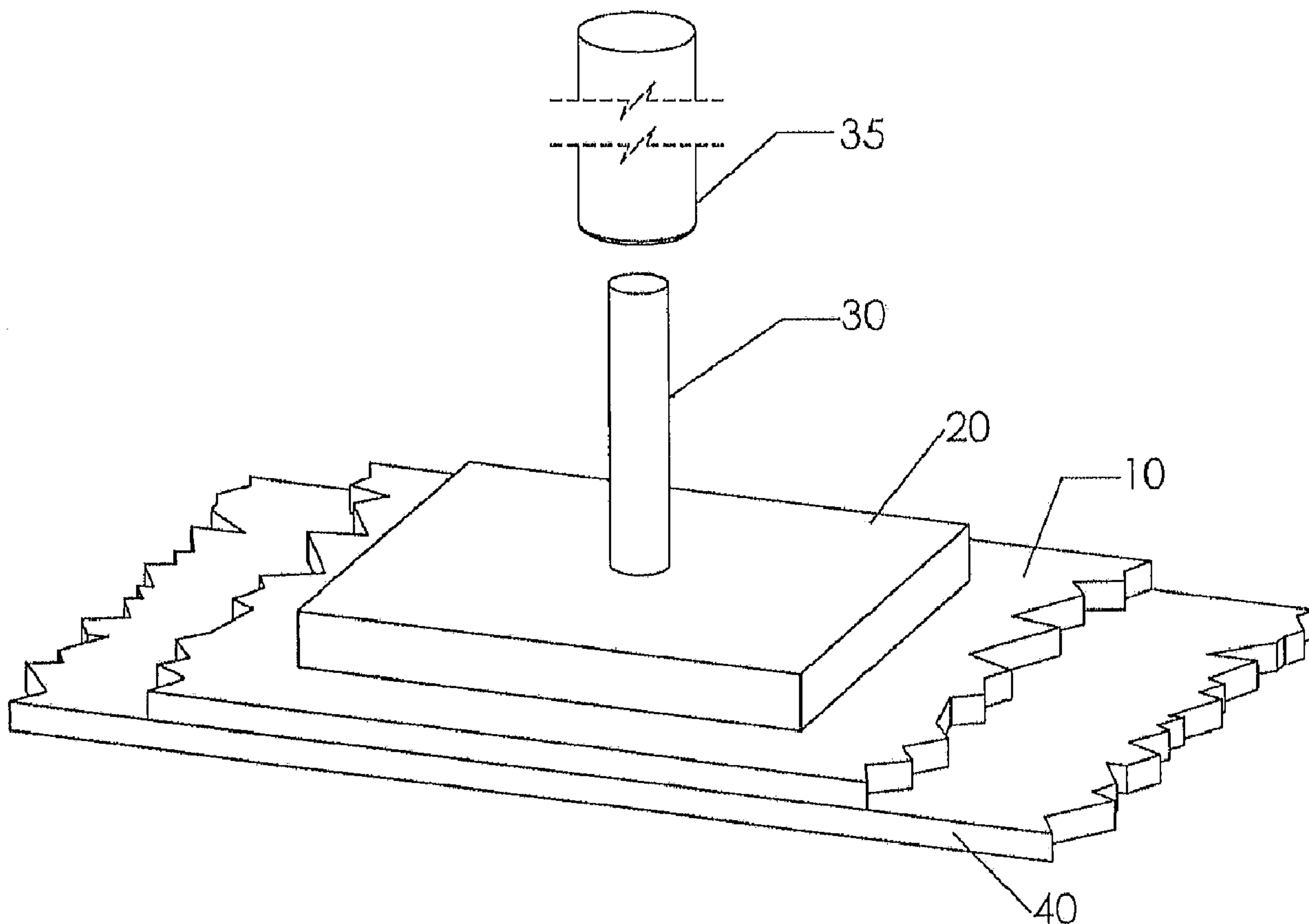




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 (54) Title: SYSTEM FOR MOUNTING OBJECTS TO POLYMERIC MEMBRANES



(57) **Abrégé/Abstract:**

Systems and methods for coupling a polymeric membrane to a structure are described herein. In some instances, the systems and methods for coupling polymeric membranes to structures is applicable to mounting structures onto polymeric membranes forming part of roofing structure. Particularly, the methods and systems described herein may be applicable to securing external structures, such as photovoltaic cells to a polymeric membrane, such as a thermoplastic membrane.

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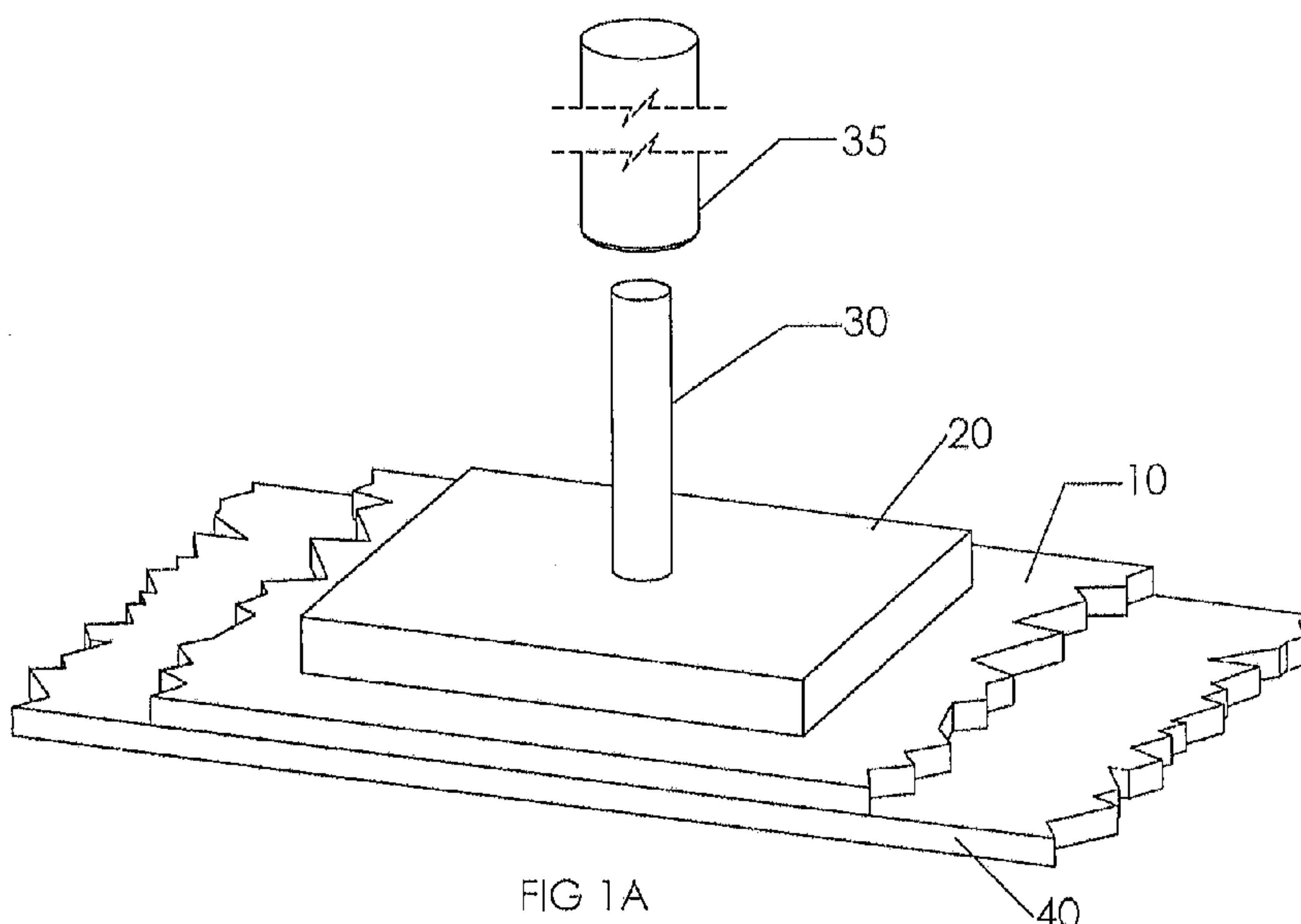


FIG 1A

(57) Abstract: Systems and methods for coupling a polymeric membrane to a structure are described herein. In some instances, the systems and methods for coupling polymeric membranes to structures is applicable to mounting structures onto polymeric membranes forming part of roofing structure. Particularly, the methods and systems described herein may be applicable to securing external structures, such as photovoltaic cells to a polymeric membrane, such as a thermoplastic membrane.

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SYSTEM FOR MOUNTING OBJECTS TO POLYMERIC MEMBRANES

Technical Field

5 The present description relates to methods and system for mounting objects to polymeric membranes.

Description of the Prior Art

10 Various applications exist in which a polymeric membrane may be placed over a surface. For example, it may be desirable to provide a polymeric membrane as a roofing material. That is, a polymeric membrane may be applied to an outer surface of a building structure, such as a roof, to protect the structure from the environment.

Brief Description of the Drawings

Figures 1A-1C show an example systems for attaching a mounting plate to a polymeric membrane.

Figure 1D shows a cross-sectional view of an example mounting plate.

15 Figure 2A is a cross-sectional view of an example mounting system including a mounting plate secured to polymeric membrane with an adhesive.

Figure 2B shows an exploded view in cross section of an example mounting system with a tape including adhesive on opposing sides thereof.

Figure 2C shows a cross-sectional view of a further example mounting system.

20 Figure 3 shows an example mounting assembly that may be coupled to a polymeric membrane.

Figure 4 shows another example mounting assembly that may be coupled to a polymeric membrane.

Figure 5 is a bottom view of the mounting assembly shown in Figure 4.

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Figures 6A-F, 7A-E, and 8A-D show various views of example mounting plates.

Figure 9 shows a cross-sectional view of a further example mounting system

Figure 10 shows a cross-sectional view of an example mounting plate illustrated in Figure 9.

5 Figure 11 shows another example mounting system.

Figure 12 is a side view of an example mounting plate shown in Figure 11.

Figure 13 is a further example mounting system that includes, among other features, an insulating member.

10 Figure 14 is an example system for bonding a ridge member to a polymeric membrane.

Description of the Preferred Embodiment

The present disclosure describes methods and systems for mounting or otherwise attaching an object to polymeric membranes. For example, in some instances, the present disclosure describes methods and systems for attaching objects to polymeric membranes utilized for covering all or a portion of a building structure roof. In some instances, the polymeric membranes may include thermoplastic polymeric membranes ("thermoplastic membranes"), while, in other instances, the polymeric membranes may include thermoset polymeric membranes ("thermoset membranes"). Example objects that may be attached include photovoltaic cells, an air handling component (e.g., air conditioning or heating components), telecommunications equipment (e.g., antennas, satellite dishes, etc.), or any other desired object. Utilizing the described systems and methods for securing one or more photovoltaic cells to the roof of a structure may provide tax benefits. For example, tax benefits may exist for having photovoltaic cells attached to the structure of a roof that are otherwise unavailable for photovoltaic cells that are merely placed on a roof unattached to the roof

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- 3 -

structure. Thus, in some implementations, the system and methods described herein provide for attaching an object to the roof structure, and, in the case of photovoltaic cells, may enable a user to enjoy the available tax benefits associated therewith.

5 In other implementations, the described methods and systems may be utilized for attaching objects to a polymeric membrane forming part of a structure. Further, while some implementations may be described with respect to thermoplastic membranes, thermoset membranes may also be applicable and vice versa. In general, the described methods and systems may be applicable to applications including roofing, waterproofing, earth lining, pond lining, tent construction, tension fabric applications, air
10 forming technologies, flexible plastic forming (such as with flexible plastic films), rigid plastic forms, as well as any other suitable application.

Figure 1A shows a perspective view of an example implementation of a system for mounting an object to a polymeric membrane. Figure 1A shows a polymeric membrane (interchangeably referred to as "membrane") 10 and a mounting plate 20. In
15 some instances, the polymeric membrane 10 is a thermoplastic membrane. Example thermoplastic membranes may include polyvinyl chloride (PVC), thermoplastic olefins (TPO), ketone ethylene esters (KEE), nitrile butadiene polymers (NBP), as well as other suitable thermoplastics. In other instances, thermoset membranes may also be used. For example, examples thermoset membranes may include membranes formed
20 from ethylene propylene diene monomer (EPDM) as well as any other suitable thermoset membranes, including thermoplastic membranes that may morph into thermoset membranes over time, such as chlorosulfonated polyethylene (CSPE).

The polymeric membrane 10 may be secured to a structure 40, such as a roof structure. The polymeric membrane 10 may be secured to the structure 40 in any
25 known or suitable manner. Further, in some instances, the mounting plate 20 may be formed entirely or in part from a metal, such as steel, galvanized steel, aluminum, titanium, or other desired or suitable metal. Additionally, the mounting plate 20 may or may not be weatherized. In other instances, the mounting plate 20 may be formed from

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other materials, such as glass, plastic, ceramics, composite materials, or any other material. It should be appreciated that some applications may not require polymeric membrane 10; as such, mounting plate 20 may be bonded or attached directly to structure 40 without the use of polymeric membrane 10.

5 As shown, the mounting plate 20 has a protrusion 30 extending therefrom that may be used for securing a structure. The protrusion 30 may allow attachment and detachment of the structure, such as structure 35, without damage or alteration to the polymeric membrane 10. For example, in some instances, the protrusion 30 may provide for a threaded connection with structure 35, although any other suitable connection mechanism may be used. In other implementations, the mounting plate 20 may be integral to a structure. In still other implementations, the mounting plate 20 may omit the protrusion 30. Alternately, the mounting plate 20 may include a mechanism for attaching or detaching a corresponding structure thereto. For example, the mounting plate 20 may include an interlocking mechanism for accepting one or more structures. Example structures may include one or more photovoltaic cells, air handling equipment (e.g., air conditioning equipment or heating equipment), one or more antennas, mounting structures therefor, a barrier, or any other desired structure.

15 In still other implementations, an example mounting plate 20 may include a threaded portion for mating engaging with a corresponding threaded portion provided on a structure to be attached or otherwise coupled to the mounting plate 20. For example, Figure 1B shows a mounting plate 20 that includes a welded nut 22 for accepting a protrusion having mating threads. Alternately, as shown in Figure 1C, the mounting plate 20 may have a threaded portion 24 formed therein for accepting the protrusion.

20 Figure 1D shows a cross-sectional view of another example mounting plate 20 in which the protrusion 30 is a separate piece insertable into an opening 32 formed in the mounting plate 20. Further, a head 34 of the protrusion 30 may be retained in a pocket 36 formed in the mounting plate 20. In other instances, the head 34 may not be retained in a pocket formed in the mounting plate 20. In some implementations, the

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protrusion 30 may be a carriage bolt insertable into the opening 32, and the interface between the opening 32 and the protrusion 30 prevents the protrusion 30 from rotating relative to the mounting plate 20. Further, a mounting plate 20 having an opening 32 of a single size may be operable to accept protrusions 30 having varying shaft lengths, widths, and/or diameters.

The mounting plate 20 may be attached to the polymeric membrane 10 in numerous ways. Figures 2A-2C show several cross sectional views of the mounting plate 20 attached to the polymeric membrane 10. For example, Figure 2A shows the mounting plate 20 attached to the membrane 10 with a binding agent, such as an adhesive 50, disposed therebetween. Alternately, the binding agent for securing the mounting plate 20 may be a carrier tape 60 having adhesive 70, 80 provided on opposing sides thereof, as shown in Figure 2B. In some implementations, the carrier tape 60 may have a removable protective film or backing 65. In some instances the adhesive 70 and adhesive 80 may be the same adhesive, while, in other instances, the adhesives 70, 80 may be different. For example, adhesives 70, 80 may be selected based on the material being adhered. For example, for a mounting plate 20 formed from steel, the adhesive 70 may be selected to adhere steel, while, for a membrane 10 formed from PVC, the adhesive 80 may be selected to adhere to PVC. In some instances the carrier tape 60 may be a foam-based tape. Carrier tape 60 may be used to secure the mounting plate 20 to the membrane 10. One or more tape strips or sheets may be used to secure the mounting plate 20. Further, the carrier tape 60 may be custom shaped and/or formed to fit to geometry of the mounting plate 20. For example, the carrier tape 60 may be custom fit to correspond to one or more geometric features of the mounting plate 20, such as protrusions or other topographical shapes.

Multiple options for adhesives 50, 70, and 80 are available and selecting an appropriate adhesive is often dependent upon the desired engineered failure during testing. In some instances, it may be desirable for the adhesion provided by the selected adhesive to give way at a chosen weight threshold preventing damage to other

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components within the assembly. In other instances, it may be desirable for the adhesive bond to be so strong that components would not separate without damage to one surface or another. In addition, the selected adhesive may be applied to a carrier tape, the carrier tape and selected adhesive also being capable of being engineered with a chosen weight threshold and thickness. Adhesives 50, 60, and 70 include cross linking as well as non-cross linked butyl adhesives. A non-exclusive list of adhesives 50, 70, and 80, as well as carrier tapes 60, that may be used are: 3M VHB 4941 F, 3M VHB 4941, 3M VHB 4932, 3M VHB 4952, 3M VHB 5925, 3M VHB 5952, 3M VHB 5962, 3M weather strip tapes, 3M Polyurethane 560, 3M Hybrid Sealant 760, 3M DP 190, 3M DP 125, and 3M 1099 Scotch Weld Adhesive, all of which are produced by 3M of 3M Center, St. Paul, MN 55144. Additionally, Ashland Aroset 1930 produced by Ashland Inc of Covington, KY 41012 is another example of a suitable adhesive. Further, SikaLastomer-68 produced by Sika Corporation of Madison Heights, MI 48071, is example of a suitable carrier tape. The following companies make similar or competing adhesive to those named above: Carlisle Syntec of Carlisle, PA, Carlisle Hardcast Incorporated of Wylie, TX, and Firestone Building Products of Indianapolis, IN. It should be appreciated that the adhesives and carrier tapes identified above may be identified as adhesives alone, or as carrier tape alone, or any combination of carrier tape and adhesive.

Figure 2C shows another example implementation in which the binding agent may be a coating of thermoplastic material 90 applied to one or more surfaces of the mounting plate 20 placed into contact with the polymeric membrane 10. For example, the polymeric membrane 10 may be a thermoplastic membrane. The mounting plate 20 may be located at a desired location on the polymeric membrane 10, and the coating 90 may be heated to form a bond between the mounting plate 20 and the polymeric membrane 10. In some instances, the coating 90 may be heated by heating the mounting plate 20, such as with a thermoinduction welder or hot iron. In other instances, energy may be applied more directly to the coating 90, such as with sonic welding. For example, the mounting plate 20 may be affixed using the coating 90 such

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as by dielectrical or sonic or vibration welding, solvent bonding, heat bonding (such as using induction heating, infra red heating, hot air heating, or hot iron heating), any combination of the above, or in any other suitable manner.

5 It should be appreciated that thermoplastic coating 90, as well as the thermoplastic coatings described in the other embodiments herein, may be represented in a variety of forms. Such forms include, but are not limited to: solids, liquids, or any mixtures of material phases suitable for the implementations disclosed herein.

10 A further example mounting system is shown in Figure 3. Figure 3 shows a mounting plate 20 secured to a polymeric membrane 10 (e.g., a thermoplastic membrane) with a binding agent 100. According to various implementations, the binding agent 100 may be, for example, a coating of thermoplastic material applied to a contact surface of the mounting plate 20. With the thermoplastic coating, the mounting plate 20 may be located at a desired location on the polymeric membrane 10 and heated to bind the mounting plate 20 to the polymeric membrane 10. Alternatively, any
15 adhesive or carrier tape, such as the adhesives and carrier tapes described above, may be used to secure the mounting plate 20 to the membrane 10. The combination of the mounting plate 20 and the polymeric membrane 10 may be considered a mounting assembly 110.

20 Referring still to Figure 3, the mounting assembly 110 may be attached to a polymeric membrane 120. In the present example, the polymeric membrane 120 may be a thermoplastic membrane. However, in other instances, the polymeric membrane 120 may be a thermoset membrane. The mounting assembly 110 may be attached to the polymeric membrane 120 in numerous ways. For example, the polymeric membrane 10 of the mounting assembly 110 may be coupled to the polymeric
25 membrane 120 using one or more of the methods described above in regards to the bonding of mounting plate 20 to polymeric membrane 10. In other instances, a bonding agent 130, such as a carrier tape and/or adhesive (such as the carrier tape and adhesive, described respectively above) may be used. It should be appreciated that

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bonding agent 130 may be another bonding medium, including various bonding materials or various bonding members. Similar to above, the carrier tape may be applied in pieces, such as one or more strips or sheets. Further, as also described above, the carrier tape may be formed to correspond to geometry of the mounting assembly 110.

Figures 4 and 5 illustrate an alternate implementation for securing the mounting assembly 110 to the polymeric membrane 120. As shown, a central portion 140 of the mounting assembly 110 may be secured to the polymeric membrane 120 with an adhesive material 145, such as one or more pieces of carrier tape or adhesive, such as the carrier tape and adhesive described above. Another attachment method or material may be used around a perimeter portion 150. For example, a coating of thermoplastic material 155 at one or more locations along the perimeter portion 150 may be used to secure the perimeter portion 150 to the polymeric membrane 120. The coating of thermoplastic material 155 may be bonded using one or more of the methods described above. Alternately, one or more of an adhesive or carrier tape may be used on the perimeter portion 150. For example, the bonding material used on the perimeter portion 150 may act to further secure the mounting assembly 110 or as a waterproofing material.

It is noted that, in some instances, a coating of thermoplastic material may be used to bond one thermoplastic membrane to another same or similar thermoplastic membrane. In other instances, the thermoplastic material may be omitted. For example, some thermoplastic membranes may be joined using one or more of the welding techniques above without the aid of a bonding material. On the other hand, a coating of thermoplastic membrane may not be capable of bonding a thermoplastic membrane or thermoset membrane to another thermoset membrane. In such instances, an adhesive, such as an adhesive or carrier tape may be used to bond such dissimilar materials to each other.

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In some instances, the polymeric membrane 120 may be the same or a similar thermoplastic as a thermoplastic forming the thermoplastic membrane 10, such as one or more of the thermoplastics described above. However, the thermoplastics forming the respective thermoplastic membrane 10 and the thermoplastic membrane 120 may be different while still bondable with or without the use of a thermoplastic material. In some instances, the thermoplastic membrane 120 may form an outer surface of a roof structure. However, the description is not so limited, and the present description may be applicable to a thermoplastic membrane in any desired application.

The mounting plate 20 may be of any desired shape. For example, the mounting plate may be circular, rectangular, square, elongated, or be of any other size or shape. Example mounting plates are illustrated in Figures 6-8. Figures 6A-6E show various views of a circular mounting plate 20 having a plurality of concentric ridges 21 formed therein as well as a central cavity 22 that may be used to capture a head of a protrusion, as discussed in a similar manner above. As also described above, the central cavity 22 may accept a protrusion of different sizes. The protrusion may extend through opening 23.

Referring to Figures 7A-E, the example mounting plate 20 also includes cavities 22 to accept the heads of protrusions. The protrusions may extend through openings 23 formed in a wall of the cavities 22. Figures 8A-D are various views of another example mounting plate 20. The mounting plate 20 may include various ridges 24 formed therein along with a cavity 22 and opening 23. Again, the cavity 22 may be used to capture an end portion of a protrusion extending through the opening 23. The mounting plate 20 may also include openings 25 formed around a periphery thereof.

Further, for the example mounting plate 20 shown in Figure 6A-8D along with others within the scope of the disclosure, the cavities 22, openings 23, and/or the combination thereof may be operable to prevent rotation of the protrusion relative to the mounting plate 20 while also accepting protrusions of different sizes. Additionally, the

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respective sizes of the ridges 24, openings 23, cavities 22, as well as other aspects of the mounting plates 20 may be altered to any desired size.

Another example mounting system is shown in Figure 9 in which a mounting plate 20 is disposed between a first polymeric membrane 500 and a second polymeric membrane 510. Fasteners 520 extend through the mounting plate 20, the second polymeric membrane 510, and into a substructure 530. The first polymeric membrane 510 overlays a first surface 540 of the mounting plate 20 and includes an opening 550 through which the protrusion 30 extends. A bonding material 560 may be used to adhere the first polymeric membrane 500 to the mounting plate 20.

In some instances, the bonding material 560 may be a coating of a thermoplastic material applied to a portion of the first surface 540 between the protrusion 30 and openings 570 formed in the mounting plate 20 through which the fasteners 520 extend. Still further, in some instances, the bonding material 560 may be applied and the first polymeric membrane 500 coupled therewith to the mounting plate 20 during one or more manufacturing processes. That is, bonding the first polymeric membrane 500 to the mounting plate 20 with the bonding material 560 may be performed remote from a job site, such as at a manufacturing facility. In other instances, the first polymeric membrane 500 may be bonded to the mounting plate 20 with the bonding material 560 at a jobsite. The bonding material 560 may be a coating of thermoplastic material and used to bond the two components in one or more of the methods described above. In addition to adhering the first polymeric membrane 500 to the mounting plate 20, the bonding material 560 may also form a seal preventing or substantially preventing fluids from penetrating through the opening 550 formed through the openings 570 and into the substructure 530.

A bonding material 580 may also be applied to the first surface 540 of the mounting plate 20. In some instances, the bonding material 580 may also be used to secure the first polymeric membrane 500 to the mounting plate 20, such as after the fasteners 520 have been used to secure the mounting plate 20 to the substructure 530.

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Utilizing the bonding material 580 after fasteners 520 have been applied avoids the need to puncture the first polymeric membrane 500 for the fastener 570. Thus, in some instances, the bonding material 560 may be used to secure only a portion of the first polymeric membrane 500 to the mounting plate 20 while still allowing passage of the fasteners 520 through the openings 570 without the need to puncture the first polymeric membrane 500. The bonding material 580 may be utilized thereafter to secure the first polymeric membrane 500 to the mounting plate 20 thereby also providing a seal. The first polymeric membrane 500 may also be secured to the second polymeric membrane 510 with a bonding material 590. Also, a coating or bonding material may be omitted where the polymeric membranes are capable of being joined without such materials. For example, the membranes may be thermoplastic membranes capable of being joined using one or more of the bonding techniques described above. In such instances, the bonding material 590 may be omitted.

A bonding material 600 may also be used to secure the mounting plate 20 to the second polymeric membrane 510. The bonding materials 560, 580, 590, and 600 cooperate to form a seal around the mounting plate 20 to aid in preventing or substantially reducing penetration of fluids and/or debris into the substructure 530. One or more of the bonding materials 560, 580, 590, and 600 may be a coating of a thermoplastic material and used to form a bond using one or more of the techniques described above. In some instances, the bonding materials 560, 580, and 590 may be the same material, such as a coating of thermoplastic material 610, and may be applied to the mounting plate 20, as shown in the example of Figure 10. Alternately, one or more of the bonding materials 560, 580, 590, and 600 may be a carrier tape or adhesive as also described above. In still other implementations, one or more of the bonding materials 560, 580, 590, and/or 600 may be omitted. For example, in some implementations, the polymeric membranes 500, 510 may be secured directly to each other using one or more of the joining techniques described above without the use of a bonding material. Still further, the mounting plate 20 may also be formed from a material that is joinable to one or more of the polymeric membrane 500 and/or

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polymeric membrane 510 without the use of a bonding agent using one or more of the techniques described above. In such instances, one or more of the bonding materials 560, 580, and/or 600 may be omitted.

5 The mounting plate 20 is shown with a protrusion 30 includes, although the protrusion 30 may be omitted. Alternately, the mounting plate 20 may be fixedly attached to another object. Still further, the mounting plate 20 may have a mechanism for selectively attaching and detaching another object.

10 Figures 11 and 12 show another example system 700 in which one or more mounting plates 710 are secured to a structure 720. For example, the structure 720 may be a roof structure, although structure 720 is not so limited but may encompass other structures, such as one or more of the structures identified above or other suitable structure. In some instances, the mounting plates 710 may be coupled to the structure 720 with fasteners, although the mounting plates 710 may be attached in other ways. A polymeric membrane 725 is applied over the mounting plates 710, such as by unrolling
15 a roll of the polymeric membrane 725. An example mounting plate 710 is shown in Figure 12. The mounting plate 710 may include a protrusion 730. Further, in some implementations, the protrusion 730 may include a piercing portion 740 adapted to puncture the polymeric membrane 725. Also, a portion of the protrusion 730 may include a fastening portion 735 that may be used to attach a structure to the mounting
20 plate. For example, in some instances, the fastening portion 735 may be a threaded portion. However other fastening mechanisms may also be used.

25 One or more of the mounting plates 710 may be secured to the structure 720, such as in an array or any other configuration. The mounting plates 710 may be secured with fasteners and/or with one or more of the techniques described herein (e.g., using a coating of thermoplastic material, carrier tape, adhesive, etc.). With the mounting plates 710 secured to the structure 720, the polymeric membrane 725 may be overlaid. The mounting plate 725 may be made to extend through the polymeric membrane 725 such as by puncturing the polymeric membrane 725 with the piercing

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portion 740. In other implementations, the polymeric membrane 725 may have preformed openings to allow the protrusions 730 to extend therethrough. The polymeric membrane 725 may be secured to the mounting plate 710 using one or more of the techniques described above. For example, the mounting plate 710 may be coupled to
5 the polymeric membrane 725 with a bonding material 727. The bonding material 727 may be one or more of the materials discussed above and the coupling may be formed using one or more of the methods described above.

Figure 13 shows another example system 900 including a mounting plate 910 coupled to a substructure 920. Among other uses, the system 900 may be applicable to
10 roofing applications. The mounting plate 910 is shown as being attached with fasteners 930. However, other techniques may be used to secure the mounting plate 910 to the substructure 920. The mounting plate 910 may include a protrusion 940 and a piercing portion 950. Further, in some implementations, the protrusion 940 may include a fastening portion 955. Additionally, while the protrusion 940 is shown as an integral
15 portion of the mounting plate 910, the protrusion 940 may be attached to the mounting plate 910 using a fastening mechanism. For example, in some implementations, the protrusion 940 may be attached to the mounting plate 910 via a threaded connection. An insulating member 960 may be disposed above the substructure 920. An attachment member 970 may be secured to the protrusion 940, such as by engaging
20 the fastening portion 950. In some implementations, the fastening portion 950 and attachment member 970 may have a threaded engagement, although other attachment interfaces may be used. A polymeric membrane 965 overlays the insulating member 960 and may be bonded to the attachment member 970 with a bonding material 980. In some implementations, the bonding material 980 may be a coating of thermoplastic
25 material applied to attachment member 970. In other implementations, a carrier tape and/or an adhesive may be used to couple polymeric membrane 965 to the attachment member 970.

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In addition, the described methods and systems can also reduce damage to a polymeric membrane. For example, when objects are unattached but are in contact, debris may become lodged between the object and the polymeric membrane, and, because of the relative movement between the two, the debris may act as an abrasive on the polymeric membrane. Over time, holes, rips, or other damage may occur to the polymeric membrane exposing the underlying structure to the environment, such as moisture, wind, etc. This exposure can cause damage to the structure. However, the present disclosure describes methods and systems that avoid these drawbacks.

Additionally, some of the methods and systems described herein also provide for securing one or more objects to a polymeric membrane without piercing the polymeric membrane. Consequently, objects remain attached to the polymeric membrane without providing a pathway for moisture or other objects, e.g., insects, debris, etc., to pass through the membrane. Again, this can have particular value in waterproofing covering applications where an unperforated covering is greatly desired.

Another example system 1000 is illustrated in Figure 14. The system 1000 includes a polymeric membrane 1010, a ridge member 1020, and a bonding member 1030. In some implementations, the polymeric membrane 1010 may form a portion of a roof structure, such as an exterior membrane. The ridge member 1020 may be coupled to the polymeric membrane 1010 by the bonding member 1030. In some instances, the bonding member 1030 may be a double sided carrier tape similar to the carrier tape described above. In some implementations, the adhesive on the sides of the carrier tape may be selected to provide a bond according to the material forming the polymeric membrane 1010 and/or the ridge member 1020. In other implementations, the bonding member 1030 may be an adhesive selected to adhere polymeric membrane 1010 to the ridge member 1020. In some instances, the adhesive may be an adhesive similar to the adhesive described above.

The bonding member 1030 may occupy a channel 1040 formed in a base 1050 of the ridge member 1020. Lips 1055 may also be formed in the ridge member 1020 to

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aid in preventing intrusion of fluids and other materials into the channel 1040. A benefit of the bonding member 1030 is that while coupling the ridge member 1020 to the polymeric membrane 1010, the bonding member 1030 may have a bonding strength less than the yield strength of the polymeric membrane 1010 and/or the ridge member 1020. Consequently, the bonding member 1030 will yield, separating the ridge member 1020 from the polymeric membrane 1010 when a shearing load on the ridge member 1020 exceeds the strength of the bonding member 1030. Consequently, the bonding member 1030 will yield without damaging either the ridge member 1020 or the polymeric membrane 1010. For example, in an application in which the polymeric membrane 1010 and ridge member 1020 form an exterior portion of a roof structure, a shearing force on the ridge member 1020, for example, caused by a sheet of ice formed on the roof structure, would not tear the polymeric membrane 1010 as the ice sheet moves down a slope of the roof. Rather, the shearing force would merely sever the ridge member 1020 from the polymeric membrane 1010. In other implementations, the bonding member 1030 may have a yield strength equal to or greater than one or more of the ridge member 1020 and/or the polymeric membrane 1010.

Although the present disclosure has been described with several implementations, various changes and modifications may be suggested to one skilled in the art. It is intended that the present disclosure encompass such changes and modifications as fall within the scope of the appended claims and their equivalence

What is claimed is:

1. A system comprising:
 - a first thermoplastic polymeric membrane having:
 - 5 a top surface; and
 - a bottom surface, said bottom surface being attached to a portion of a roof structure;
 - a mounting plate having a bottom surface;
 - a second thermoplastic polymeric membrane consisting of polyvinyl chloride, said
 - 10 second membrane having:
 - an upper surface, said upper surface being thermally bonded to said bottom surface of the mounting plate; and
 - a lower surface having:
 - 15 a first surface area, said first surface area extending peripherally along a perimeter of said lower surface, said first surface area being thermally fused to said top surface area of said first membrane; and
 - a second surface area, said second surface area being enclosed within said first surface area, said second surface area being positioned below said mounting plate, said second surface area remaining separable from said first membrane as a force is exerted
 - 20 against said mounting plate;
 - a protrusion attached to said mounting plate, said protrusion extending in a direction opposite to the roof structure.
 2. The system of claim 1, wherein said protrusion is adapted to be coupled to the
 - 25 structure.
 3. The system of claim 2, wherein said protrusion forms at least a part of the structure.
 4. The system of claim 1 further comprising:
 - a third thermoplastic polymeric membrane; and
 - a first bonding medium, wherein said first bonding medium is disposed between a top
 - 30 surface of said mounting plate and said third membrane; and
 - wherein said third membrane overlays a portion of the mounting bracket and couples thereto by the first bonding medium.
 5. The system of claim 4, wherein said first bonding medium is at least one of a material forming said mounting plate or said third membrane.

(Replacement Sheet)

6. The system of claim 4, wherein said mounting plate is sandwiched between said second membrane and said third membrane.
7. The system of claim 4 further comprising:
a fastener; and
5 a substructure disposed on a side of said third membrane opposite said mounting plate, wherein said fastener extends through said mounting plate to couple said mounting plate to said substructure.
8. The mounting system of claim 4, wherein said third member comprises a peripheral edge extending beyond edges of said mounting plate and wherein said peripheral edge of said third member is coupled to said second member with a second bonding medium.
10
9. The system of claim 1 further comprising:
a third thermoplastic polymeric membrane; and
15 a first bonding medium disposed between the second membrane and said third membrane.
10. The system of claim 9, wherein said first bonding medium comprises one of a thermoplastic coating, an adhesive, or a carrier tape.
11. The system of claim 9, wherein said first bonding medium comprises at least one of a material forming said second membrane or said third membrane.
12. A method for providing a mounting location coupled to a first thermoplastic polymeric membrane, said first membrane having a top surface area and a bottom surface area, the method comprising:
20 bonding said bottom surface area of said first membrane to a roof structure;
bonding a bracket to an upper surface of a second thermoplastic polymeric membrane with one of a thermoplastic, an adhesive, or carrier tape, said second membrane being bonded onto at least a portion of a first surface of said bracket;
25 attaching a protrusion to said mounting plate, said protrusion being adapted to extend in a direction away from said first membrane;
placing said second membrane on a portion of said first membrane, said second membrane consisting of polyvinyl chloride, said second membrane having:
30 said upper surface bonded to said bracket; and
a lower surface having:
a first surface area, said first surface area extending peripherally along a perimeter of said lower surface, said first surface area being thermally fused to said top surface area of said first membrane: and
35

5 a second surface area, said second surface area being enclosed within said first surface area, said second surface area being positioned below said mounting plate, said second surface area remaining separable from said first membrane as a force is exerted against said mounting plate.

13. The method of claim 12, further comprising:

10 bonding a third thermoplastic polymeric membrane onto at least a portion of a second surface of said bracket opposite said first surface, said third membrane being bonded to at least a portion of said second surface by one of a thermoplastic, an adhesive, or a carrier tape; and

bonding a portion of said third membrane to a portion of said second membrane.

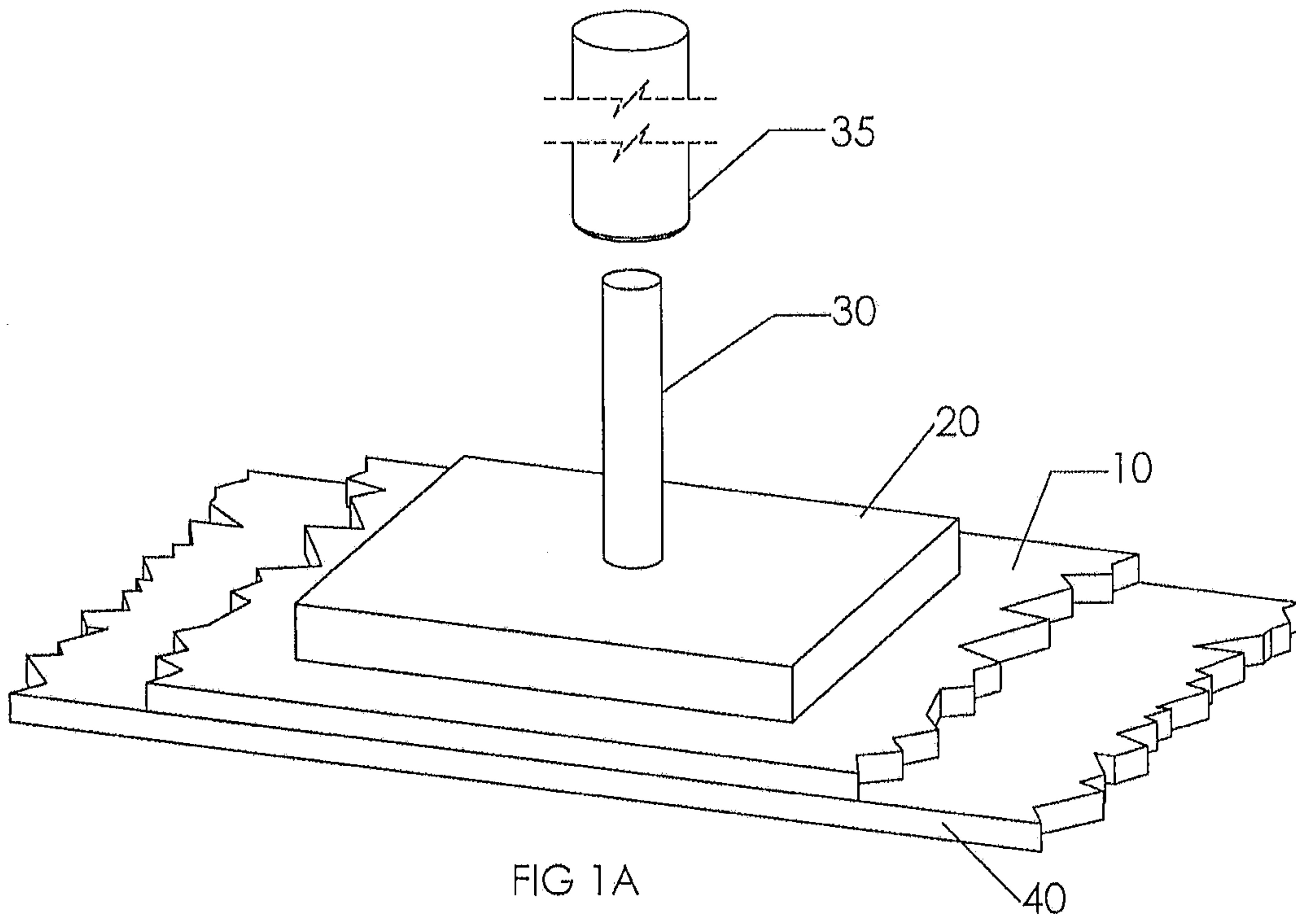


FIG 1A

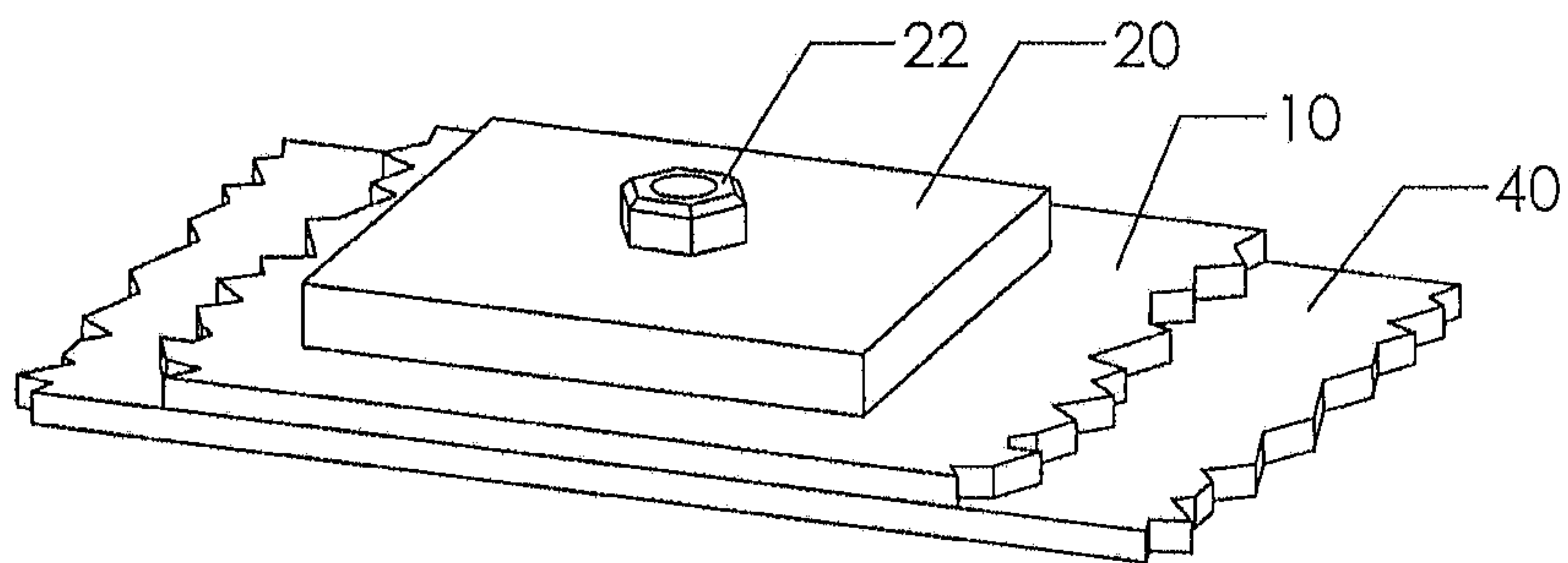


FIG 1B

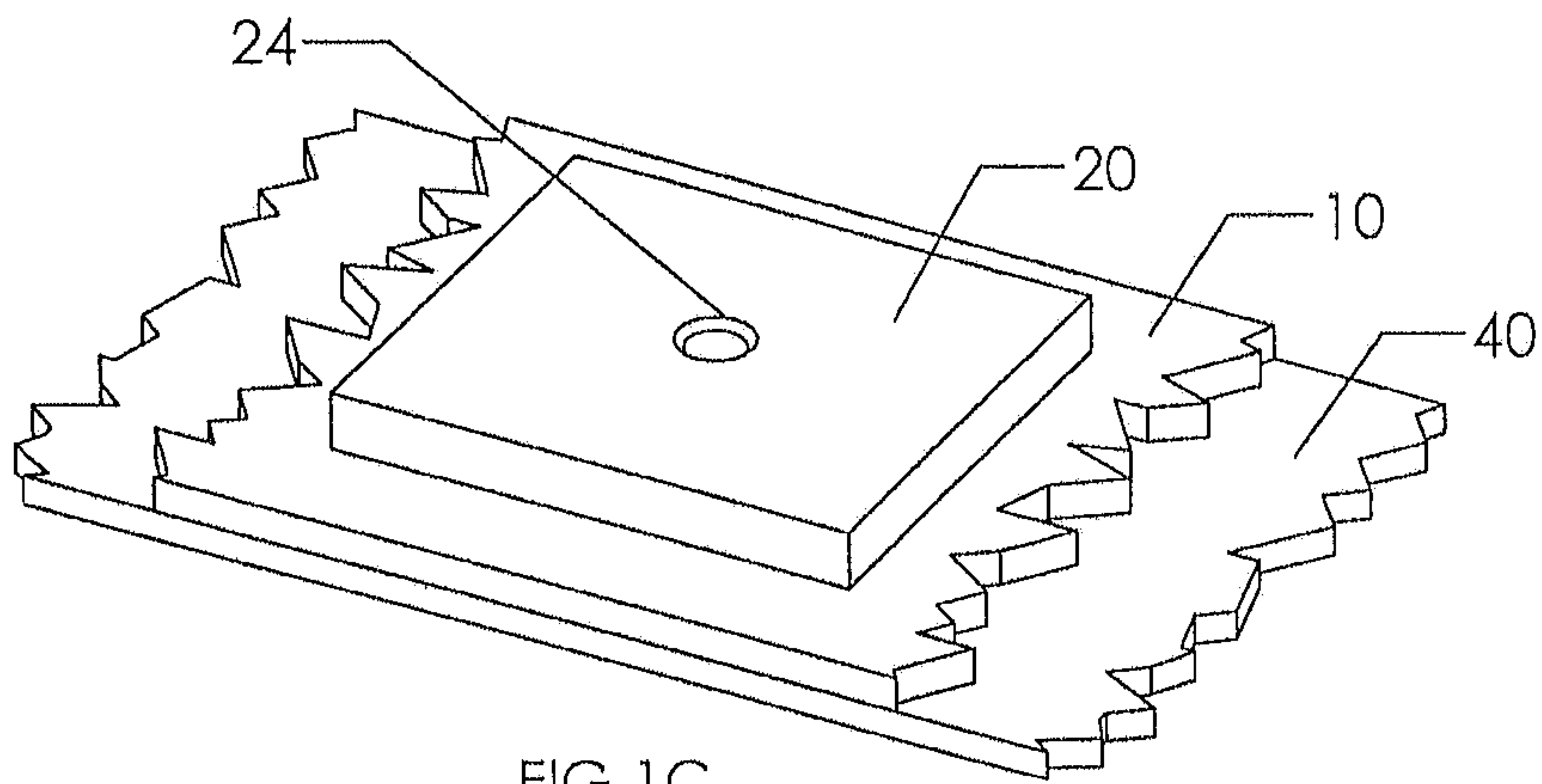


FIG 1C

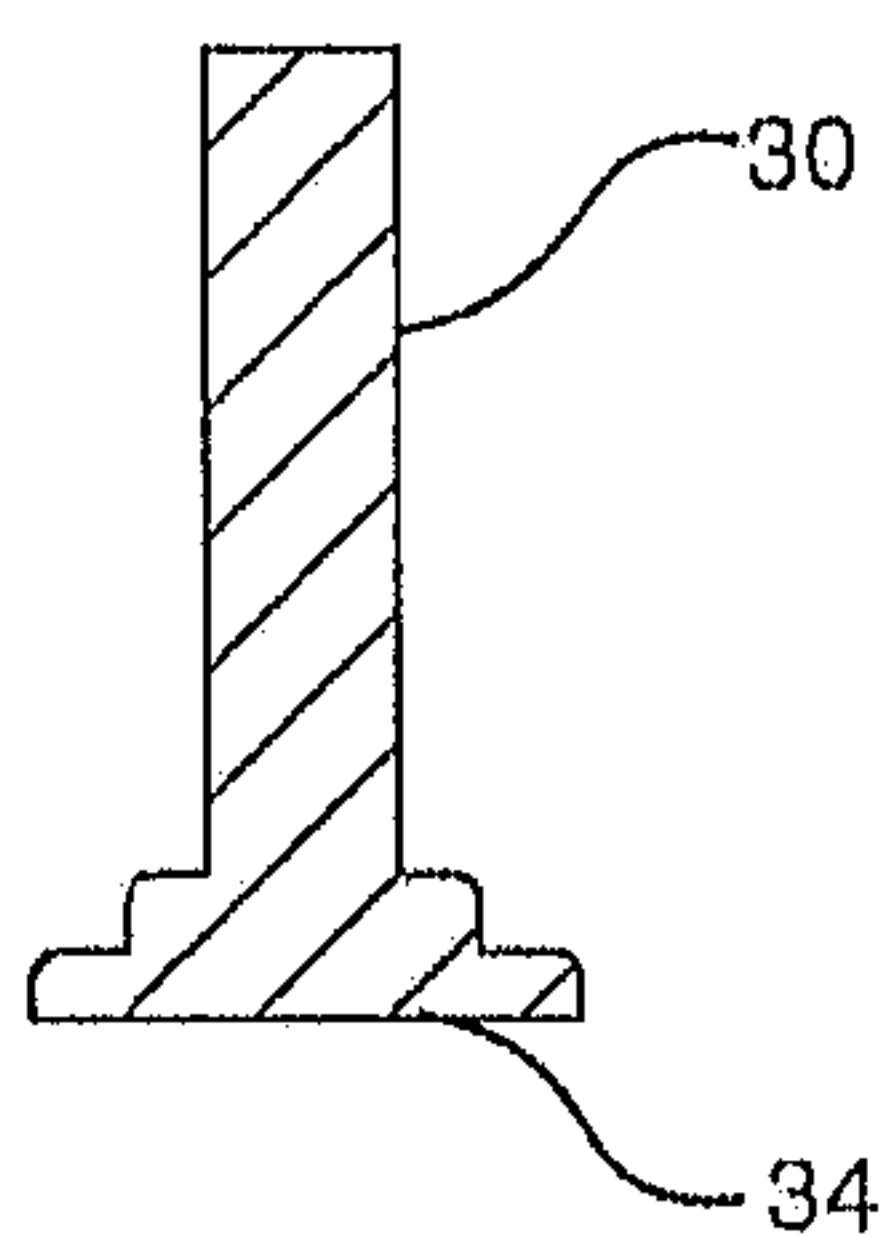
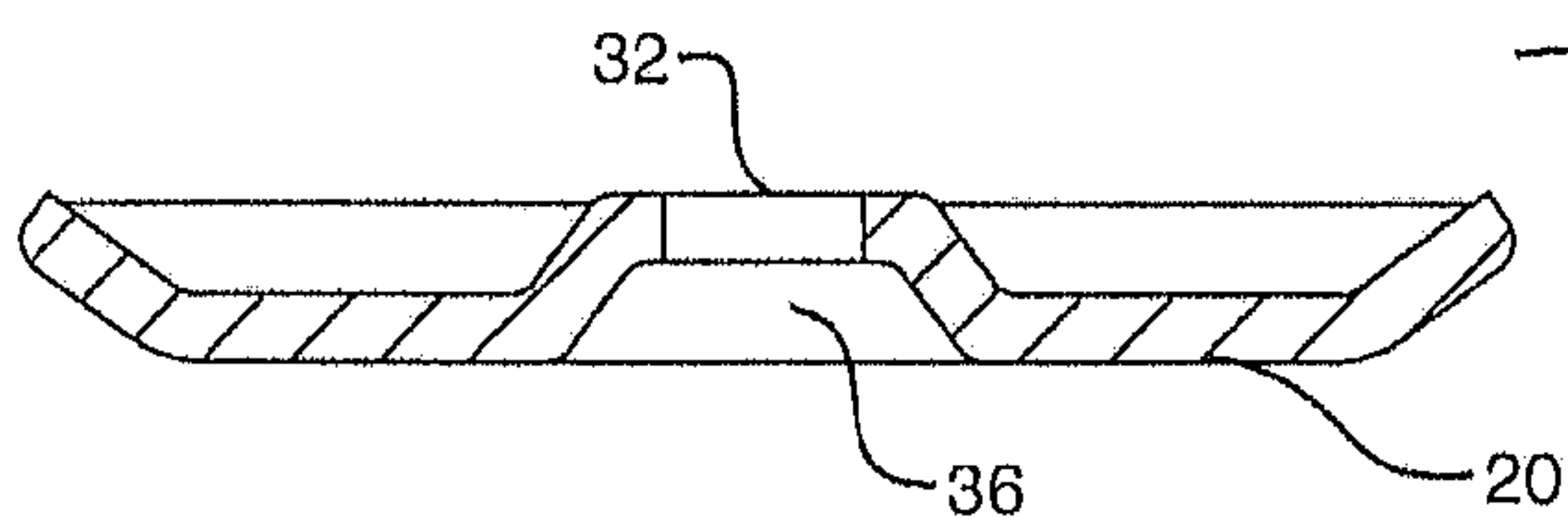
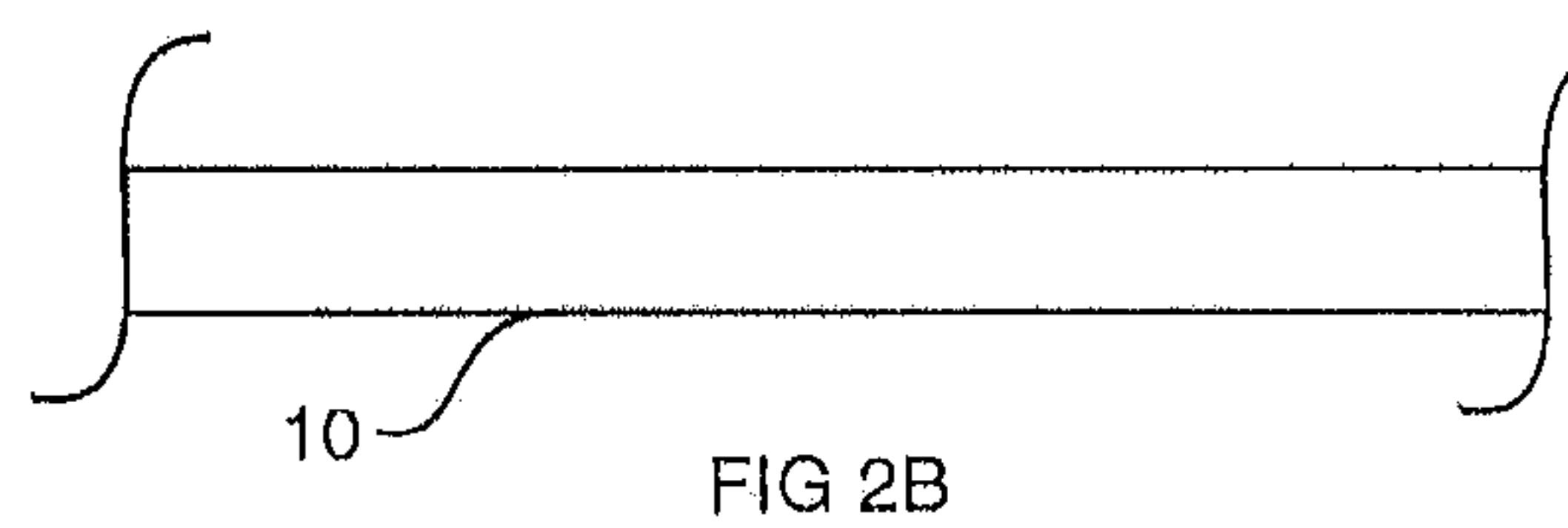
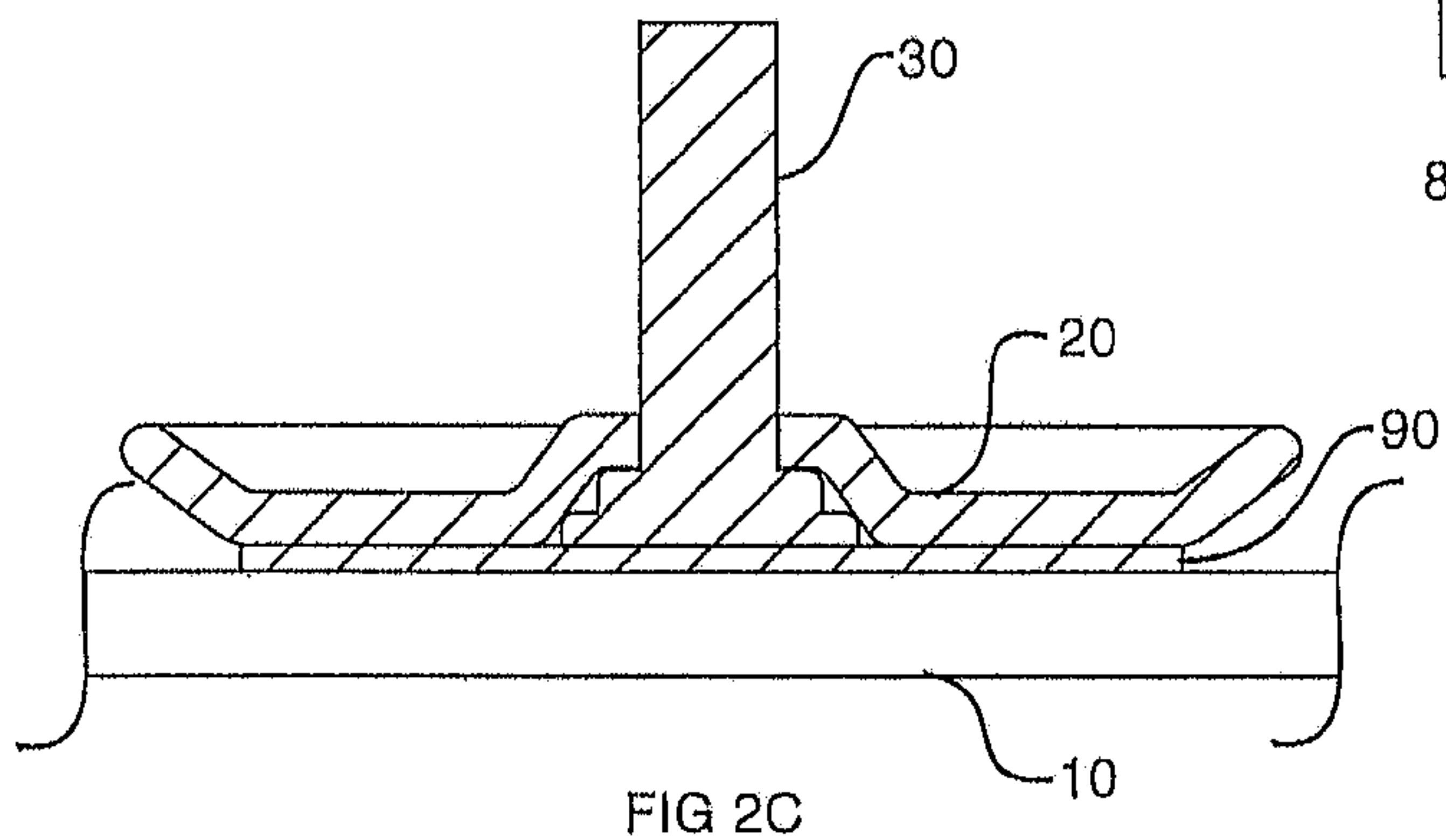
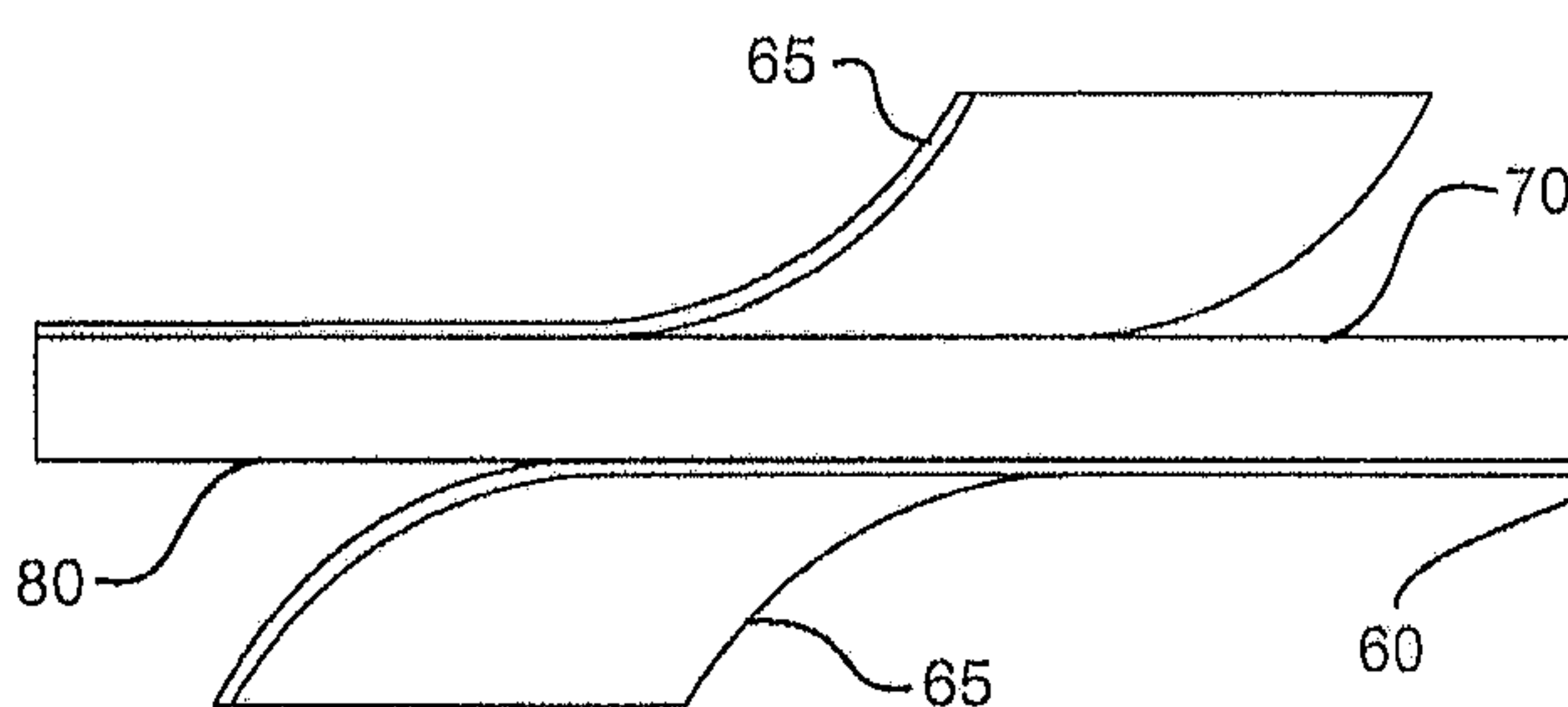
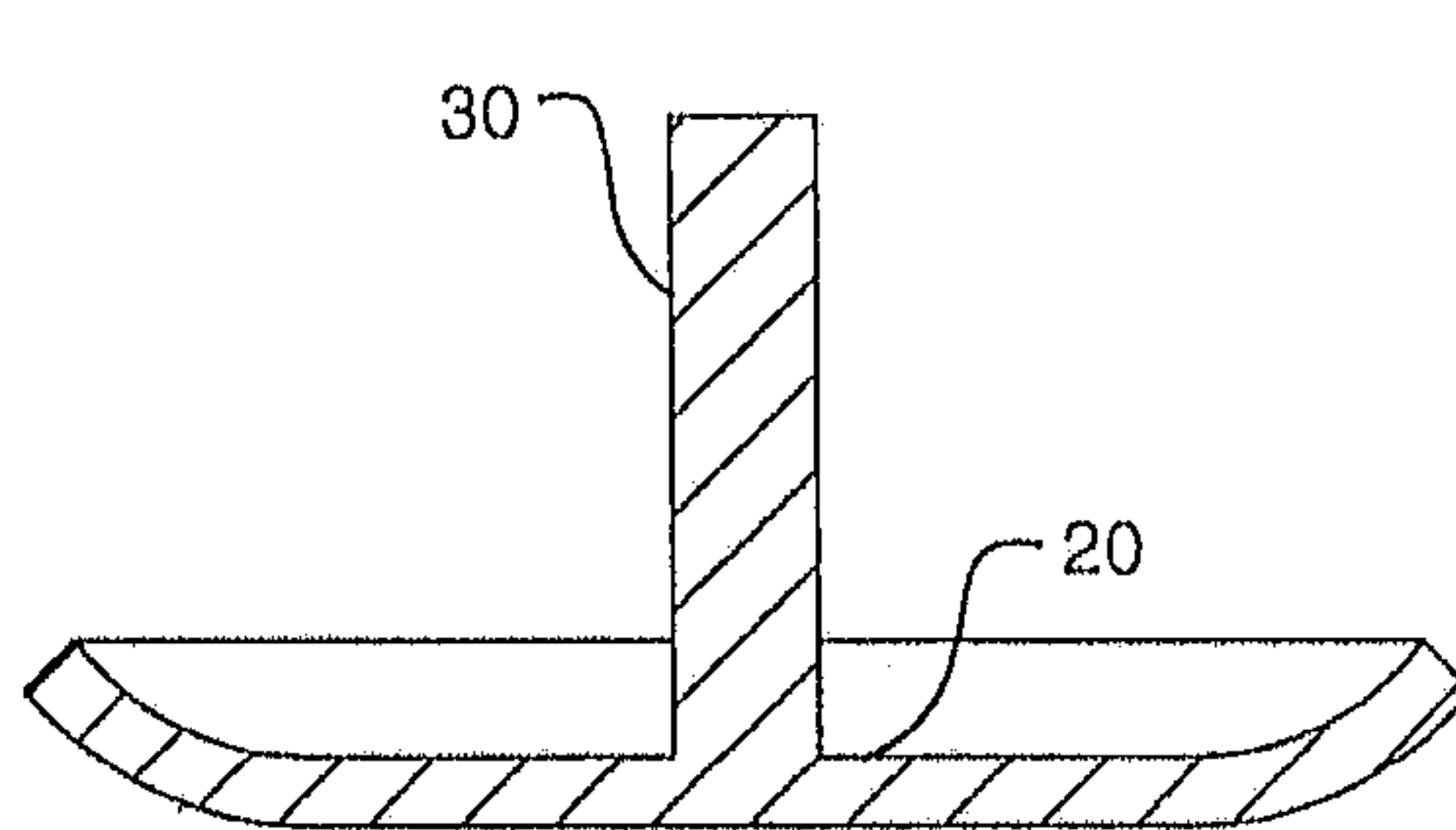
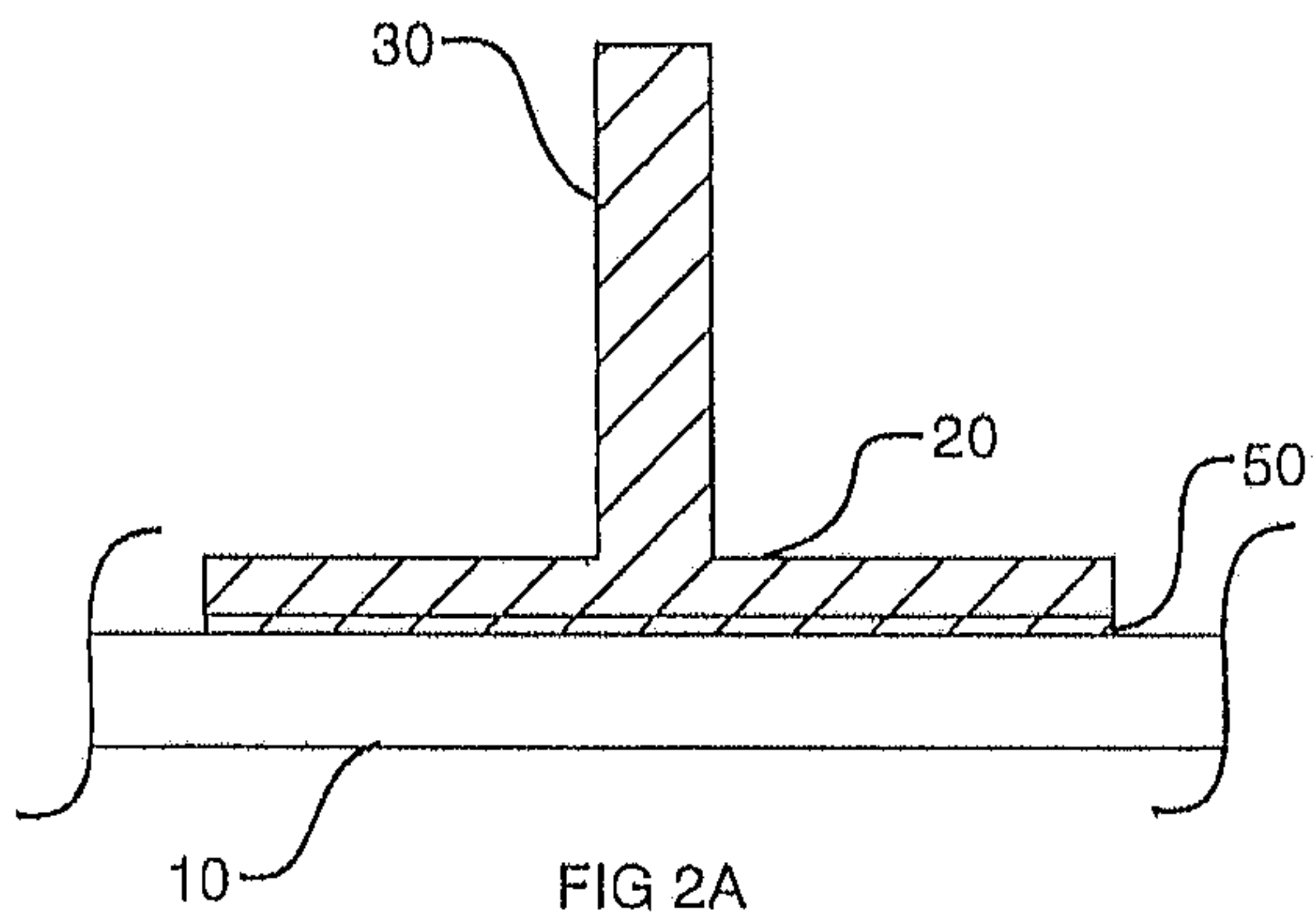


FIG 1D

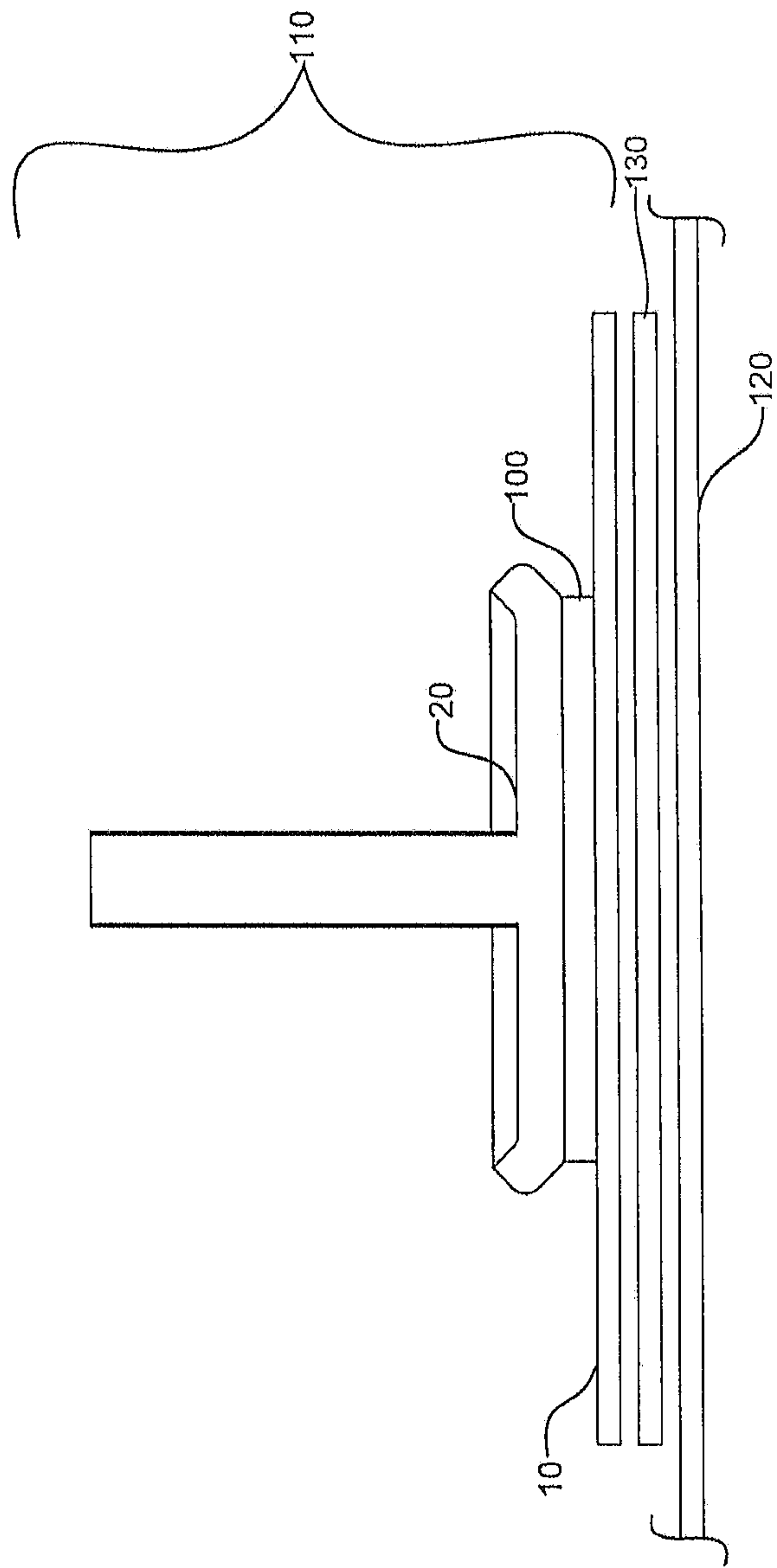
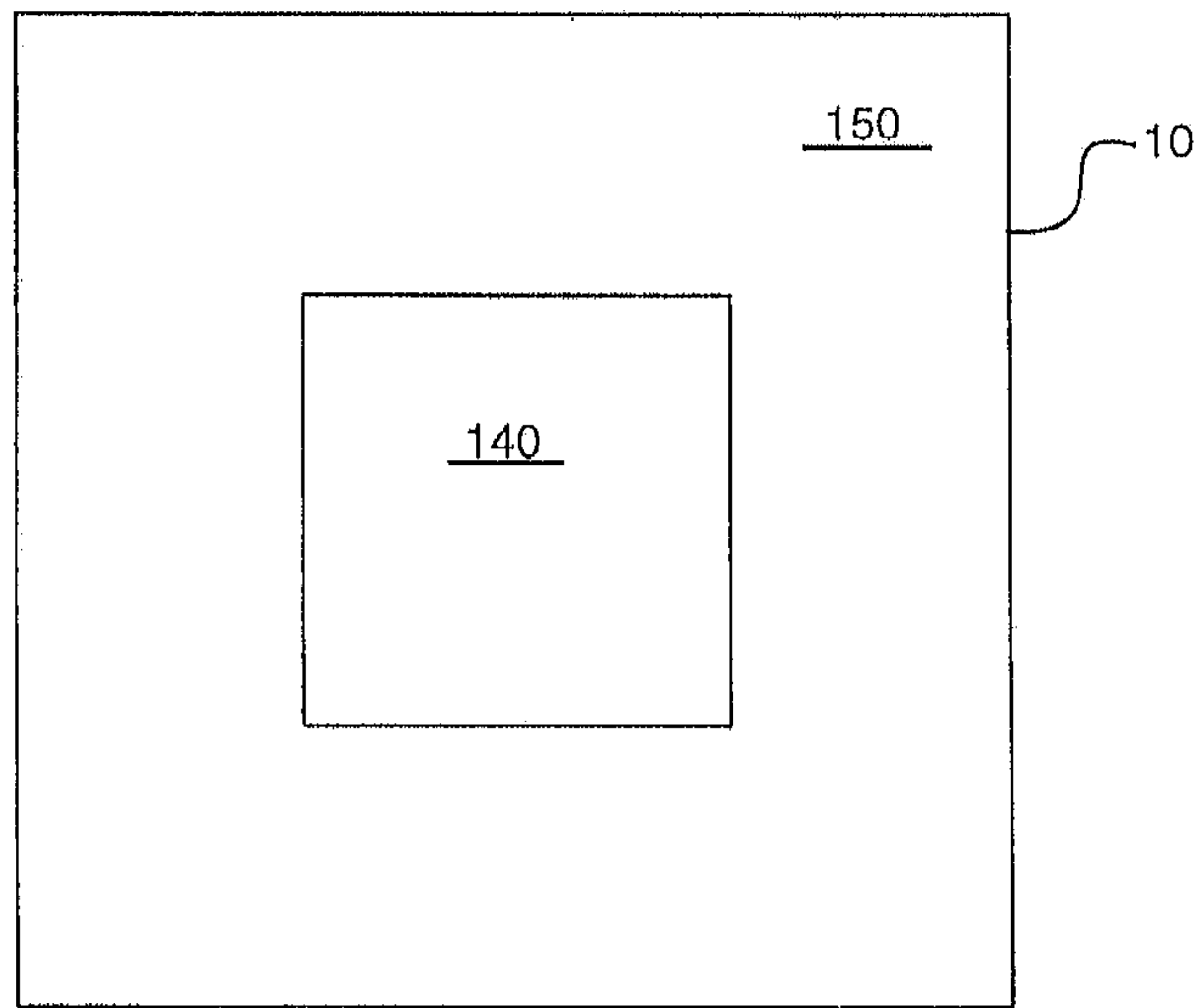
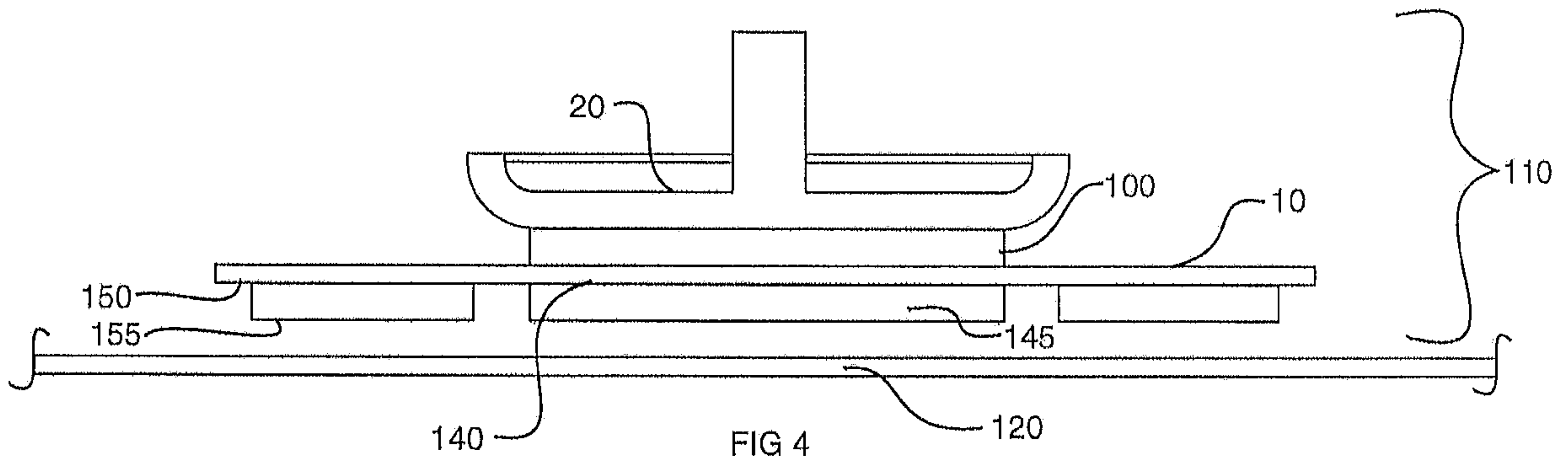


FIG 3



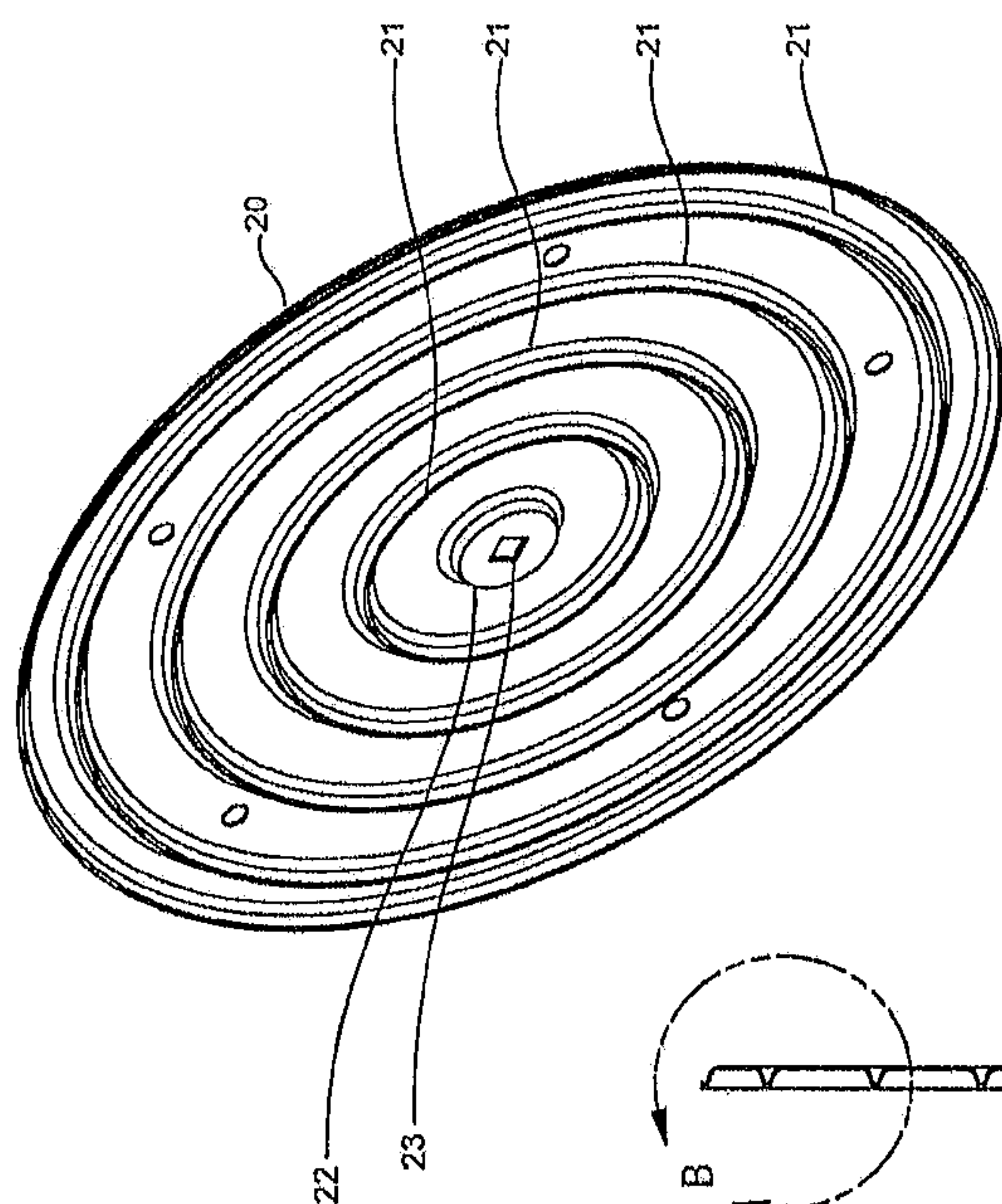


FIG 6F

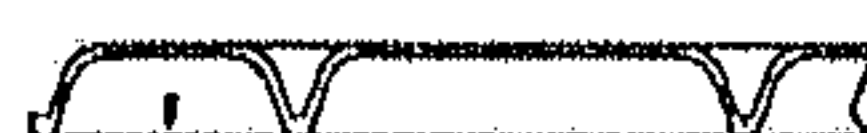


FIG 6E

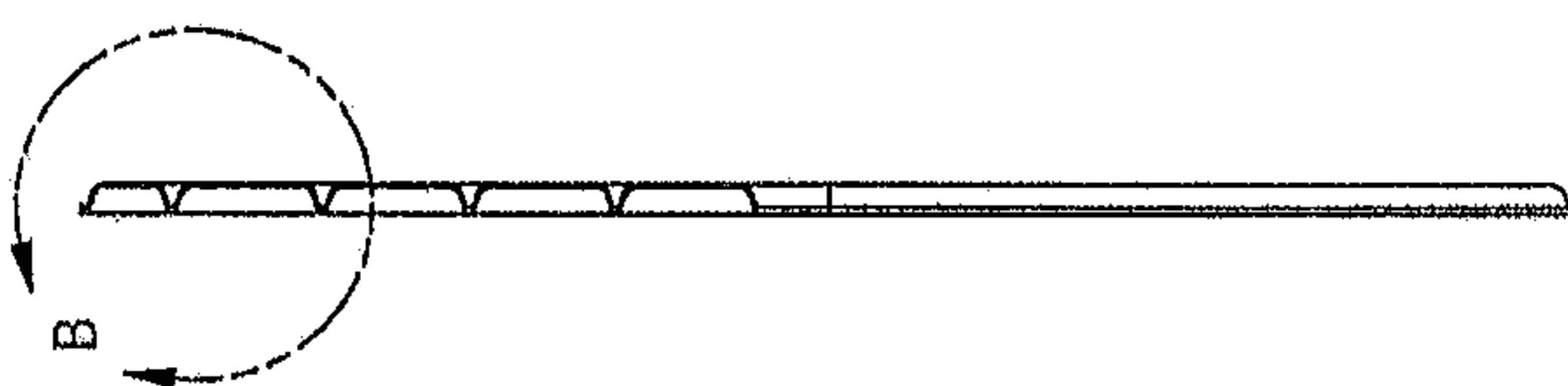


FIG 6D

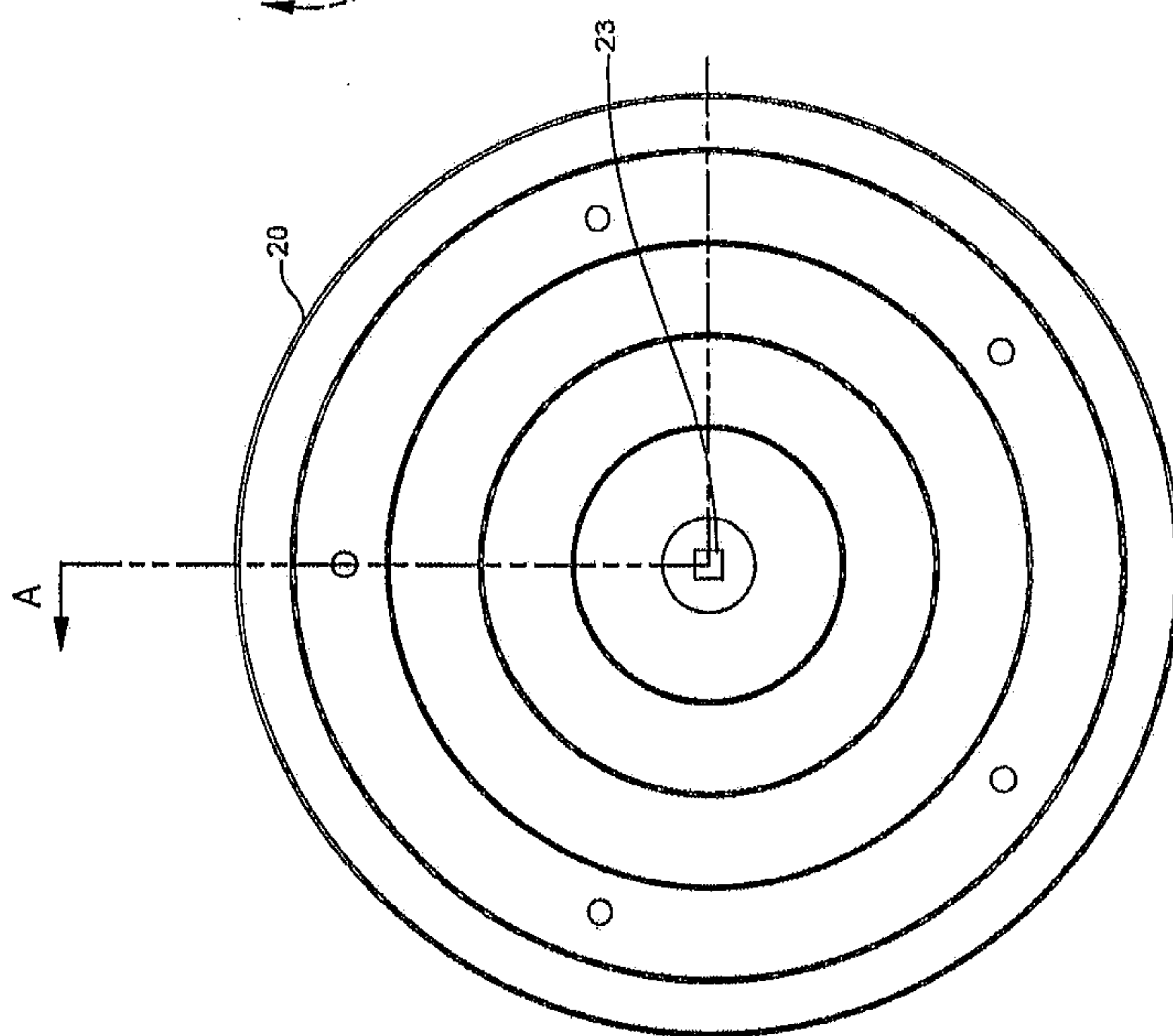


FIG 6B

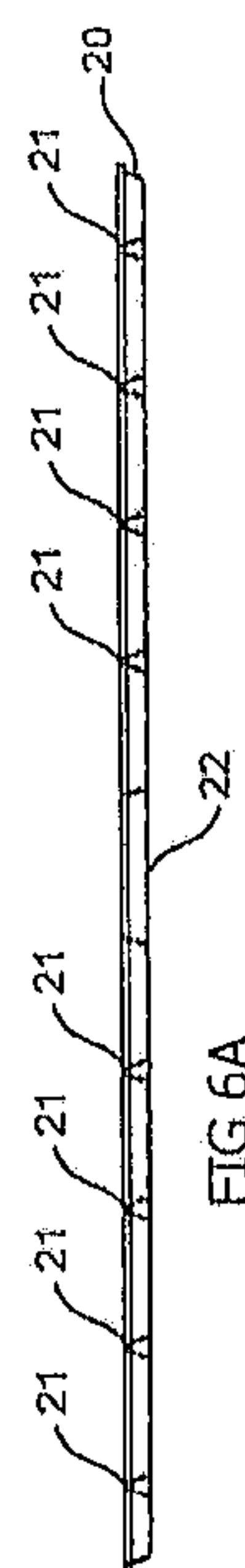
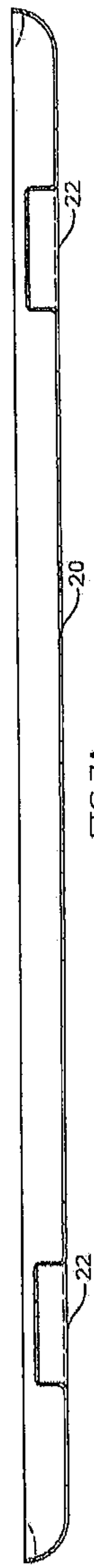
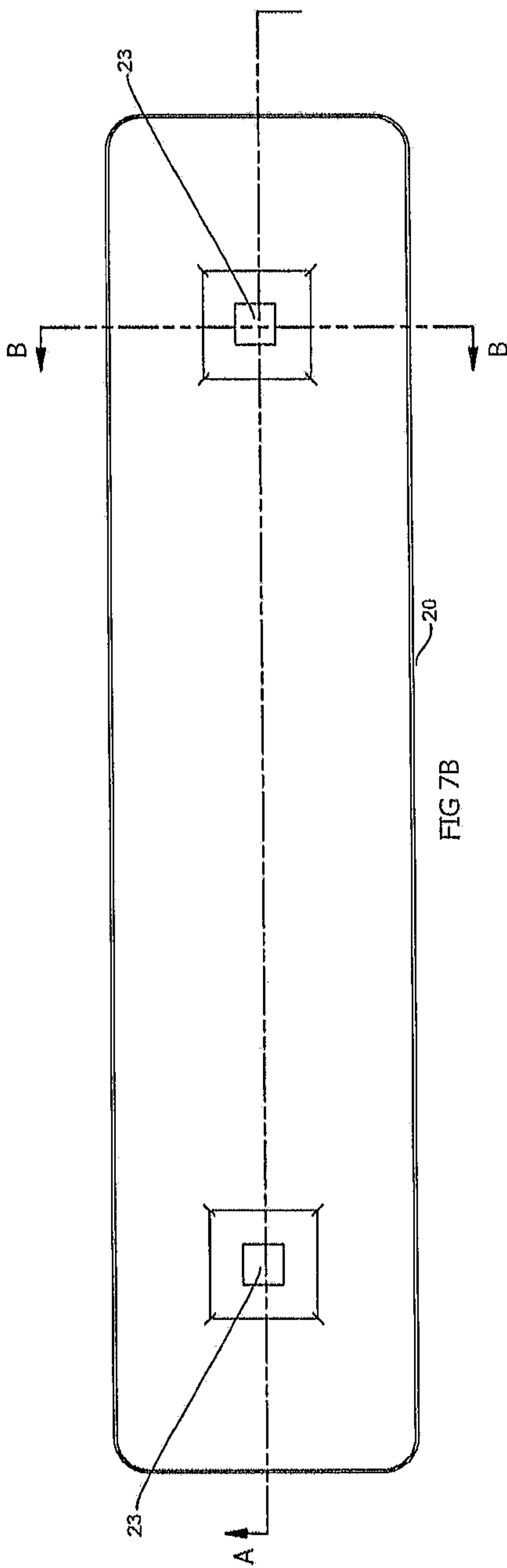
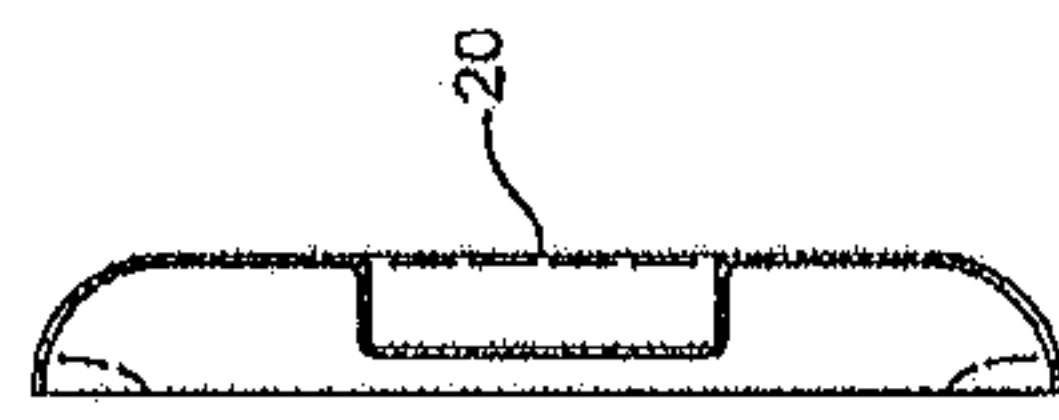
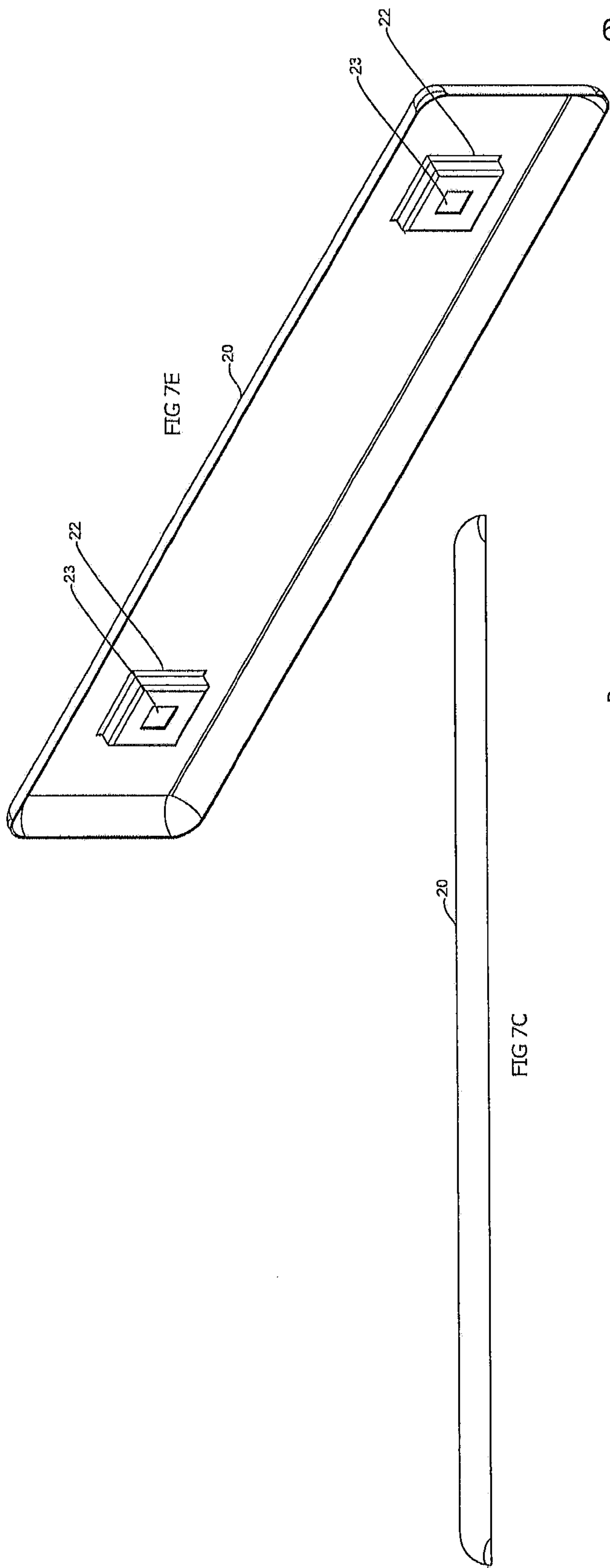


FIG 6A



FIG 6C

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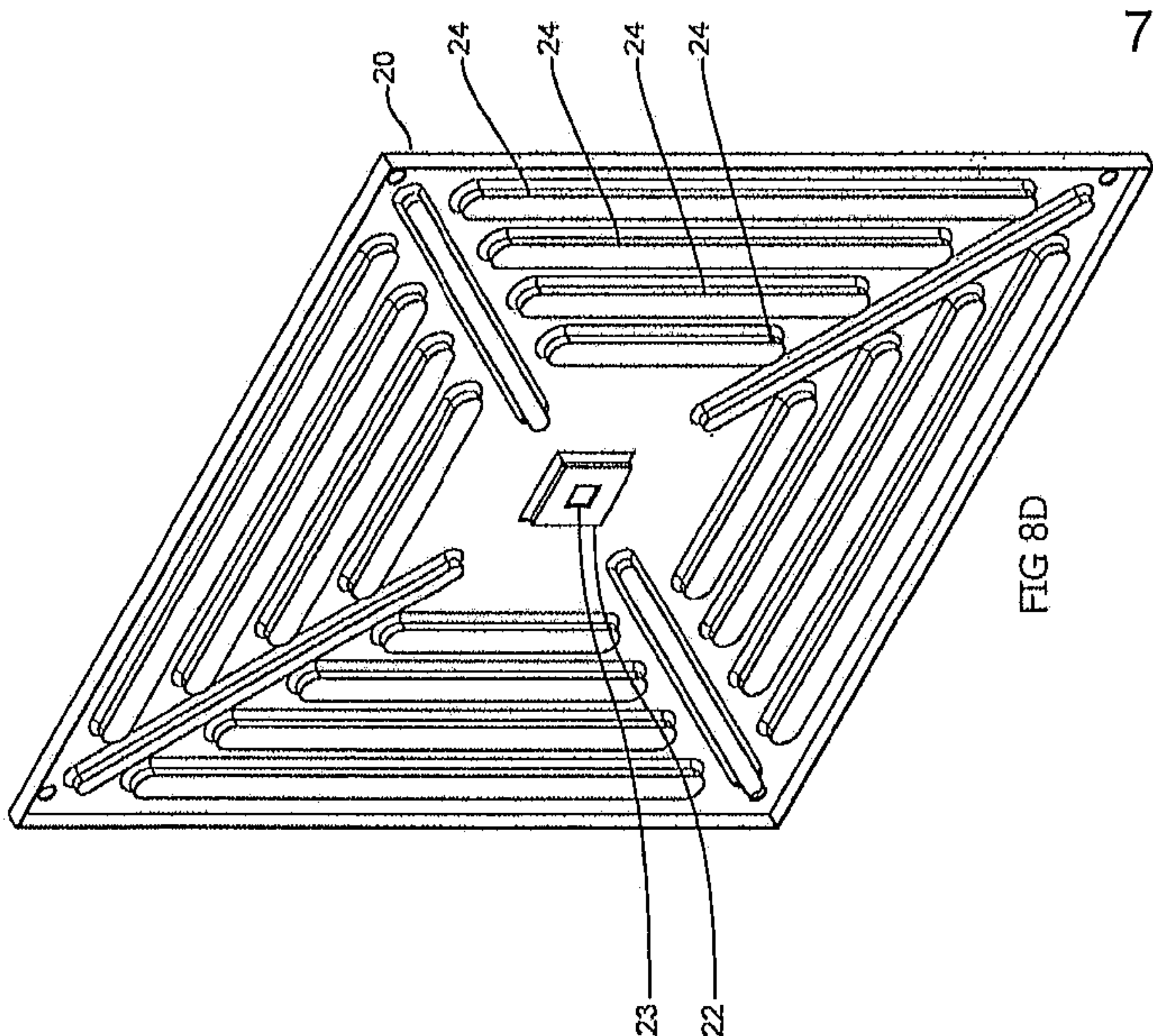


FIG 8D

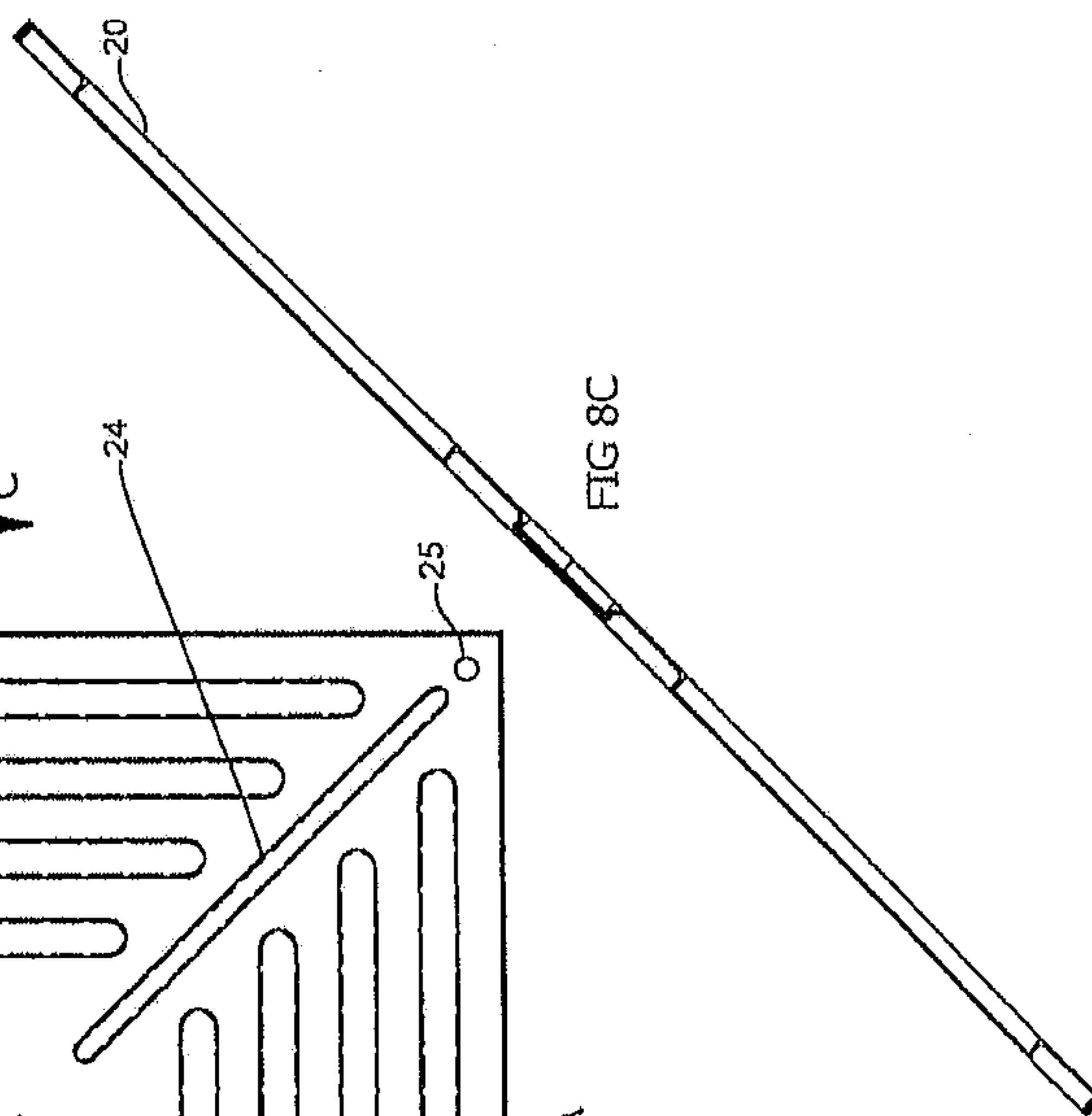


FIG 8C



FIG 8C

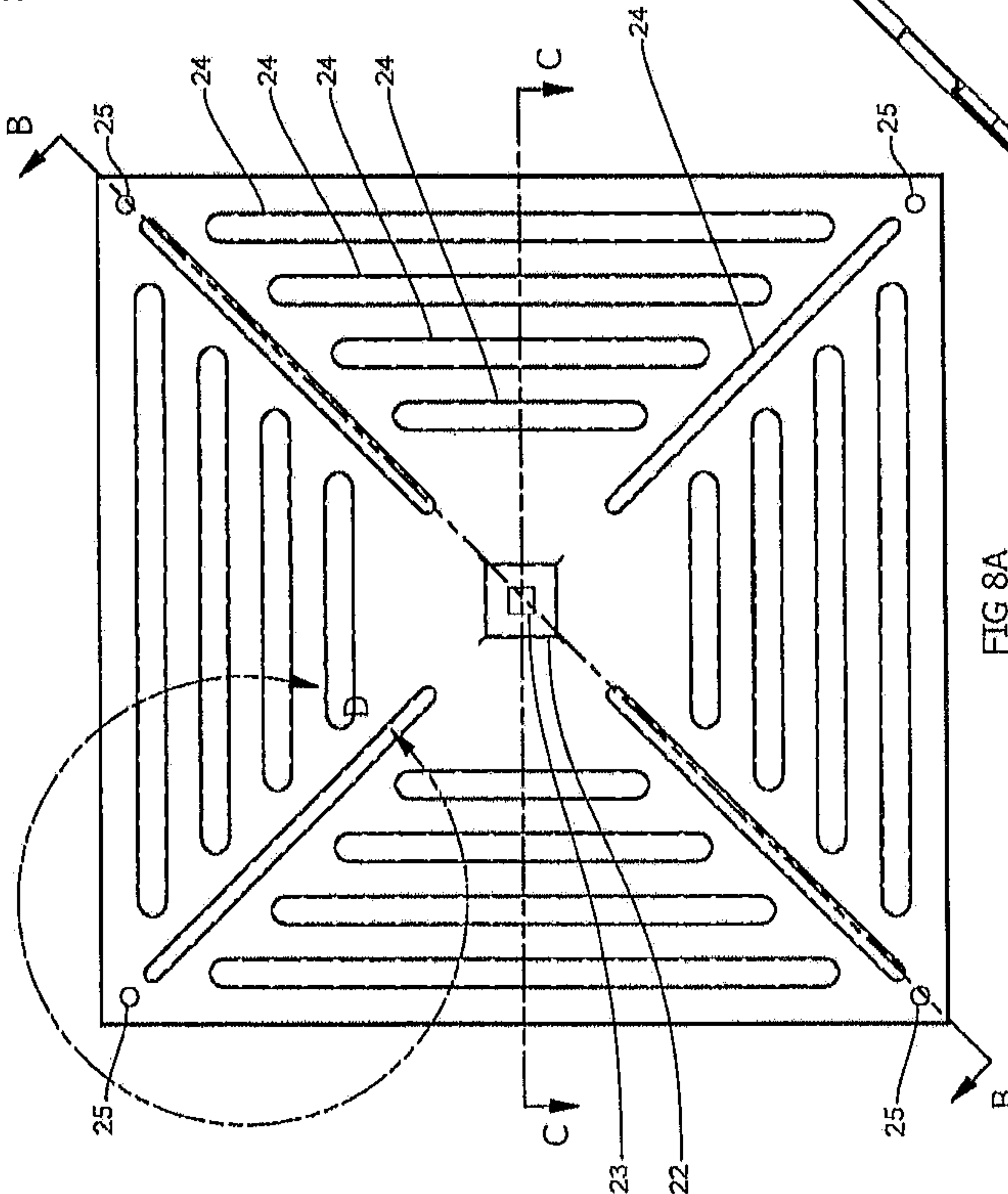
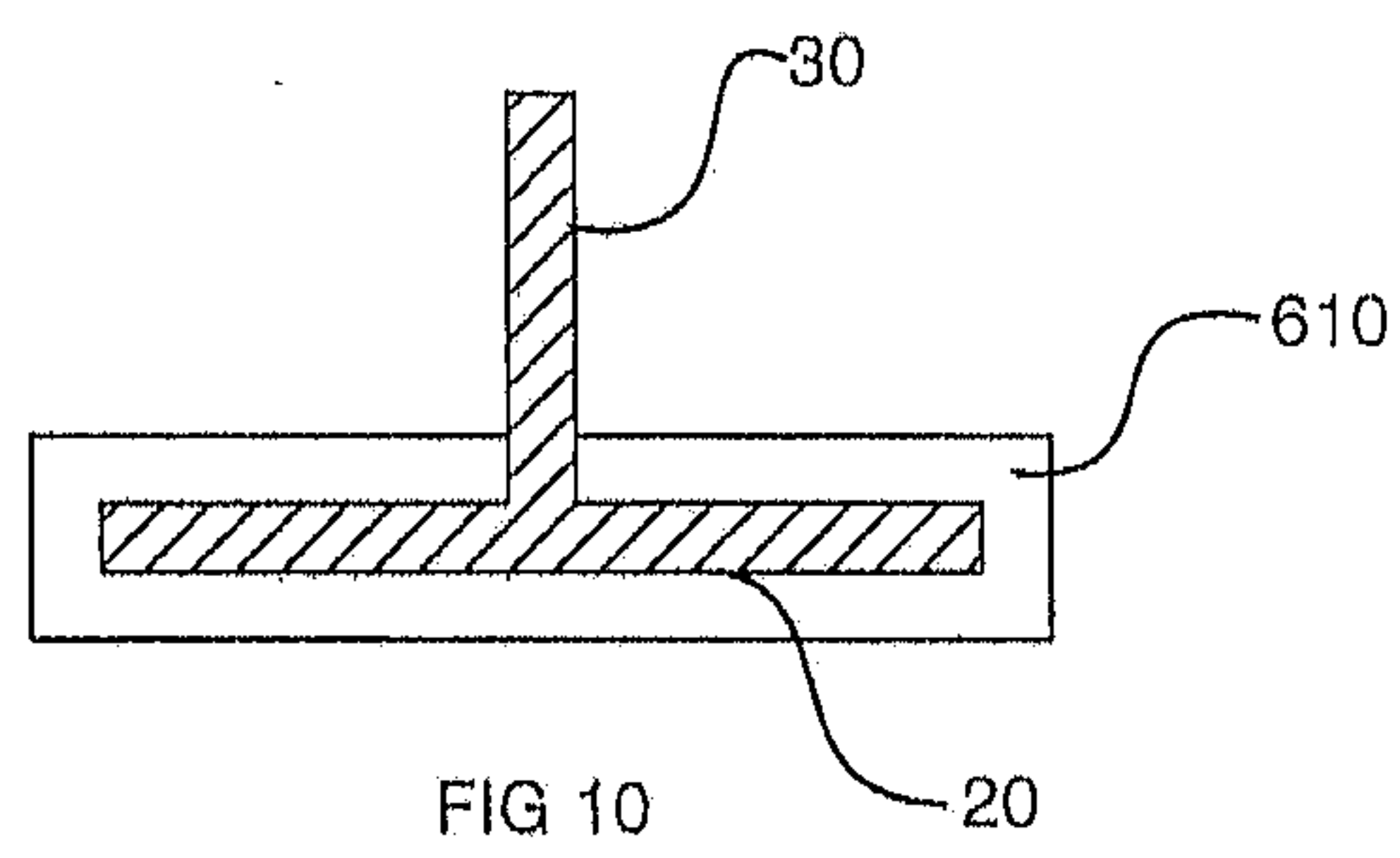
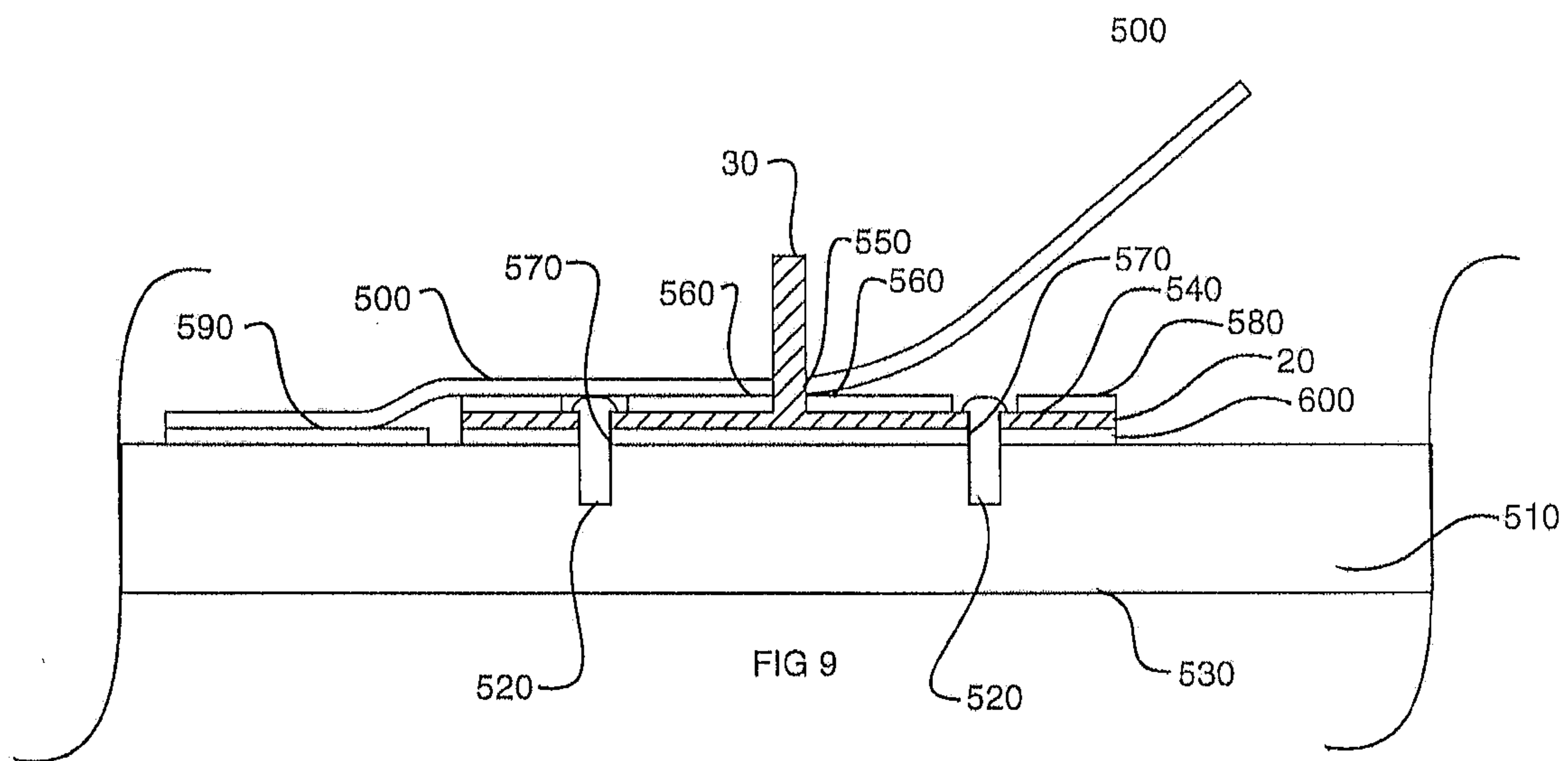


FIG 8A



FIG 8B



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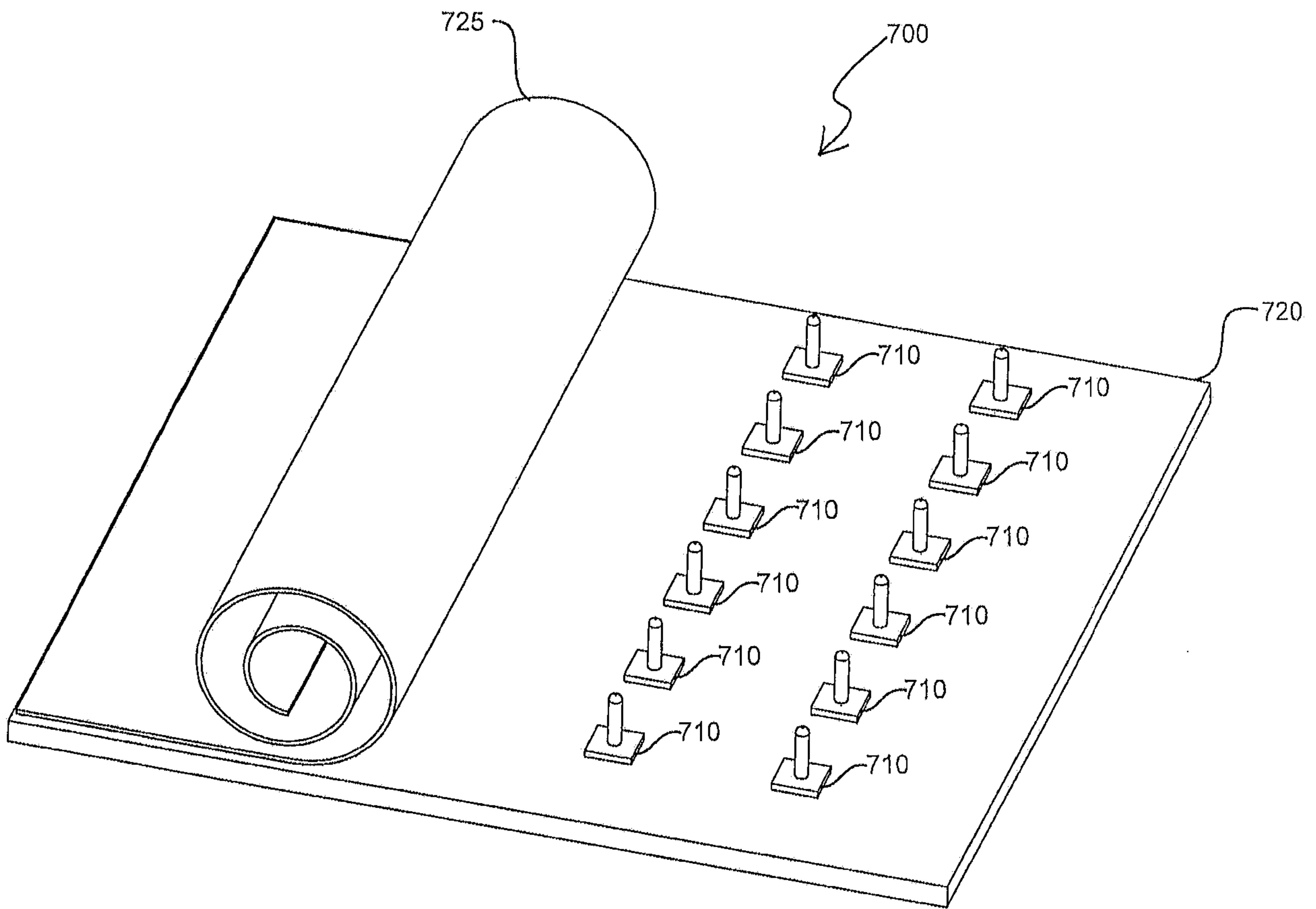


FIG 11

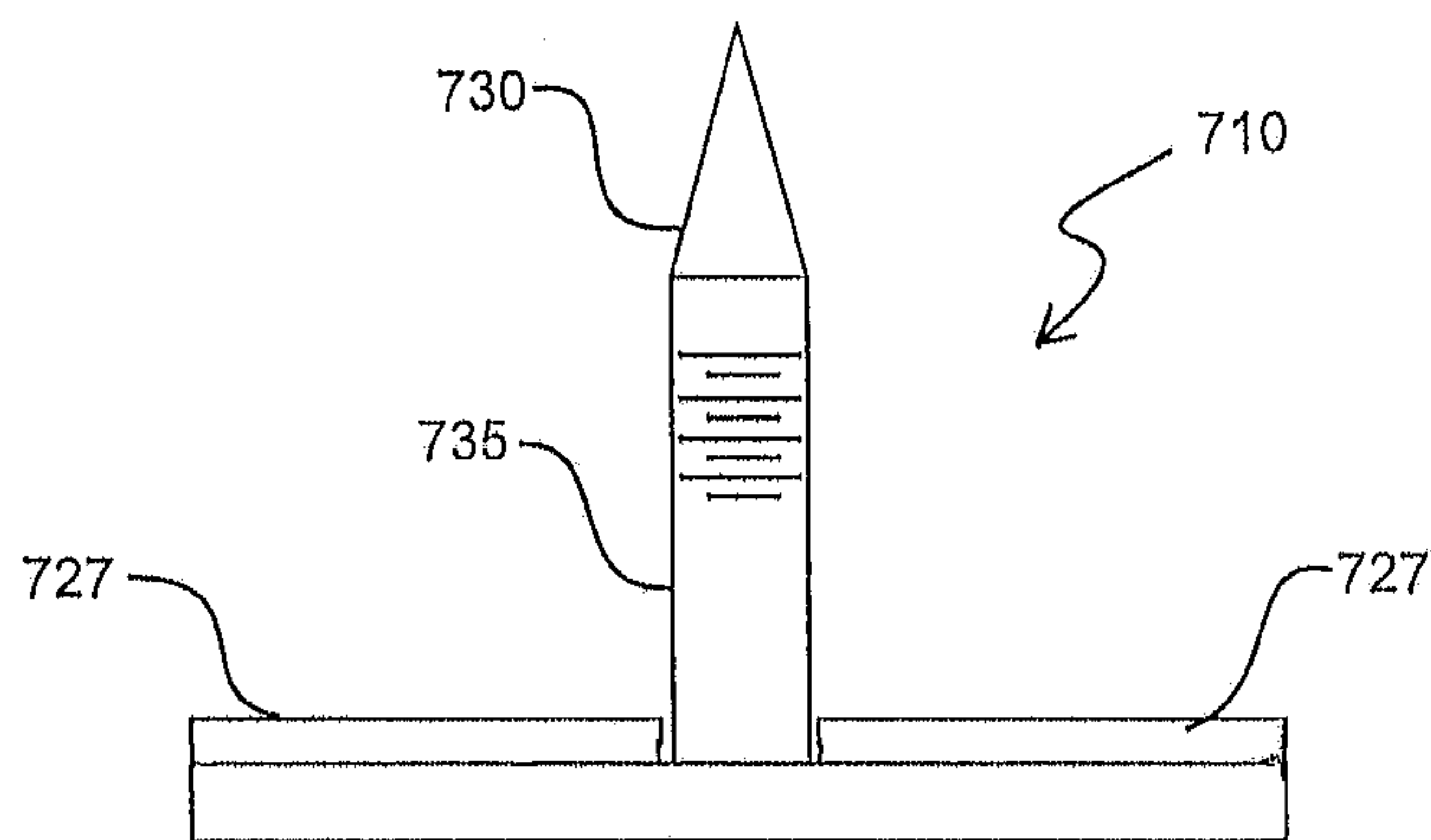


FIG 12

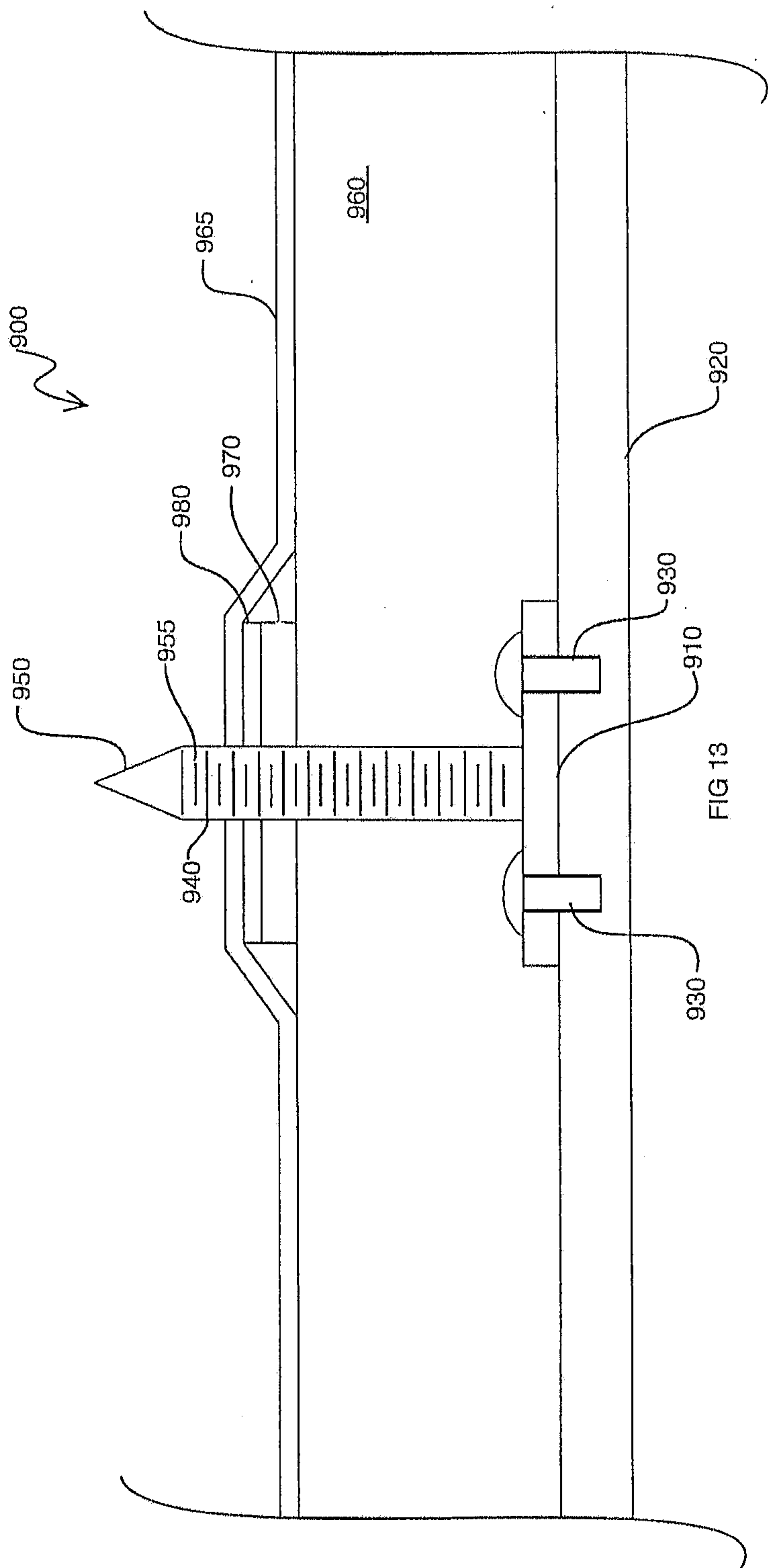


FIG 13

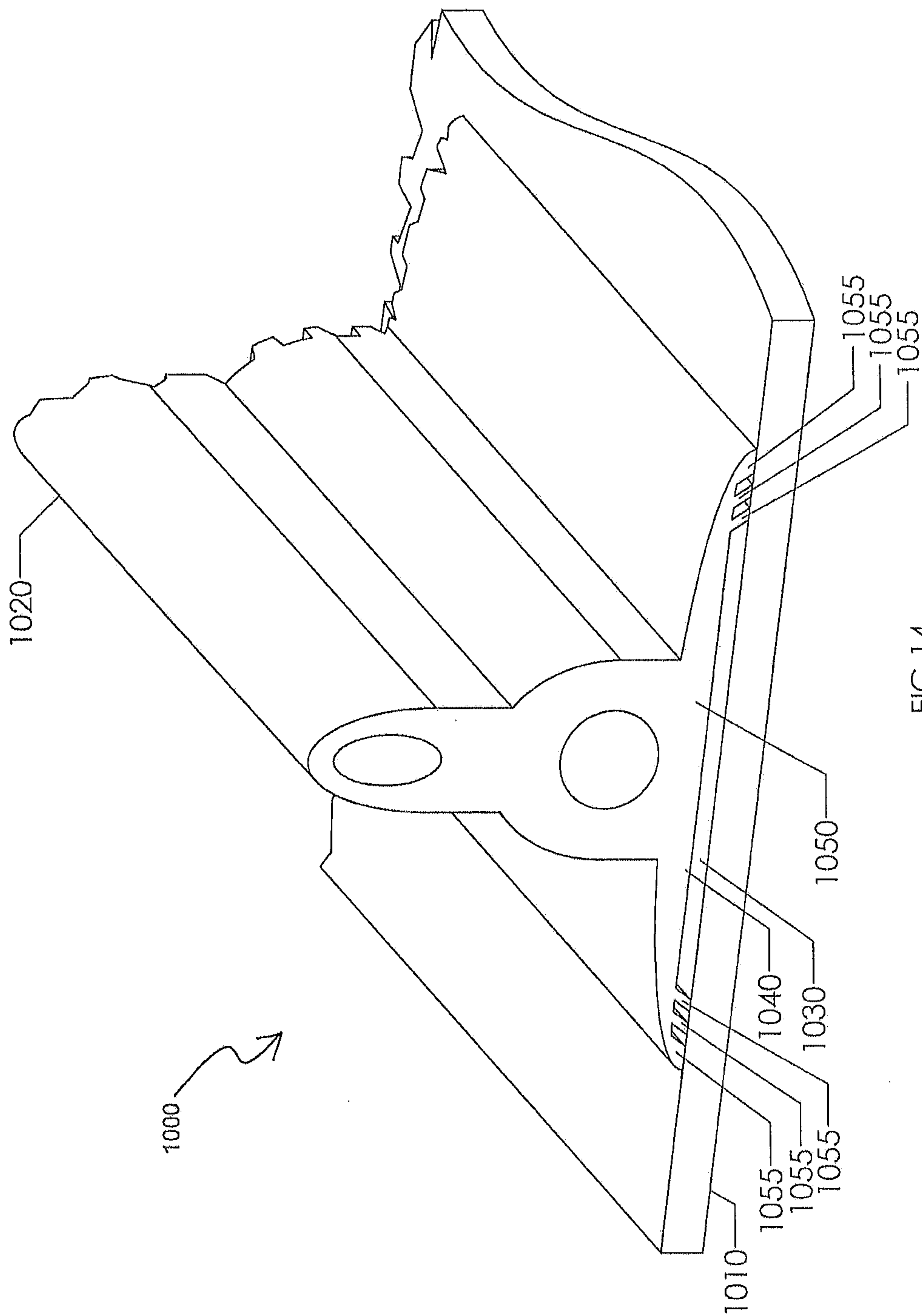


FIG 14

