showing dimensions.

FIG. 4 is a top plan view of an alternate embodiment of the support post with the interlocking face having flat surfaces.

FIG. 5 is a top plan view of an alternate embodiment of the support post with squared ends.

FIG. 6 is a top perspective view of another alternate embodiment of a support post with threaded facing surfaces to allow a bolt in the threads to be used to attach items to the support post.

FIG. 7 is a side perspective view of a threaded support post.

FIG. 8 is a top plan view of a single face member alternate embodiment.

FIG. 9 is a side perspective view of the single face member shown in FIG. 8

FIG. 10 is a top plan view of an alternate embodiment that can be used as a frame for a solar panel next to a thermal exchange panel.

FIG. 11 is a side perspective view of the FIG. 10 embodiment.

FIG. 12 is a top plan view of another embodiment that can be used as a rack for a panel.

FIG. 13 is a side perspective view of the FIG. 12 embodiment.

FIG. 14 is a side perspective view of a central FIG. 1 embodiment coupled to two FIG. 10 type embodiments.

FIG. 15 is a top plan view of a support post interlocked with a frame member.

FIG. 16 is a perspective view of a sliding anchor suited to fit into an interlocking face of a support post.

FIG. 17 is a perspective view of a connector for joining the interlocking faces of two support posts at right angles.

FIG. 18 is a perspective view of another connector for joining the interlocking faces of two support posts at right angles.

FIG. 19 is a perspective view of the FIG. 1 support post with a FIG. 17 connector installed.

FIG. 20 is an exploded view of a stand off and flashing to attach a support post to a roof or other surface.

FIG. 21 is a cross section of the stand off and flashing of FIG. 22.

FIG. 22 is a cross section of another stand off and flashing.

FIG. 23 is an exploded view of the stand off of FIG. 22.

FIG. 24 shows the FIG. 23 stand off initially installed.

FIG. 25 shows the FIG. 24 stand off ready to accept a support post.

FIG. 26 shows the FIG. 25 stand off attached to the stand off.

FIG. 27 is a front plan view of a base for a bracket.

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FIG. 28 is a side perspective view of the FIG. 27 bracket assembled.

FIG. 29 is a top plan view of the FIG. 28 bracket.

FIG. 30 is a side elevation view of the FIG. 28 bracket.

FIG. 31 is a front plan view of the FIG. 28 bracket ready to receive a support post.

FIG. 32 is the same view as FIG. 31 with the support post partially installed.

FIG. 33 is the same view as FIG. 32 with the support post installed on the bracket.

FIG. 34 is a top plan view of the bracket of FIG. 35 with the support post attached.

FIG. 35 is a bracket for attaching into a face in a conventional male-female interaction.

FIG. 36 is a cross sectional view of a stand off supporting the bracket/support post of FIG. 34.

FIG. 37 is the same view as FIG. 1 with a solar panel frame ready to mount to a jaw.

FIG. 38 is a side perspective view of the FIG. 37 embodiment.

FIG. 39 is a side perspective view of the FIG. 11 style frame in use.

FIG. 40 is a front elevation view of a stand off supporting a variety of rack configurations.

FIG. 41 is a front elevation view of an alternative stand off supporting a variety of rack configurations.

FIG. 42 is a top perspective view of a stand off being installed.

FIG. 43 is a top perspective view of a row of stand offs on a roof.

FIG. 44 is a top plan view of a support post (bracket) with the interlocking face on opposing sides.

FIG. 45 is a side perspective view of a pair of interlocked brackets.

FIG. 46 is a front elevation view of a bolt anchor securing the bracket.

FIG. 47 is a front elevation view of a mounting clip.

FIG. 48 is a front elevation view of a bracket jaw holding the mounting clip of FIG. 47.

FIG. 49 is a top plan view of the mounting clip before it was formed.

FIG. 50 is a top perspective view of the clip of FIG. 47 in a jaw.

FIG. 51 is a side elevation view of a cabinet mounted to a wall via a pair of single jaw brackets.

FIG. 52 is the same view as FIG. 51 before mounting.

FIG. 53 is the same view as FIG. 53 with the jaws interconnected just before a final push is used to interlock the jaws.

FIG. 54 is a cross sectional exploded view of a stand off with a double bolt stud.

FIG. 55 is a bottom perspective view of the double bolt stud.

FIG. 56 is a top perspective view of the stand off of FIG. 54 supporting a W spring base.

FIG. 57 is a top perspective view of the stand off of FIG. 54 supporting a T slide.

FIG. 58 is a top perspective view of a four jaw support post with a snap in conduit clamp installed.

FIG. 59 is a top perspective view of the two vertical clips of the conduit clamp being installed in the jaw.

FIG. 60 is a front elevation view of a wide mouth four jaw support post.

FIG. 61 is the same view as FIG. 60 with a four jaw support post received in the wide mouth.

FIG. 62 is a top perspective view of a sign post received in the wide mouth four jaw support post.

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FIG. 63 is a top perspective view of a smaller four jaw support post in the wide mouth four jaw support post.

FIG. 64 is a front elevation view of a triangular three jaw support post.

FIG. 65 is a side elevation view of a roof anchor.

FIG. 66 is a partial sectional view of the roof anchor installed through a metal roof.

FIG. 67 is a partial sectional view of the roof anchor installed through a roof tile.

FIG. 68 is a bottom perspective view of a bolt embodiment of the roof anchor of FIG. 65.

FIG. 69 is a bottom perspective view of a threaded hole embodiment of the roof anchor of FIG. 65.

Before explaining the disclosed embodiment of the present invention in detail, it is to be understood that the invention is not limited in its application to the details of the particular arrangement shown, since the invention is capable of other embodiments. Exemplary embodiments are illustrated in referenced figures of the drawings. It is intended that the embodiments and figures disclosed herein are to be considered illustrative rather than limiting. Also, the terminology used herein is for the purpose of description and not of limitation.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring first to FIG. 1, support post 100 has four recesses 101 and four outer surfaces 102 around a central core 103 forming four faces 104. The support post 100 can be any chosen length. In the depicted embodiment the central core 103 is hollow and there are spaces 105, however there could be a solid core and/or space 105 could be filled, depending on the application. Each jaw 104 has a recess 101 with two upper facing surfaces 106 and two lower facing surfaces 107 set back from the upper facing surfaces 106, forming lip 108. The lips 108 of support posts 100 and 100a interlock. The upper facing surfaces 106 meet the outer surface 102 forming edge 109. The support post 100 could be used in any number of applications, such as a support post for signs or other uses; a frame for signs, solar panels, or any similar devices. Other applications of members with one or more of the jaws 104 as described herein are also possible, no limitation of the uses of the members should be inferred from the example uses herein.

In the depicted embodiment the outer surfaces 102 are concaved and have a curved appearance. The curved appearance is for aesthetic purposes and is not part of the functionality of the design. FIGS. 3 and 4 are alternate embodiments of the outer surface 302 and 402 respectively. The outer surfaces 102 have groove 110 which interacts with edge 109 when the faces 104 are interlocked as in FIG. 1. The jaws 104 are offset when interconnected, as seen in FIG. 1. The two lips 108 lock together with the upper facing surface 106 in contact with the lower facing surface 107 of the other jaw 104.

FIG. 3 shows dimensions of the FIG. 1 embodiment:

W1=50.8 mm

W2=9.66 mm

D1=11.95 mm

D2=15 mm

D3=1.0 mm

D4=2.0 mm

D5=5.0 mm

D6=14 mm

D7=1.0 mm

D8=4.3 mm

D9=0.035 inch (FIG. 27)

D10=0.07 inch (FIG. 27)

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Radius (R1)=1.2 inch
Radius (R2)=0.25 inch

FIGS. 4 and 5 show two embodiments 302, 402 that do not have the curved outer surface 102 of the FIG. 1 embodiment. Support post 302a is interlocked with support post 302. Lips 108 interlock. Tongue 109a locks into groove 110a. Many other possible configurations of the outer surface 102 are possible, so long as the shape of the outer surface 102 allows the interlocking of the jaws 104. As will be shown below, the entire jaw 104 is not required to interlock another face 104 in place. Support post 402 has facing surfaces 106 with threads 111.

FIG. 5 is a perspective view of an alternate embodiment support post 100b wherein the upper facing surfaces 106 have threads 111. These threads allow for a bolt to be screwed between the facing surfaces, as in FIG. 4. This allows for any desired object to be attached to the jaw 104. These threads 111 are an optional feature that can be used on any of the embodiments as needed for a particular application.

FIGS. 6, 7 support post 100T with threads. Bolt 412 with threads 413 engage threads 111 in support post 100T.

FIGS. 8 and 9 show another embodiment of the invention, one jaw support post 701 where there is a single jaw 104. This would allow the flat surface 702 to be part of any desired frame or surface that the user wished to have the jaw 104 on to allow interlocking.

FIGS. 10 and 11 show another embodiment, support post 800, that is designed to be used as a rack for a frame for a solar panel SP with an adjacent panel such as a thermal exchange panel P. The three recesses 101 form a jaw 104 and two partial jaws 104a, wherein the partial jaws 104a do not have a second outer surface 102. However, as seen in FIG. 13, a partial jaw 104a can still interlock with a face 104. The support post 800 extends for the length of the panel, with the body of the panel P fitted into space 801 between extensions 802 and 803, as seen in FIG. 8. Rubber gasketing may be used between the panels SP and P and the support post 800.

FIGS. 12 and 13 show another support post 900 that can act as a frame for a panel P. The panel P is fixed in space 901. The height H of space 901 can be varied, depending on the panel to be framed by the member 900, the length of member 900, or any of the members or posts disclosed herein, will depend on the size needed for any given application. The support post 900 could be on a single side of the panel P, or on all sides, depending on the choice of the user. Also, support posts 900 or 800 could be only a part of any side of the frame being made, with the rest of the side being a standard frame. The amount of the frame or post that contain the present invention will depend on where and what portion of a given frame or post the user desires to have a jaw 104 or a partial jaw 104a for interlocking with another jaw 104 or partial jaw 104a, or for attaching one of the attachment devices described below.

FIG. 14 shows a central support post 100 interlocked with adjoining support posts 800. Wiring for the solar panels SP could run along spaces 101.

FIG. 15 shows support post 100 interlocked with support post 900, wherein the system provides a wide variety of rack combinations especially useful for mounting solar panels on a roof.

FIGS. 16-18 are connectors that can be used to attach two support panels with jaws 104 together at right angles to each other or to attach a threaded post to the jaw 104 of a member for use in attaching an object to member. FIG. 16 is a slide 1301 with a T shaped member 1302 that is adapted to fit into the opening 101. Grooves 1304 slide against upper facing surfaces 106. The upper surface 1305 of groove 1304 is in contact with upper surface 102 at edge 109, as can be seen in

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FIG. 19. End 1307 is wider than groove 1304 to engage lip 108 and lock the slide 1301 into the jaw 104.

FIG. 17 is a slide 1310 with two T shaped members 1302 to allow two members jaws 104 to be held at right angles to each other by sliding the T members 1302 in to the recesses 101 as seen in FIG. 17 with the slide 1310 in one of the recesses.

FIG. 18 is a slide connector 1314 that works on the same principle as slide 1310, however 1314 has faces 1315 and 1316 with threaded holes HL to allow screws 1317 to be threaded through the slide connector 1314 and into the groove 115 the bottom of recess 101.

FIG. 19 shows a support post 100 wherein space 101 is used as a channel for (solar panel) wire 1902. A plastic snap in cover 1901 protects the wire 1902. A slide 1310 is installed in space 101 via jaw 104.

FIGS. 20, 21 show a flashing and stand off 2200 that can be used when mounting a frame or rack, either made from members of the present invention or standard members, on a roof or similar surface. Base 1901 attaches to the roof truss or other surface with screws 1903. Known flashing 1902 (preferably sheet metal) is placed over the base 1901 to prevent water from getting to the holes created by the screws. With prior art standoffs, there are problems with water getting into the standoff and causing corrosion of the standoff. The present stand off 2200 solves this issue. Threaded bolt 1904 extends up from base 1901, through hole 1415 in flashing 1902. Core 1908 has a threaded hole 1909 which threads onto bolt 1904. A soft washer 1906 having hole 1405 is placed between the core 1908 and flashing 1903 to provide a water-tight or near water-tight seal. With ridge R creating a metal to metal joint against flashing 1902. As core 1908 is solid other than threaded hole 1909, once core 1908 is screwed down on to bolt 1904 with the washer 1906, a watertight seal is formed over the hole 1415 in flashing 1902. This helps to prevent water from getting under the flashing 1902. In the depicted embodiment the washer is neoprene, but any know polymer with similar properties to neoprene could be used as well. Core 1908 has an outer surface with threads 1910. Cover 1911 has a threaded recess 1912, seen in FIG. 20, which corresponds to threads 1910, allowing the cover 1911 to be threaded down on to core 1910. The cover 1911 has a top threaded hole 1912, which does not connect to threaded recess 1912. The height of the stand-off is adjusted by choosing how far down cover 1911 is threaded on to core 1908. This allows for very precise and replicable height adjustments.

FIG. 22 shows the roof truss T with a roof surface TP on top of truss T. A shingle SH is exposed to the environment. Water is prevented from reaching screws 1903. The flashing 1902 is made waterproof at its periphery E in known manners including glue, tar, overlay shingles. Base 1999 serves as an anchor for the entire stand off assembly 2222. Hole 1920 has threads to accept bolt 1926 which secures the core 1924 to the base 1999 as shown in FIG. 23. The soft washer 1906 fits into donut recess 1928 at the bottom of the core 1924. Rim 1928 is circular and seals the washer 1906 inside the metal to metal joint of members 1929 against 1902. Thus washer 1906 is protected from the elements, and no water can get into hole 1405.

The threads 1925 receive the cover 1922 after the mounting bolt 1921 is set to a desired height as shown by gauge G in FIG. 23 forming height D8 in FIG. 25. Bolt 412 threads into hole 1923.

FIG. 36 shows a stand off assembly 2222 supporting one version of a rack. The rack consists of bracket 1500 which supports the support post 100 of FIG. 34.

A series of assemblies 2222 can be mounted on a roof in a straight line ready to support a support post 100 as shown in

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FIGS. 25 and 43. The jaw 104 is slid down a series of aligned bolts 412. Then each cover 1922 is tightened (turned counterclockwise CC) thereby locking bolt 412 against lip 108, shown in FIG. 26. No tools are needed.

Referring next to FIGS. 27 thru 33, a bracket 1700 with W shaped prongs 1701 and face seat 1702 can hold a support post 100 in a conventional male/female interaction when needed. A bolt 2711 can secure the bracket 1700 to a flashing 1902.

FIGS. 31-33 show the snap on connection of the support post 10 to bracket 1700 via jaw 104. Pliable springs PS (preferably rubber) help expand the prongs 1701 onto the lip 108.

FIG. 35 is a clamp 1500 designed to hold a support post with at least one jaw 104, in the depicted example shown in FIG. 18 the support post 100 is held. The clamp 1500 has a base 1501 with a face seat 1502 which is shaped to hold outer surface 102. If one of the alternate embodiment outer surfaces is used, face seat 1502 would be shaped accordingly. The base 1501 has stem 1503. In the depicted example stem 1503 is a bicycle bolt to hold stem 1503 into central core 103 by threading bolt 1504 into the stem 1503 and causing the triangle piece 1505 to off-set in a known manner, locking the stem 1503 into the core 103, placing the clamp on one end of a support post 100. This allows the support post to be clamped to be put any desired orientation relative to the faces of support post 100. Once the clamp 1500 is in place the support post 100 is placed in face seat 1502 and clamped in place with hooks 1506 and levers 1507, as seen in FIG. 34.

FIG. 36 shows one possible roof stand off and rack assembly which could support solar panels or wind turbines or satellite dishes.

FIGS. 37, 38 show a (solar panel) panel rack assembly 3700. A solar panel frame SPS (or any frame for a panel) has a tongue 3707 sized to fit in space 101 via jaw 104. Thus, side by side support posts 100 can interlock solar panels SPS between them. This is an anti-theft design because no removal of panel SPS is possible without removing the support posts 100 from the roof.

FIG. 39 shows a solar panel SP mounted flush against a thermal panel P used for cooling the solar panel SP via fluid piped thru tubes 3950. Support post 800a has a top flange 888 to sandwich panel SP against member 803.

FIG. 40 shows some of the variety of rack configurations possible using stand off 2222. Rack A shows the bolt 412 of stand off 2222 inserted into space 101 of support post 100. Rack B shows a bracket 1700 with bolt 412 threaded thru its bottom hole. The support post 100 is snapped onto bracket 1700. Rack C has support post 100 mounted to stand off 2222 via bolt 412. Then back to back brackets 1700 are held together with rivet 4000. Support post 100 snaps into upper bracket 1700. Rack D has support 100 attached to support post 100 via bolt 412. Then bracket 1700 is snapped into space 101 of upper support post 100. A rivet 4000 holds the bracket 1700/support post 100 assembly. Rack E attaches a lower support post 100 to stand off 2222 via bolt 412. Then upside down bracket 1700 has rivet 4000 supporting bracket 1700 and its support post 100. It is shown that multiple spacings and directions of support posts 100 are possible with few individual parts.

FIG. 41 shows the base 1999 supporting bolt 2711 which holds bracket 1700 on flashing 1902. Rack F shows support post 100 snapped into bracket 1700. Rack G shows back to back brackets 1700 atop lower support post 100 could run perpendicular to lower support post 100 depending on the setting of rivet 4000. Rack H has the lower support post 100

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supporting upside down bracket 1700 which has rivet 4000 supporting upper support post 100 perpendicular to the lower support post 100.

FIG. 42 shows a method to affix the FIG. 22 embodiment 2222 on a shingle roof. Shingle SHU is lifted to cover the edge 1902e of flashing 1902.

FIG. 43 shows the support post 100 mounted at a uniform height UH above a curving roof SH. Each bolt 412/cover 1922 combination is raised up or down shown by arrows U, D to level post 100.

In FIG. 44 a support post (bracket) 9000 has two recesses 9001 and four outer surfaces 9002. Two jaws 9003 are formed. Longitudinal axis LA creates two identical half brackets 9000A and 9000B. Half brackets 9000A and 9000B are joined together by bridge 9004, which forms the extension between support segments 9000A and 9000B.

Outer surfaces 9002U and 9002L are dissected by support segment 9004A. Each jaw 9003 consists of a pair of upper facing surfaces 106 (optionally having threads T), and a pair of lower facing surfaces 107 set back from the upper facing surfaces 106. Spaces 105 may be solid, but for cost and weight reduction, are shown as hollows. The lip pairs 108 of each jaw 9003 oppose one another and provide interlock means for adjoined brackets 9000 as shown in FIG. 2. Locking grooves 110 support edges 109 of interlocked brackets 9000.

The nominal dimensions are: D1=1.495 inches, D2=1.995 inches, D3=0.591 inches, D4=0.380 inches, D5=11.95 mm, D6=0.104 inches, D7=0.039 inches, D8=0.091 inches, D9=0.038 inches, D10=0.434 inches and D11=0.169 inches.

The radii of curvatures nominally are: R1=0.202 inches, R2=1.185 inches and R3=0.039 inches.

Referring next to FIG. 45 bracket 9000-1 is interlocked with identical bracket 9000-20. Jaw 9003-10 receives lip 108-20 of bracket 9000-10. Locking grooves 110-20 receive edges 109-10 of bracket 9000-10. Jaw 9003-20 receives lip 108-10 of bracket 9000-10.

In FIG. 46 an anchor 3000 has a protruding bolt 3002 with a bolt head 3002. A bracket 9000 has a lower jaw 9003L that receives bolt head 3002 in recess 9001. Bolt head 3002 rests securely on lips 108 because bolt stem 3001 which extends D18 above surface S, D18 equals dimension D11 of FIG. 1. Upper jaw 9003U can support clip 9050 of FIG. 4.

Referring next to FIGS. 47-50, a mounting clip 9050 consists of a U shaped anchor 9052 with an end edge 9057 that rests under lip 108A of jaw 9003 of bracket 9000. Leg 9056 of anchor 9052 abuts face 106B and does not contact lip 108B. Mounting arm 9051 has a mounting hole 9053. The nominal dimensions are: D17=1.6 inches, D12=0.6 inches, D13=2.5 inches, D14=0.5 inches, D15=1.6 inches, D16=0.5 inches and radius R4=0.320 inches.

The nominal angles are 1ANG=12 degrees, 2ANG=22 degrees for arm 9051-A, 3ANG=32 degrees for arm 9051-B, 4ANG=10 degrees, 5ANG=3 degrees. The preferred material is 0.060 (16 gage) 304 stainless steel. The starting blank dimension is 2.5 inches by approximately 2.75 inches before bending.

Referring next to FIGS. 51-53 a wall accessory cabinet is mounted to a flat surface wall via a pair of one jaw support posts 701. (See FIG. 8) Screws S mount the posts 701 to the CABINET and WALL. The length of each post 701 is a load choice. Each post is mounted horizontally. The installer lifts the cabinet in FIG. 52 toward the WALL. In FIG. 53 he latches the jaws 104 together. In FIG. 51 he pushes the CABINET straight against the WALL, thereby interlocking the two jaws. The edge 109 interlocks in groove 110.

Referring next to FIGS. 54, 55 a stand off 5444 has a base 5430 screwed into a roof truss T via screws 1903. The base

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5430 has a threaded boss **5400**. A flashing **1902** with hole **1415** is placed atop the boss **5400**. A soft washer **1906** has hole **1405** aligned with hole **1405**. The double bolt stud **5401** has a lower bolt which screws into boss **5400**. The washer **1906** is received in recess **5501**. The ridge **5570** protects the washer **1906** from the sun and forms a watertight or nearly watertight seal, metal to metal, against flashing **1902**. The wrench surfaces WR of double bolt stud **5401** allow a wrench to tighten the stud **5401** as desired. The upper bolt **5402** receives the core **1924** via threaded hole **1927**. The core outer threads **1925** receive the cover **1922**. A mounting bolt **412** is screwed into the top of the cover **1922** to provide an anchor for support posts and any desired attachment. The double bolt stud/washer assembly is denoted **5500**.

Referring next to FIGS. **56, 57** the stand off **5444** can anchor a bracket **1700** or a T slide which has a hole on its bottom (not shown). A vast array of racks can be built atop the protective stand off **5444**.

Referring next to FIGS. **58, 59** the support post **100** has a jaw **104** (see FIG. **1**). A pipe clamp **5800** secures a conduit CON. A pair of vertical clips **5801, 5802** are identical and face one another with their concave mounting recesses **5901** forming the clamp for the conduit CON. A bolt **5803** tightens the clips **5801, 5802** together via nut **5804**. To lock a clip into jaw **104** the clip is placed in direction DOWN into jaw **104** at an angle as shown in FIG. **59**. Then the clip is twisted to lock the jaw face **106** into a groove **5903** of the clip **5801**. Each clip has opposing grooves **5903** to lock into jaw faces **106**.

Referring next to FIGS. **60-63** a wide mouth support post combination post systems are shown for use in sign posts, solar racks and the like. Nominal dimensions are D**60**=3.5 inch, D**62**=2.0 inch, D**63**=2.0 inch. A sign post **6201** may be anchored at a street side. The wide mouth support post **6000** can slide over it and offer four mounting jaws **104** for accessories such as signs.

In FIG. **63** a solar array may be constructed with inter sliding posts **100** and **6000**. The wide mouth support post **6000** has a square central core **6020** with about equal sides **6021**. The jaws **104** are the same as in FIG. **1**.

In FIG. **64** a triangular support post **6400** has a circular central core **6401**. Each jaw **104** is the same as in FIG. **1**, except outer surfaces **6402** have different dimensions.

Referring next to FIGS. **65-69** a roof anchor **6500** has a cylindrical body **6501** with a threaded top **6502**. A threaded hole **6503** can receive a bolt so as to act like bolt **412** in FIG. **21**. Alternately an Allen head or screw head or the like could be on the top. Solar racks can be built atop the bolt (not shown). The screw **6504** is threaded into mounting hole **6505** at the bottom of body **6501**. A recess **6999** receives washer **1906** similar to FIG. **21**, wherein ridge R protects the washer from the sun and can provide a metal to metal seal. FIG. **66** shows a metal roof **6666** using ridge R for a metal to metal seal. A cover **1911** (FIG. **21**) could also be put on threads **6502**, thus providing height adjustment for a bolt **412**. Wrench face WR allows a socket SOC or wrench W to screw the screw **6504** into a truss T.

FIG. **67** shows a tile roof TR having the tile TR drilled with a hole **6700** to allow anchor **6500** to be placed down atop a truss T. Usually a plywood roof layer PY is present. So even on a tile roof the anchor **6500** provides the support for a solar panel rack.

In FIGS. **68, 69** nominal dimensions are D**68**=0.38 inch, D**69**=1.0 inch, D**70**=1.5 inch. The threaded hole **6505** serves as a mount for attaching to various stand offs including the embodiments of FIG. **21** and FIG. **54**. The hole **6505** would receive bolt **1904** (FIG. **21**) or **5402** (FIG. **54**). The FIG. **68** embodiment with bolt **6801** can be used to insert into boss

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5400 of FIG. **54**. All the embodiments protect the washer **1906** from the sun via a recess such as **6999**.

While a number of exemplary aspects and embodiments have been discussed above, those of skill in the art will recognize certain modifications, permutations, additions and sub-combinations therefore. It is therefore intended that the claims hereinafter introduced are interpreted to include all such modifications, permutations, additions and sub-combinations are within their true spirit and scope. Each apparatus embodiment described herein has numerous equivalents.

The terms and expressions which have been employed are used as terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of the features shown and described or portions thereof, but it is recognized that various modifications are possible within the scope of the invention claimed. Thus, it should be understood that although the present invention has been specifically disclosed by preferred embodiments and optional features, modification and variation of the concepts herein disclosed may be resorted to by those skilled in the art, and that such modifications and variations are considered to be within the scope of this invention as defined by the appended claims. Whenever a range is given in the specification, all intermediate ranges and subranges, as well as all individual values included in the ranges given are intended to be included in the disclosure. When a Markush group or other grouping is used herein, all individual members of the group and all combinations and subcombinations possible of the group are intended to be individually included in the disclosure.

In general the terms and phrases used herein have their art-recognized meaning, which can be found by reference to standard texts, journal references and contexts known to those skilled in the art. The above definitions are provided to clarify their specific use in the context of the invention.

All patents and publications mentioned in the specification are indicative of the levels of skill of those skilled in the art to which the invention pertains. All references cited herein are hereby incorporated by reference to the extent that there is no inconsistency with the disclosure of this specification. Some references provided herein are incorporated by reference herein to provide details concerning additional starting materials, additional methods of synthesis, additional methods of analysis and additional uses of the invention.

We claim:

1. A roof standoff device for use in mounting an object to a roof, said standoff device comprising:
 - a base bracket having at least one mounting hole for receiving an attachment element for attaching the base bracket to a roof surface, said base bracket further including a first threaded attachment element;
 - a flashing having:
 - a raised section with an upper surface and a flashing aperture extending through said raised section, wherein said flashing aperture is configured for alignment with said first threaded attachment element of said base bracket;
 - a flange extending beyond a base of said raised section, wherein, when disposed over said base bracket on the roof surface, an inside surface of said raised section receives and surrounds said base bracket and said flange rests on the roof surface;
 - an attachment bracket having a bracket aperture passing through a lower portion of said attachment bracket, said bracket aperture configured for alignment with said first threaded attachment element of said base bracket;

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a second threaded attachment element, said second threaded attachment element configured to threadably engage said first threaded attachment element, wherein, upon said first and second threaded attachment elements being threadably engaged, said flashing is compressed between said base bracket and said attachment bracket; and
said attachment bracket having a third attachment element disposed on an upper portion of said attachment bracket for attaching an object to said attachment bracket.

2. The device of claim 1, wherein said upper surface of said raised section comprises a first planar surface and a portion of a bottom surface of said attachment bracket comprises a second planar surface.

3. The device of claim 2, wherein said second planar surface of said attachment bracket is in direct contact with said first planar surface of said flashing when said first and second threaded attachment elements are threadably engaged compressing said flashing between said base bracket and said attachment bracket.

4. The device of claim 2, further comprising:
a soft washer disposed around said aperture in said flashing, wherein said soft washer surrounds said aperture in said flashing and is compressed upon said first and second threaded attachment elements being threadably engaged.

5. The device of claim 1, wherein:
said first threaded attachment element comprises a threaded bolt attached to said base bracket, wherein said threaded bolt is configured to extend through said flashing aperture in said raised section of said flashing and through said bracket aperture in said attachment bracket; and

said second threaded attachment element comprises a female threaded aperture.

6. The device of claim 1, wherein:
said first threaded attachment element comprises a threaded aperture in said base bracket; and
said second threaded attachment element comprises a threaded bolt extending through said bracket aperture and said flashing aperture.

7. The device of claim 1, wherein said base bracket further comprises:
a raised portion surrounding said first attachment element.

8. The device of claim 7, wherein a portion of said flashing surrounding said aperture is compressed between said raised portion of said base bracket and said attachment bracket.

9. The device of claim 8, wherein a lower surface of said raised section of said flashing is in direct contact with said raised portion of said base bracket.

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10. The device of claim 1, wherein said third attachment element comprises a slot formed in said upper portion of said attachment bracket.

11. The device of claim 10, further comprising:
a snap connector disposed in said slot.

12. A roof standoff device for use in mounting an object to a roof, said standoff device comprising:
a base bracket having at least one mounting hole for receiving an attachment element for attaching the base bracket to a roof surface, said base bracket further including a first threaded attachment element and a raised surface surrounding the first threaded attachment element;

a flashing having:
a raised section with a planar upper surface and a flashing aperture extending through said raised section; and

a flange extending beyond a base of said raised section, wherein, when disposed over said base bracket on the roof surface, an inside surface of said raised section overlays said raised surface of said base bracket surrounding said first threaded attachment element;

an attachment bracket having a bracket aperture passing through a lower portion and configured for alignment with said first threaded attachment element of said base bracket, said attachment bracket having a planar bottom contact surface;

a second threaded attachment element configured to threadably engage said first threaded attachment element, wherein, upon said first and second threaded attachment elements being threadably engaged, said flashing is compressed between said raised surface surrounding said first threaded element and said bottom planar contact surface of said attachment bracket, wherein said bottom planer contact surface is in direct contact with said planar upper surface of said flashing; and

said attachment bracket having a third attachment element disposed on an upper portion of said attachment bracket for attaching an object to said attachment bracket.

13. The device of claim 12, further comprising:
a soft washer disposed about said aperture in said flashing, wherein said soft washer is compressed upon said first and second threaded attachment elements being threadably engaged.

14. The device of claim 12, wherein said attachment bracket and said flange are metal elements and said direct contact is metal to metal contact.

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