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(54) Building apparatus and method

Vorrichtung und Verfahren zur Errichtung von Gebäudeteilen

Appareil de construction et procédé associé

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Description

[0001] This invention relates to building apparatus, particularly but not exclusively to building apparatus for use in the construction industry.

[0002] Although the following description refers almost exclusively to building apparatus for use in the construction of sea and river defences, it will be understood by persons skilled in the art that the building apparatus according to the present invention can be used in many different constructions, such as retaining walls, marine harbour construction, jetty construction, bridge foundations, land reclamation and/or the like. In addition, a scaled down version of the building apparatus can be used to form the elements of a child's toy.

[0003] There is becoming an increasing public awareness of environmental issues such as global warming. It is believed that the pole glaciers are melting and sea levels are rising and will continue to rise in the future, claiming many coastal land areas and eroding coastal environments. It is therefore important to provide sea defences to combat rising water levels and prevent flooding during periods of bad weather.

[0004] Conventional forms of sea defence structures include stone laying or concrete pouring in areas vulnerable to flooding or erosion. However, it is difficult to arrange stones in such a way that they form a stable structure and do not let water pass through the same. Problems are associated with pouring concrete onto areas vulnerable to flooding or which are already under water and include transporting the equipment required to make and pour the cement, difficulties associated with cement setting in water to form a stable structure, cost, time required to form adequate defences and difficulties of moulding the cement on site into a desired shape.

[0005] A further example of a known sea defence system is the provision of pre-cast blocks/units which can be arranged together to form a wall construction. These blocks have apertures provided therein and short pins made of fibreglass or metal. Blocks are typically joined together by lowering one block onto another block such that the short pin on one of the blocks locates in the aperture of the other block. This product is complicated and time consuming to assemble due to the accuracy of the alignment required for a short pin to locate with a small aperture. This is undesirable, particularly if some of the construction is to take place in or under water. In addition, a single pin is in communication with a single block only and so stability of a construction using these blocks relies on a large number of blocks being used. US-A-4,651,485 discloses an interlocking building block system according to the preamble of appended claim 1.

[0006] An aim of the present invention is to provide building apparatus which can be used to form constructions both quickly and easily and which is inexpensive to manufacture.

[0007] According to a first aspect of the present invention there is provided building apparatus according to ap-

pended claim 1.

[0008] Preferably the at least one location member is an elongate rod.

[0009] Preferably the top and base surfaces of each pre-cast unit are planar so that the units can be stacked on top of each other.

[0010] Thus the present invention has the advantage over the prior art in that a plurality of pre-cast units are in contact with any one common elongate rod, thereby creating a more stable structure resistant to earth and fluid pressure.

[0011] The at least one elongate rod is secured in a surface on which the construction is to be built in a pre-determined position prior to location of the pre-cast units therewith.

[0012] In one embodiment the location member is secured in the surface at the site on which the construction is to be built. In an alternative embodiment the location member is supported in a pre-determined position, at least in part, by the units locating with the same.

[0013] Preferably the at least one portion of the pre-cast unit is a slot.

[0014] In one embodiment the at least one portion of the pre-cast unit which locates with the location member is an aperture through which the location member passes.

[0015] In one embodiment the pre-cast unit is provided with a single aperture or slot. In an alternative embodiment the pre-cast unit is provided with two or more slots or apertures to locate with two or more location members. In this latter embodiment the slots can be provided on the same side and/or end of the unit.

Alternatively the slots can be provided on opposite sides and/or ends of the unit.

[0016] Once a pre-cast unit has been located with a location member, securing means are provided to further maintain the units in communication with the location member.

The securing means are "key stones" which are placed in any remaining gap of the slot or aperture when the unit is located with the location member. The keystones prevent and/or limit unilateral movement. Adhesive means such as concrete can be used to fill any remaining gaps.

[0017] Preferably a series of pre-cast units are placed one on top of the other in either an aligned or non-aligned, overlapping arrangement to form a construction. In either of these arrangements a common location member locates with a stack comprising a plurality of pre-cast units.

[0018] Preferably the slot of a pre-cast unit is placed in an off-set relationship with the units above and below the same, thereby increasing the stability of the construction. The units can be arranged in layers and can be arranged in a jigsaw interlocking type configuration.

[0019] In one embodiment the pre-cast units have interlocking portions on end or side walls which when placed side by side, end to end or side to end with complementary portions of a similar unit interlock, thereby further increasing the stability of the construction.

[0020] The pre-cast units can be located with the location member by workers manually locating each unit in turn with a location member. In an alternative embodiment, the pre-cast units can be lowered onto or around the location member by a crane or other lifting apparatus.

[0021] In one embodiment the at least one location member can be located in or on the surface in a substantially vertical position. Alternatively the at least one location member can be located at an acute angle to the vertical. In this latter embodiment, the slots or apertures of the pre-cast units are angled accordingly.

[0022] Preferably the pre-cast units are cast from concrete or any other material which allows the units to withstand temperature, moisture extremes and land movement.

[0023] Preferably polyurethane membranes can be provided between and/or around the pre-cast units, thereby preventing water ingress through the resulting structure. This technique can be used to prevent water/fluid from entering a particular designated area i.e., for use as flood defences, or keep water/fluid in a pre-designated area i.e., for use in reservoir/tank construction.

[0024] According to a second aspect there is provided a pre-cast unit comprising at least one slot and/or recess which allows the pre-cast unit to be located with at least one location member to form, in conjunction with a series of pre-cast units, a construction

[0025] Preferably the pre-cast building unit comprises a single slot.

[0026] Preferably two or more slots are provided on opposite sides and/or ends of the unit.

[0027] Preferably the two or more slots are provided on the same side and/or ends of the unit.

[0028] According to a further aspect there is provided a construction including a plurality of pre-cast building units and at least one location member, the pre-cast building units having at least one location portion and wherein the pre-cast building units locate with at least one common location member.

[0029] Preferably the number of location members are spaced on a ground surface a pre-determined distance apart in such a way that the pre-cast units locating with the location members form at least one adjoining layer.

[0030] According to a further aspect there is provided a construction including a plurality of location members positioned on a ground surface and spaced a pre-determined distance apart, and a plurality of pre-cast units, each unit having at least one location portion for location with one or more of said location members, said pre-cast units within said construction being arranged in a number of layers, and each location member being common to a unit in each layer.

[0031] According to a yet further aspect there is provided a method of forming a construction, said method including assembling a plurality of pre-cast building units in a mutually supporting arrangement by locating at least one common location member with at least one slot and/or recess provided on each of said pre-cast units,

and stacking said located pre-cast building units to form a construction.

[0032] Advantages of the present invention are that the pre-cast units can be used to form a construction in or under the water both quickly and easily and in all kinds of weather conditions. No special training is required to assemble the pre-cast units with the location members, which are self locating and the same can be fitted together in a similar manner to fitting a jigsaw together. Since the units and the location members are pre-cast, there is no requirement for the same to be made on site and they can be transported easily to a desired location.

[0033] A large number of aesthetically appealing designs/patterns can be provided with the pre-cast units when forming a structure. In addition, the pre-cast units of the present invention can be fitted together to reinforce an existing structure by forming constructions in front of or behind the same without requiring the existing structure to be demolished.

[0034] In one embodiment of the invention, the pre-cast units can be provided in such a form that they allow workers assembling the pre-cast units to work on one side of the construction only. This is particularly advantageous when a water defence is being built and the workers can work on the land side of the construction. The pre-cast units can be provided in a variety of sizes and shapes making the same useful for a wide variety of applications. The pre-cast units and the location members are also inexpensive to produce.

[0035] The design of the building apparatus and pre-cast units of the present invention allows additional pre-cast units to be added to a construction at a later date, thereby allowing water defences or similar to be raised as water levels rise.

[0036] Embodiments of the present invention will now be described with reference to the accompanying figures wherein:

Figure 1 is a schematic view of the building apparatus according to the present invention;

Figure 2 is a detailed example of a possible construction using the building apparatus;

Figure 3 is an example of securing means for use with the building apparatus;

Figure 4A-4B are an example of a pre-cast unit according to an embodiment of the present invention;

Figure 5, 5a and 5b are a perspective view and first and second side views respectively of embodiments of constructions formed using the present invention;

Figures 6A-6T are examples of pre-cast units according to the present invention; and

Figures 7A-7D are further examples of pre-cast units

according to the present invention.

[0037] Referring firstly to Figure 1, there is illustrated a schematic view of the building apparatus of the present invention used for the construction of a sea defence.

[0038] Location members in the form of elongate rods 2 and 2' are secured into the ground 4 below the water level 6. The rods are positioned a pre-determined spaced distance apart.

[0039] Pre-cast unit 8 (pre-cast units hereinafter referred to as units) are provided with slots 10 and 12, slot 10 being located with rod 2 as illustrated. A single perspective view of a unit only is shown in Figure 1 for clarity, and a number of units in side view are shown in connection with rods 2 and 2' above.

[0040] Units 14 and 16 are of a similar type to unit 8 but shown from the side, such that slots provided in each unit locate with rods 2 and 2' respectively. Alternatively the units can be provided with two slots, such that one slot locates with rod 2 and the other slot locates with rod 2', as shown by units 18 and 20 when viewed from the side. Units 14 and 16 can be placed in adjacent layers to units 18 and 20, so that in one section of a construction layer a unit contacts both rods and in adjacent layers a unit contacts a single rod, thereby forming a stable structure.

[0041] Caps 22 can be located over the free ends of elongate rods 2, 2' to prevent the units from being removed once located with the rods.

[0042] Figure 2 is a detailed example of the building apparatus according to the present invention. The unit 102 is provided with slots 104, 104'. The slots 104, 104' include a rod location portion 106 and a key stone location portion 108. Slot 104' is located with the rod 110 by lowering the unit over the free end thereof.

[0043] Slot 101' of unit 102' is located with rod 110 on top of unit 102. The openings of the slots on the side walls of the units are typically positioned on different sides of the wall construction in each unit layer, such that the slots of units in adjacent layers do not align.

[0044] A key stone 112 is provided to fit in the key stone location portion 108, as shown by arrow 113. The key stone increases the stability of the construction by providing support for the units above and/or below the key stone, and also prevents movement, particularly unilateral movement, of the unit relative to the rod.

[0045] Figure 3 is a further example of a unit 202 having a rod location portion 204 and a key stone location portion 206 for location of a key stone 208. The portions 204 and 206 can be shaped according to the shape of the rods and key stones which are to be located therewith. Unit 202 has further interlocking portions in the form of an interlocking protrusion 210 and interlocking recess 212. Unit 202 can be interconnected side by side, end to end or side to end with other units, having complementary interlocking portions, such that ends and/or sides of units interlock.

[0046] Figure 4a is a plan view of a shaped unit 302

having a slot portion 304. This type of unit is particularly useful for the construction of towers, channels, corners of constructions and/or the like. Figure 4b shows a perspective view of the unit in Figure 4a.

[0047] Elongate rods can be located with slot portion 304 and/or complementary shaped protrusion portions of adjacent units can be interlocked therewith.

[0048] Figures 5, 5a and b illustrate further examples of possible constructions according to the present invention, with rod supports 402 in the figure being secured substantially vertically in the ground although they can as shown in Figure 5b, be secured in the grounds at an acute angle to the vertical.

[0049] The rods in one embodiment can be secured at a particular orientation in the ground by setting the rod in a concrete base. Alternatively the weight of the units, when stacked in layers to form a construction, provide sufficient support for the rods.

[0050] The slots 407 of the units 406 as previously described are angled according to the type of rod support they are to be located therewith. The Figures 5, 5a and b illustrate how the building apparatus of the present invention can be used to form a sea defence construction, the sea level shown by arrow 408 and the sea wall 410. Different sized units 405, 406 can be provided within the construction to create an aesthetic feature and/or functional feature, i.e., concave structure to prevent/limit waves from breaching over the top of the structure.

[0051] Figures 6A-6T illustrate examples of further units of the present invention. Figure 6a shows a unit 502 having two slot portions 504 and 506 opening onto the same side 508 of the unit. The remaining sides and ends of the unit 502 are substantially planar.

[0052] Figure 6B shows a unit 510 having two slots 512 and 514, each comprising key stone location portions 516 and 518 and rod location portions 520 and 522 respectively. In addition, the unit 510 is provided with interlocking portions in the form of a recess 524 and a protrusion 526 on opposite ends, other units having complementary interlocking portions being interlocked therewith for the formation of a construction/structure.

[0053] Figure 6C shows a unit 528 having two slots 530 and 532 and partially tapered ends 534 for interlocking with similar shaped blocks. A plan and end view of the unit and a side view of the unit are shown in Figures 6D and 6E respectively.

[0054] Figure 6F shows a perspective view of a unit 536 having a single slot 538 and angled ends 540 and 542. Figures 6G and 6H show a plan view and side view of unit 536 respectively.

[0055] Figure 6I shows an arrangement of a plurality of the units shown in Figures 6f-6H, each angled end of the units adjoining with a complementary angled end of an adjacent unit to form a construction. The direction of the slots 538 in adjacent units are arranged in opposite directions, and slots in adjacent layers are not aligned, thereby forming a stable structure.

[0056] Figure 6J is a plan view of a unit 544 having

slots 546 and 548 opening onto opposite sides 550 and 552 of the unit. The ends of the unit are again angled. Figure 6K and 6L show the unit 544 in end view and side view respectively.

[0057] Figures 6M-6N and 6P show a unit 553, similar to unit 544 (as illustrated in Figure 6J), but the two slots 554 and 556 open onto the same side 558 of the unit.

[0058] Figure 6o shows an arrangement of a unit 555 shown in Figure 6Q to form a construction with adjacent similar units, all units located on spaced rods 557 to form a barrier between the water 559 and land 561.

[0059] Figure 6R shows a further arrangement of a possible unit 560 having hemispherical slots on the side walls 564, elongate slots 563 on the side wall 566 and intermediate the walls there is provided a hollow section 565 which can act as a locating means and/or a means by which material savings can be obtained.. The slots 562 are provided on side 564 and ends 566 and 568 of the unit 560. Figures 6S shows a plan view of the unit 560 and Figure 6T shows a construction which can be formed using the units 560 and rods 561 in plan and elevation an end view and side view respectively of unit 560.

[0060] Figure 7A and 7B show a plan view and perspective view of a "fill type" unit 600 respectively. A slot 602 is provided for location with a rod/piling. Shaped apertures 604 are provided within the unit 600 which can be filled with earth or other matter to further support the resulting structure. Alternatively the apertures can be left unfilled and provide a light weight structure which can be easily transported and constructed.

[0061] Figure 7C and 7D show a plan view and perspective view of a "hollow W type" unit 610. Two slots 612 and 614 are provided on side 616 of the unit for location with locations rods. Shaped recesses 618 are provided at each end 620, 622 of the unit to interlock with units having ends and/or sides of complementary shape.

[0062] It is noted that the present invention in its simplest form can comprise one or more rods locating with a single layer of units.

[0063] The location rods or piling are placed at the correct pitch in the ground prior to locating the pre-cast units therewith. Ground density analysis is typically performed to ensure the piling is placed at the correct pitch. The piles can be maintained at the correct pitch by special fixing rods, typically made of steep or fibre ropes, which can be removed during the construction process. The screw rods also help to prevent turnover movement of the construction. Levelling of the ground prior to location of the pre-cast units is often not required due to the weight of the units levelling out uneven ground.

[0064] It will be appreciated by persons skilled in the art the examples given of the possible shapes of the units and slots is non-exhaustive. The self locating and interlocking action can be achieved with reasonable accuracy both in and out of waterlogged ground and/or in extreme weather conditions.

[0065] The units can also include one or more aper-

tures in addition to or as an alternative to one or more slots.

[0066] The size and shape of the units typically vary depending on the type and size of construction for which they are to be used. In addition, the slots or apertures vary in size and shape according to the size and shape of the rods with which they are to be located.

[0067] The present invention can be used to combat coastal erosion, for the construction of retaining walls, particularly marine harbour and jetty formation, bridge formation, land reclamation, stepped agricultural terraces, motorway central reservation structures and/or the like.

[0068] The units, location members and/or key stone can be made from any or a combination of concrete, reinforced concrete, stone or recycled materials.

[0069] Thus it can be seen that the present invention provides novel building apparatus, with pre-cast units which when located with one or more elongate rods forms the basis of a stable construction which is easy and quick to construct.

Claims

1. Building apparatus, said apparatus including a plurality of pre-cast building units(8,102) and at least one location member (2,110), the pre-cast building units having at least one location portion (10,12,104) and wherein the pre-cast building units locate with at least one common location member to form a construction, wherein securing means (112) are provided to secure at least one said pre-cast unit to the location member once said pre-cast unit has been located with said location member, and wherein the location portion is in the form of a slot and/or recess in a side wall of the pre-cast unit, **characterised in that** the securing means is a key stone (112) which is shaped for location in said slot (104) and/or recess between said location member (110) and the opening of said slot and/or recess on said side wall.
2. Building apparatus according to claim 1 wherein the location member is an elongate rod (110).
3. Building apparatus according to claim 2 wherein the at least one elongate rod (110) is supported in a pre-determined position by one or more pre-cast units (102).
4. Building apparatus according to claim 1 wherein a number of location members (110) are provided and are spaced at pre-determined distances apart in the construction.

Patentansprüche

1. Konstruktionsgeraet, das besagte Geraet inklusive einer Vielzahl von vorgefertigten Einheiten (8,102) und mindestens einem Lokalisierungsteil (2, 110), die vorgefertigten Konstruktionsteile haben mindestens ein Lokalisierungsteil (10, 12, 104) (wobei die vorgefertigten Konstruktionsteile mit mindestens einem Lokalisierungsteil zusammen eine Konstruktion bilden). Wobei Verstaerkungen (112) vorhanden sind um mindestens ein vorgefertigtes Konstruktionsteil mit dem Lokalisierungsteil zu verbinden. Sobald eine vorgefertigte Einheit am Lokalisierungsteil befestigt ist, wobei das Lokalisierungsteil die Form eines Schlitzes und/oder eine Aussparung an der Seitenwand der vorgefertigten Einheit hat, wird **dadurch** charakterisiert, dass die Befestigung ein Bogenschluss ist (112) welcher die entsprechende Form fuer den besagten Schlitz hat (104) und/oder der Aussparung an der besagten Seitenwand. 20
2. Konstruktionsgeraet entsprechend Anspruch 1 wobei das Lokalisierungsteil einer laenglichen Stange entspricht (110). 25
3. Konstruktionsgeraet entsprechend Anspruch 2 wobei die Position mindestens einer laenglichen Stange (110) durch eine oder mehrere vorgefertigte Einheiten (102) vorher bestimmt wird. 30
4. Konstruktionsgeraet entsprechend Anspruch 1 wobei eine Anzahl von Lokalisierungsteilen (110) vorhanden sind und sich in vorbestimmten Abstaenden in der Konstruktion befinden. 35
2. : Appareil de construction selon la revendication 1 dans laquelle l'emplacement localisé est une tige allongée (110)
3. : Appareil de construction selon la revendication 2 dans laquelle au moins une tige allongée (110) est soutenue dans une position prédéterminée par une ou plusieurs unités préfabriquées (102).
4. : Appareil de construction selon la revendication 1 dans laquelle un certain nombre d'emplacements localisés (110) sont fournis et espacés à une distance prédéterminée séparément de la construction.

Revendications

1. : Construction d'un appareil ledit appareil comprend une majorité d'unités d'éléments préfabriquées (8, 102) et au moins un membre localisé (2, 110), les unités d'éléments préfabriqués ont au moins une portion de l'emplacement localisé (10, 12, 104) où les unités d'éléments préfabriqués se localisent dans au moins un emplacement commun pour former la construction, où des moyens sécurisés (112) sont fournis afin de sécuriser au moins une de ladite unité préfabriquée de l'emplacement localisé une fois que ladite unité préfabriquée a été localiser avec ledit emplacement localisé, et ou la portion localisée prend la forme d'une fente et/ou évidement niche dans un mur latéral de l'unité préfabriquée, avec cette caractéristique le moyen sécurisé est un chaînon essentiel de fermeture (112) qui a la forme de la localisation de ladite fente (104) et/ou niche entre le membre localisé (110) et l'ouverture de ladite fente et/ou évidement dudit mur latéral. 55

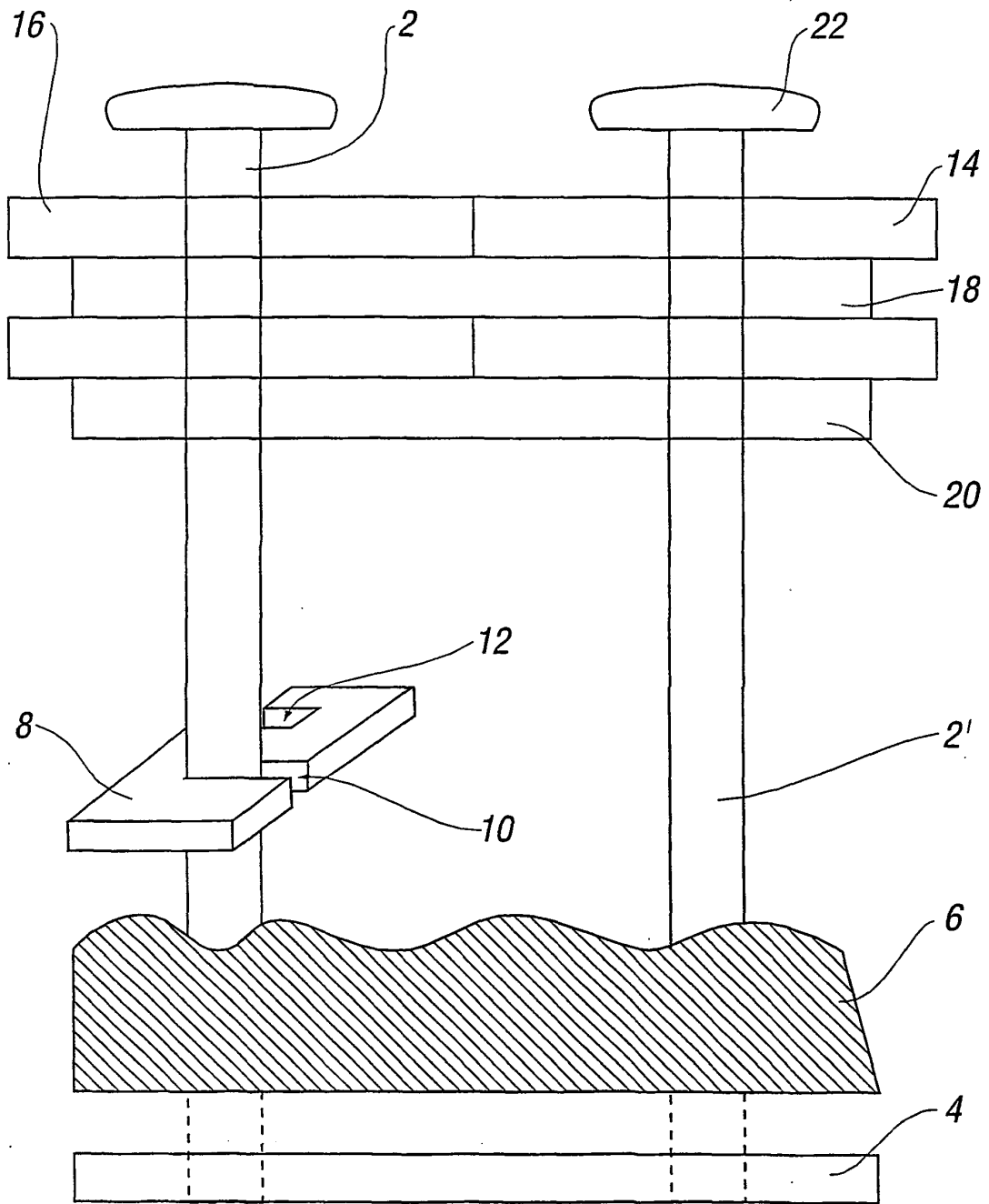


FIG. 1

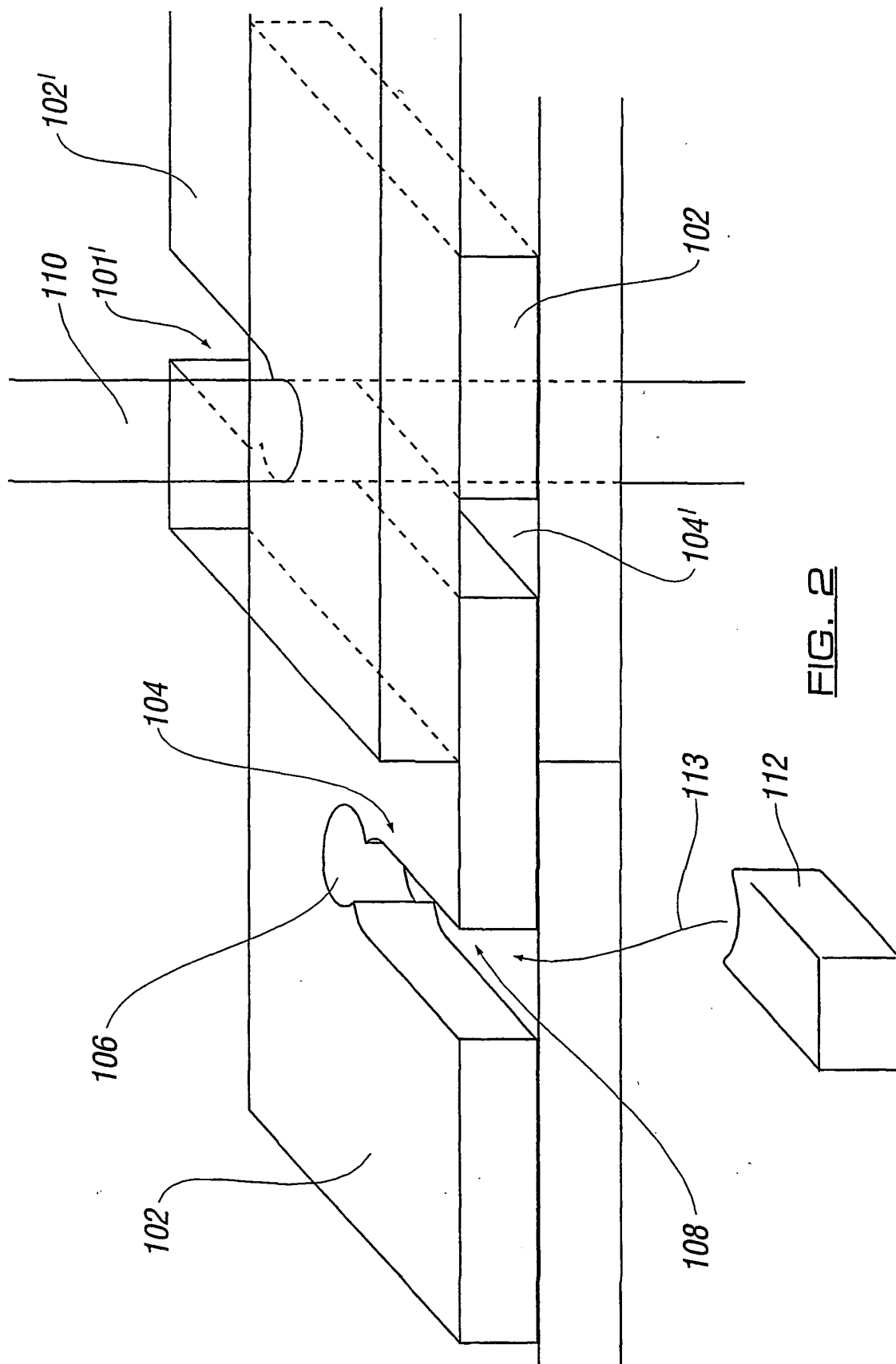
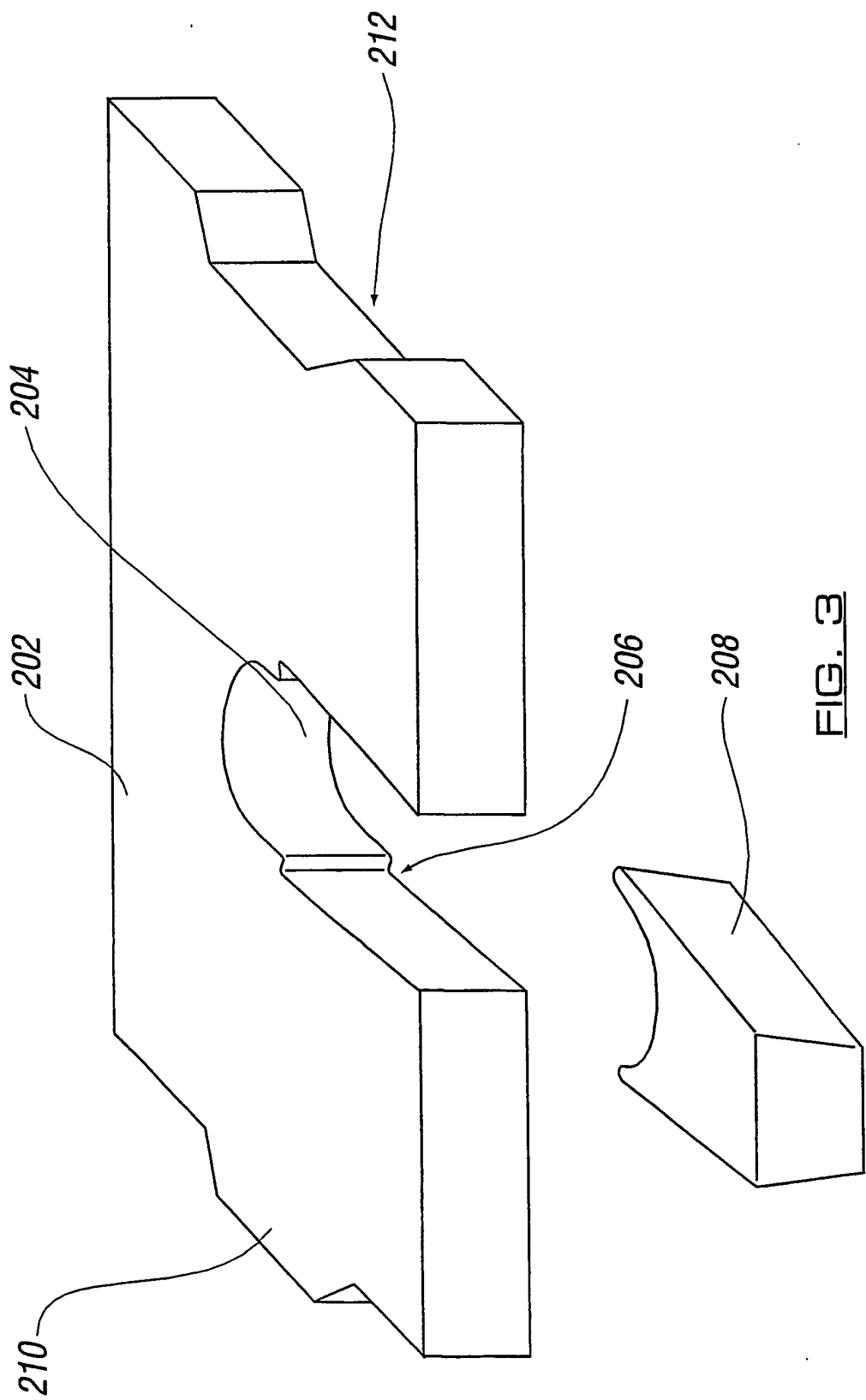


FIG. 2



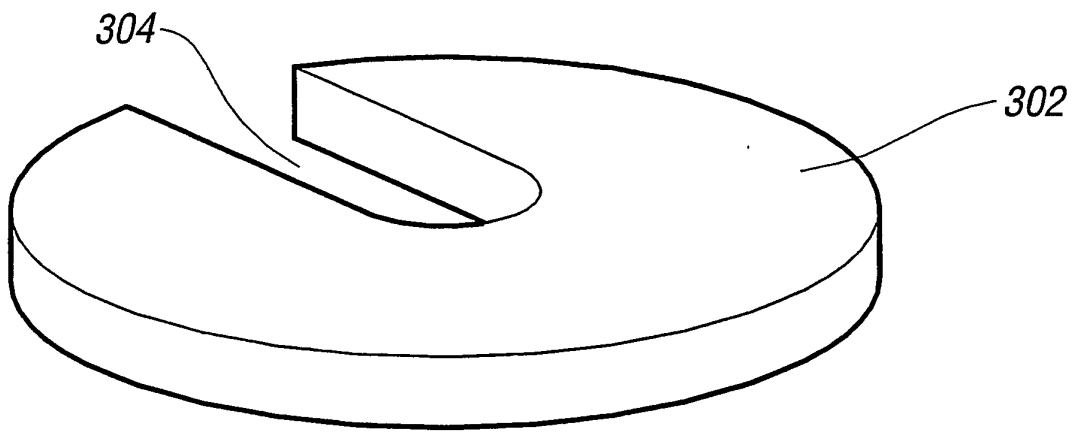


FIG. 4B

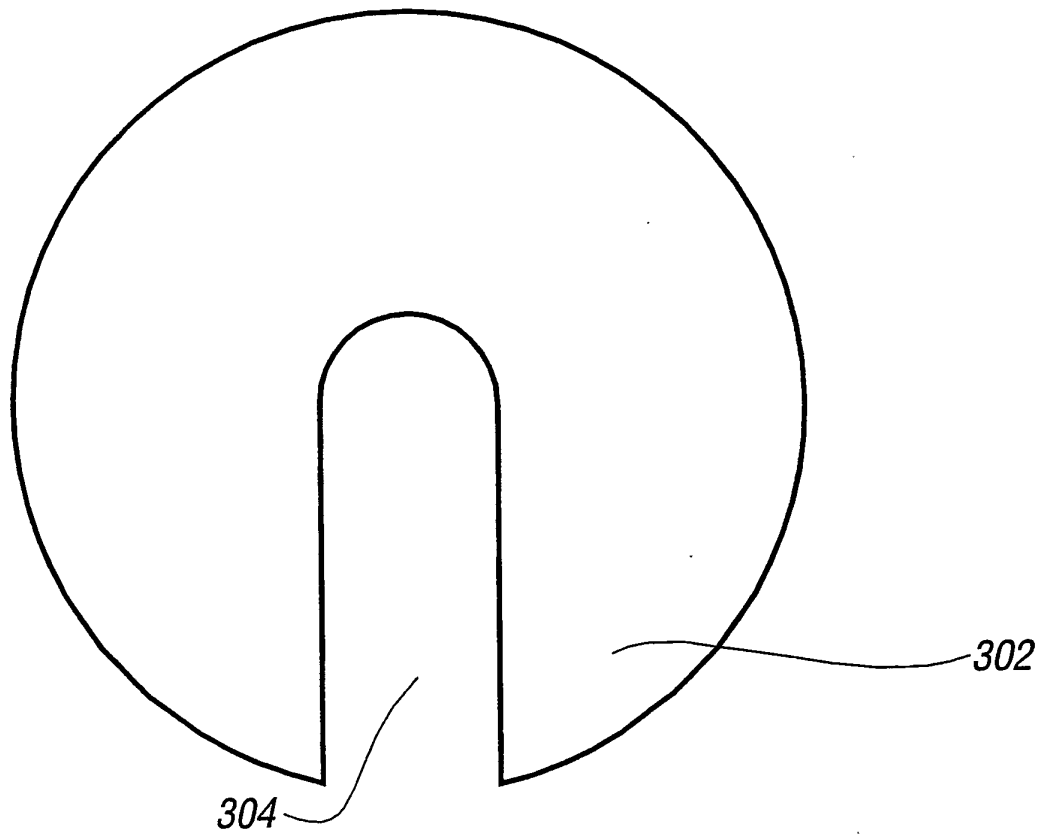


FIG. 4A

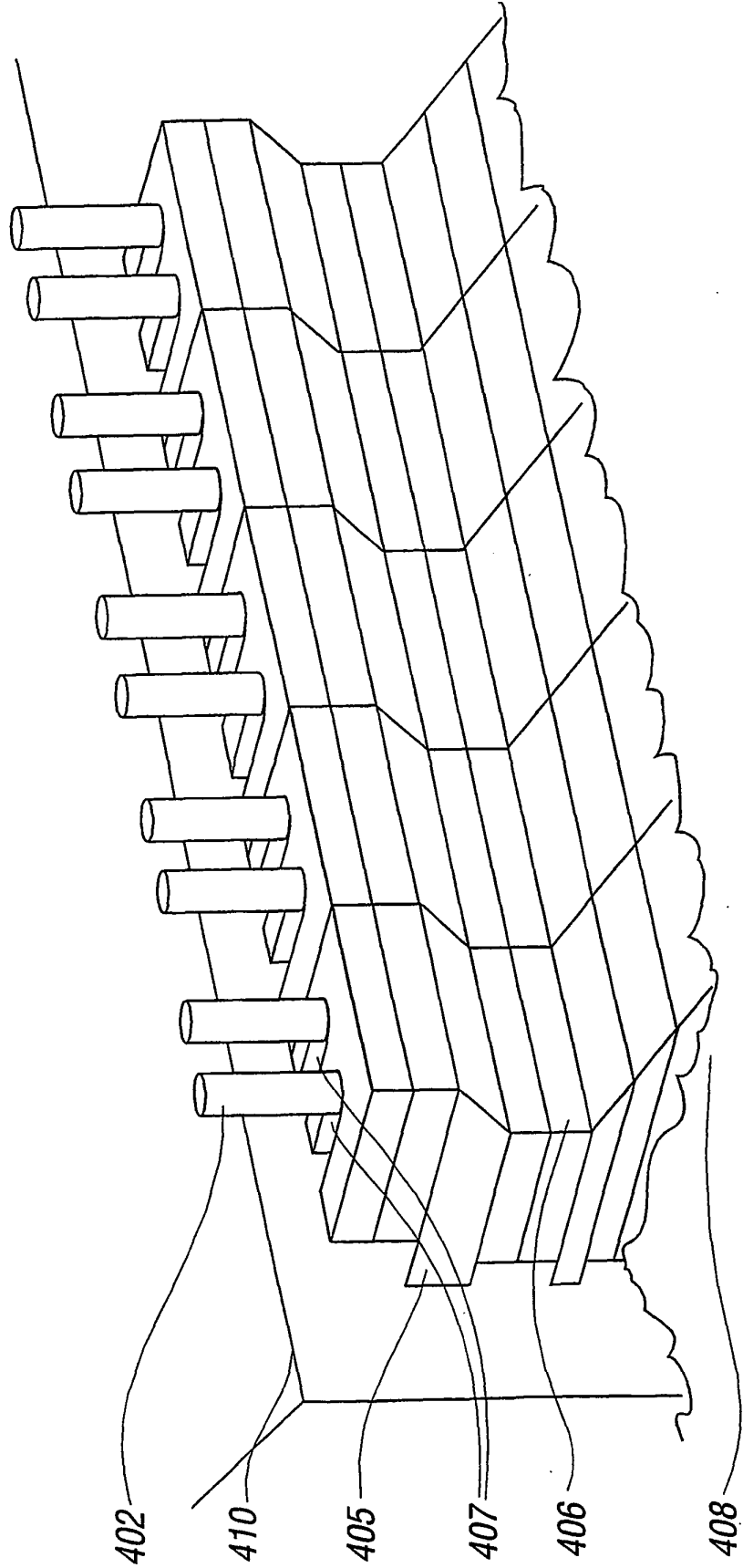


FIG. 5

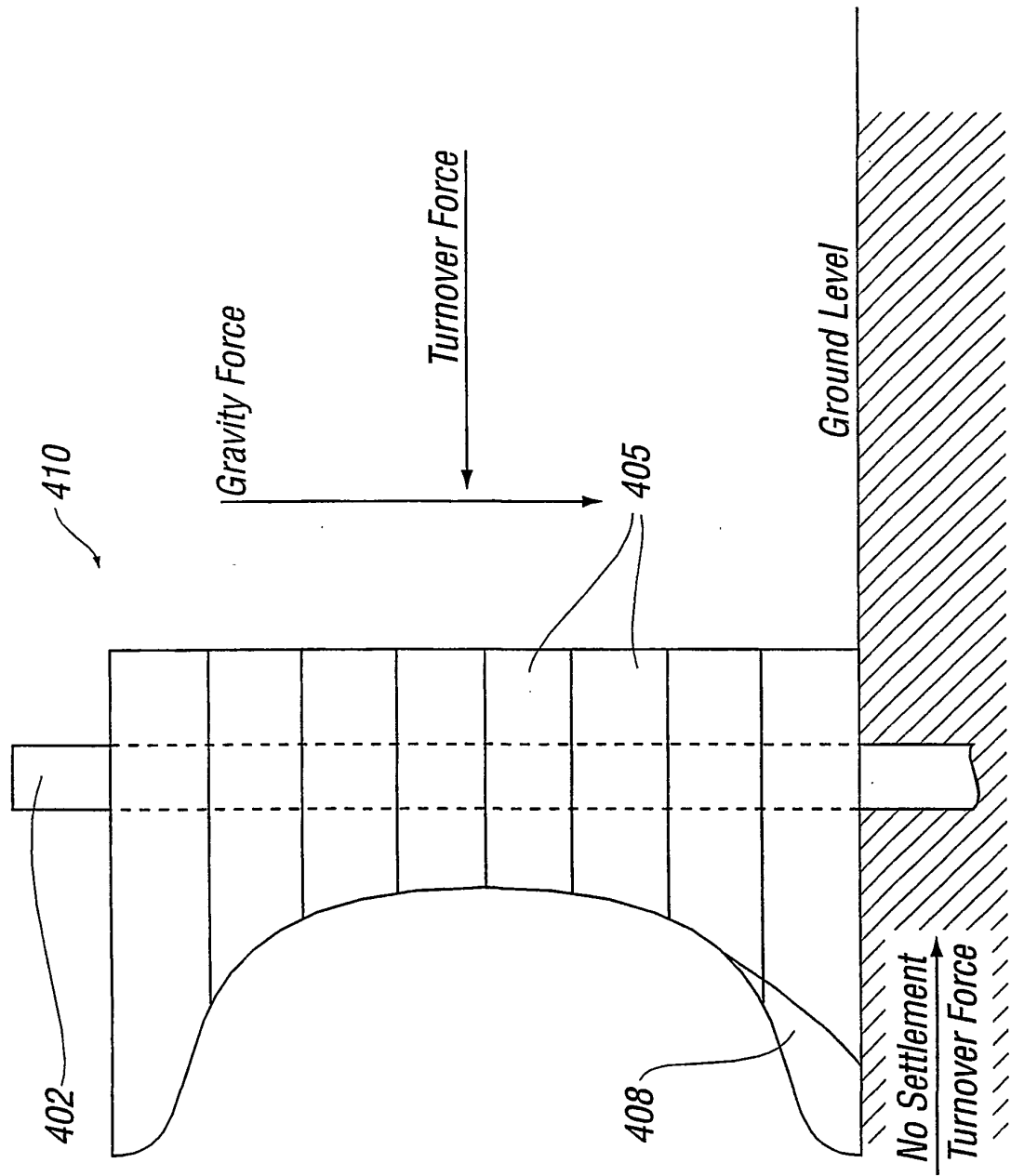
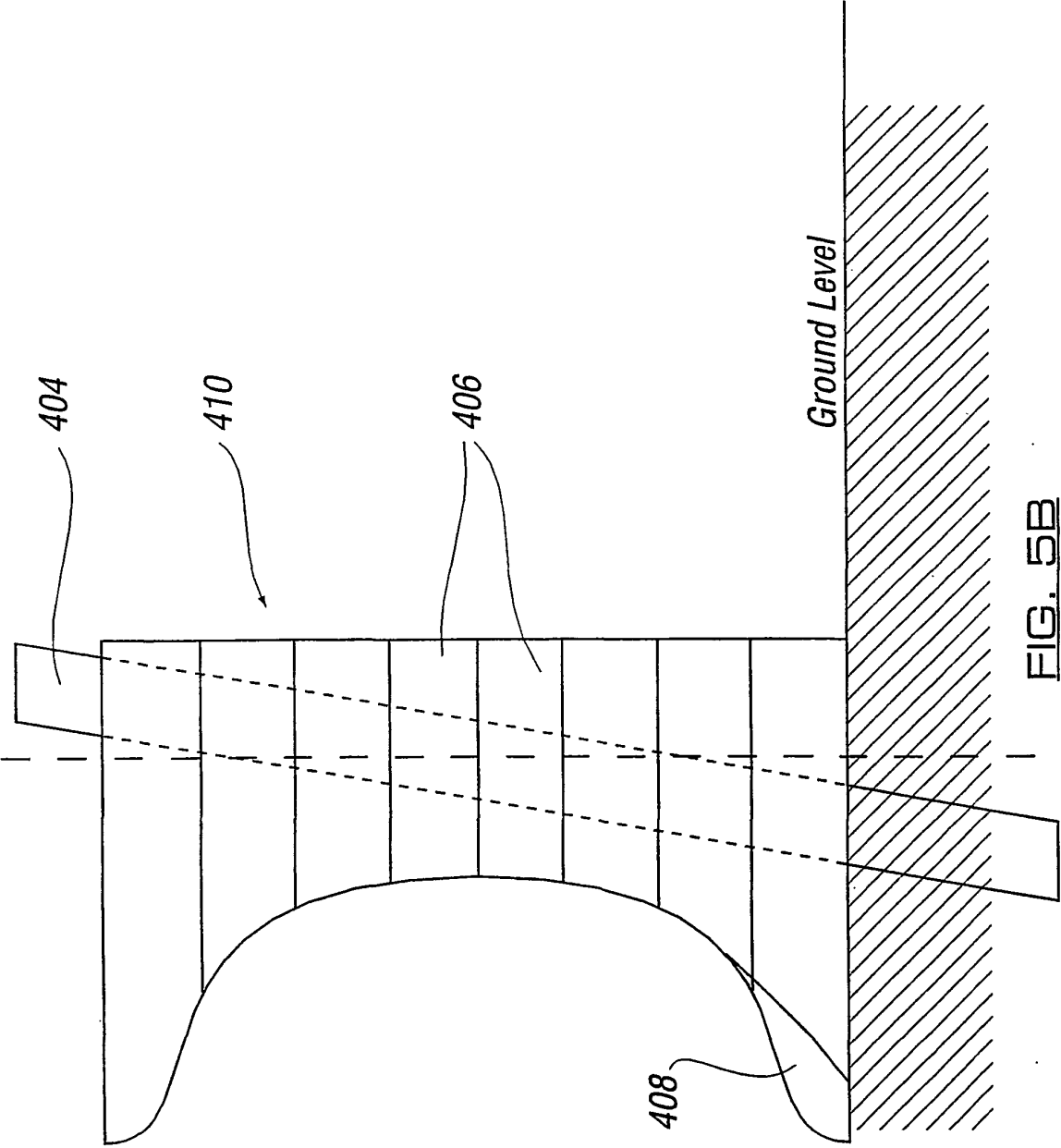


FIG. 5A



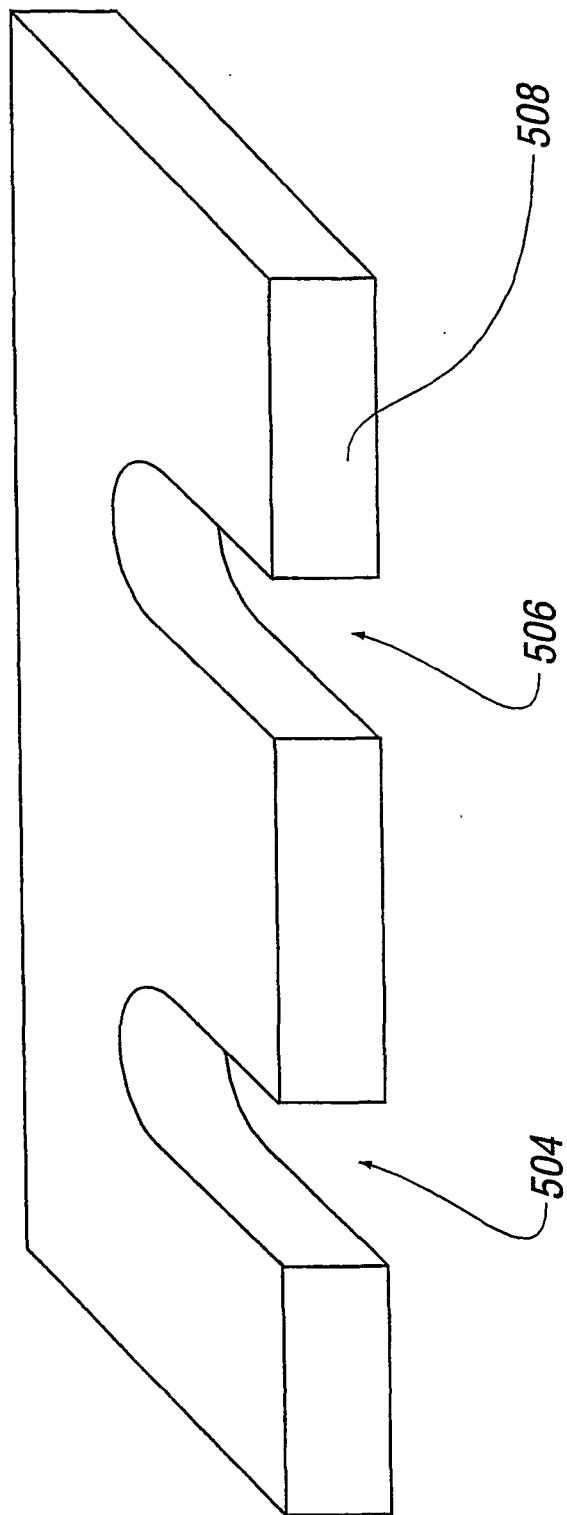


FIG. 6A

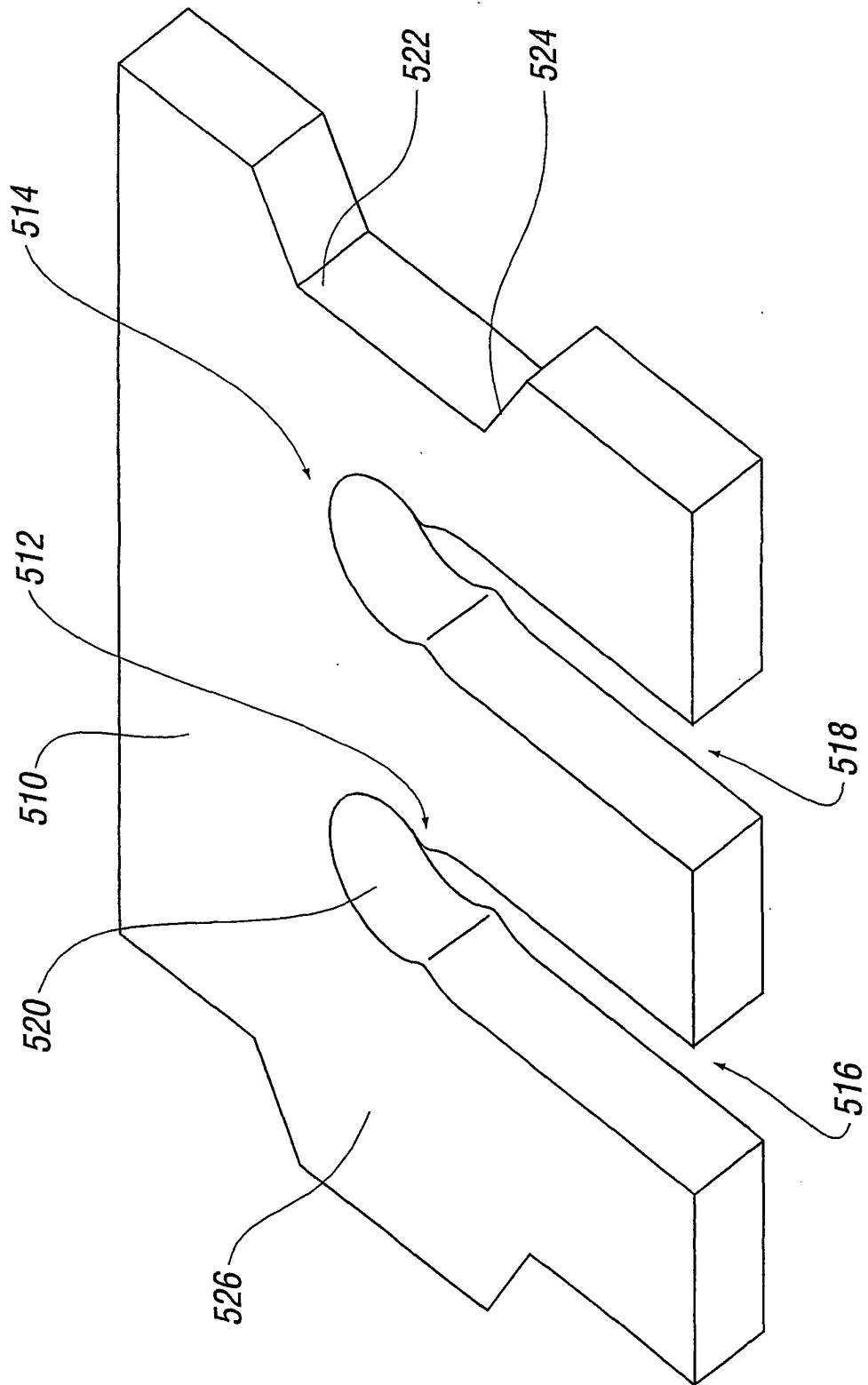


FIG. 6B

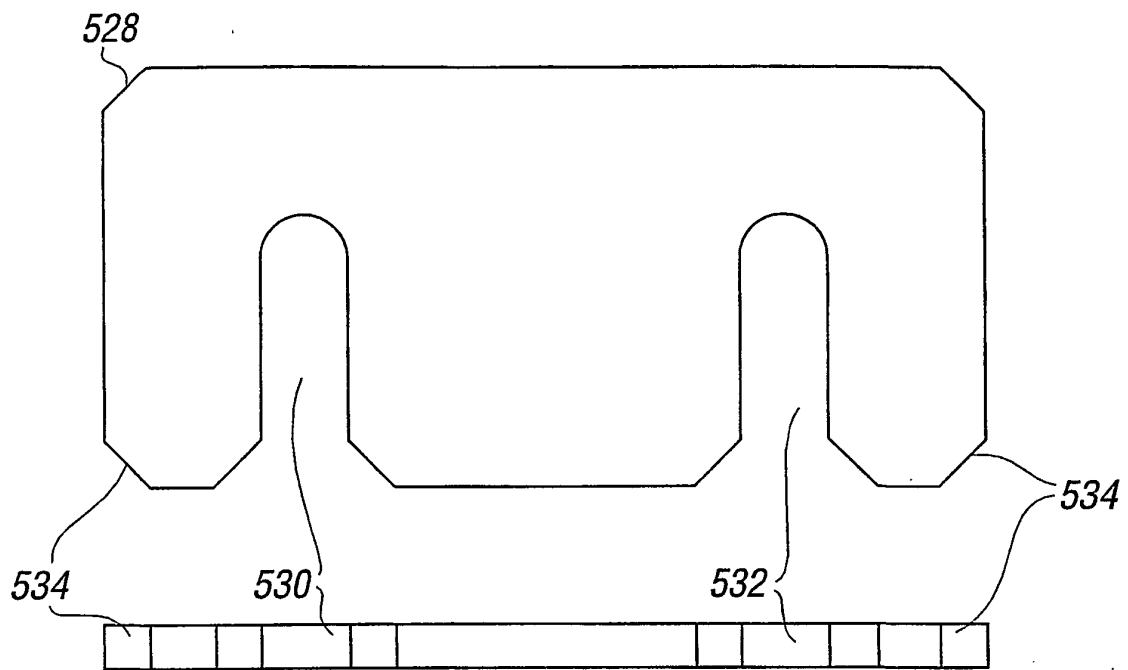


FIG. 6E

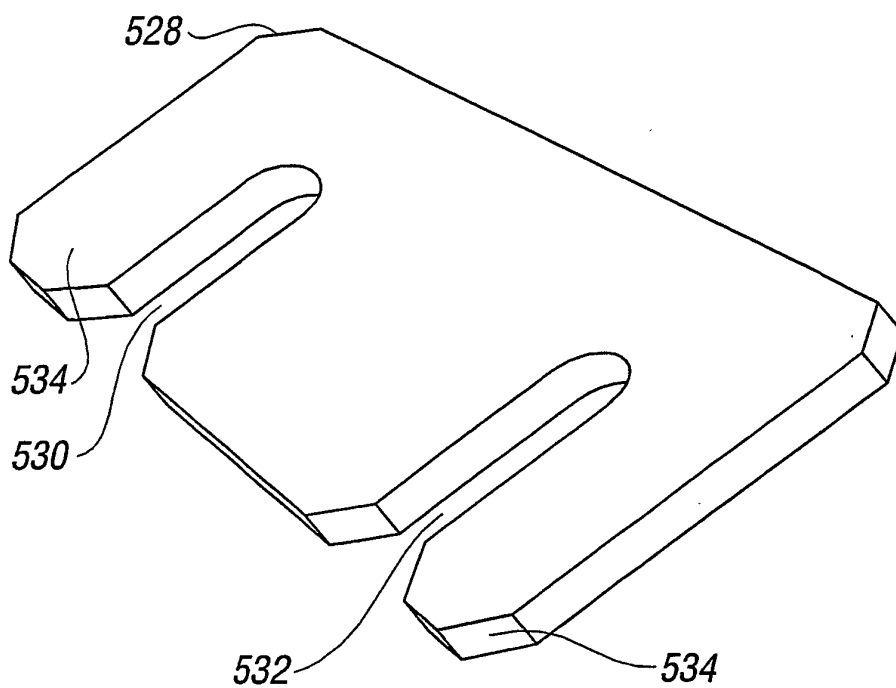


FIG. 6C

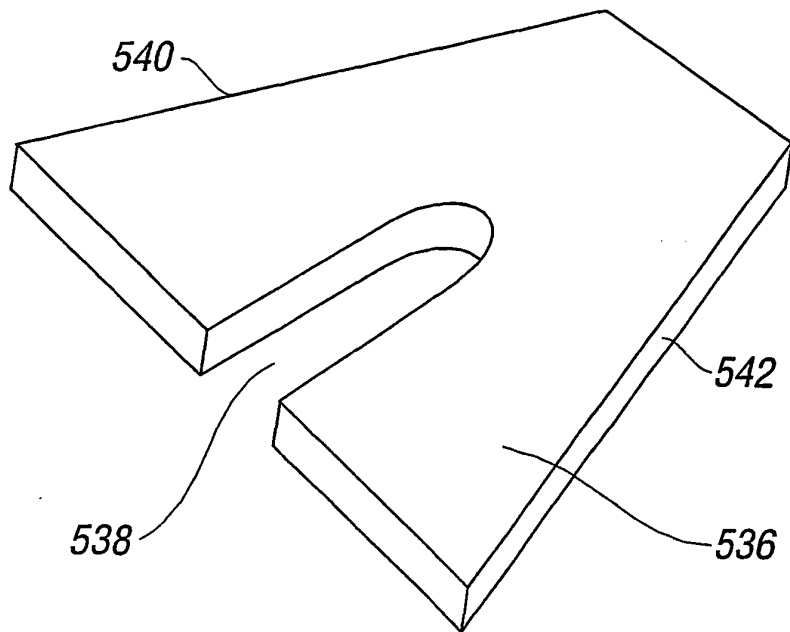
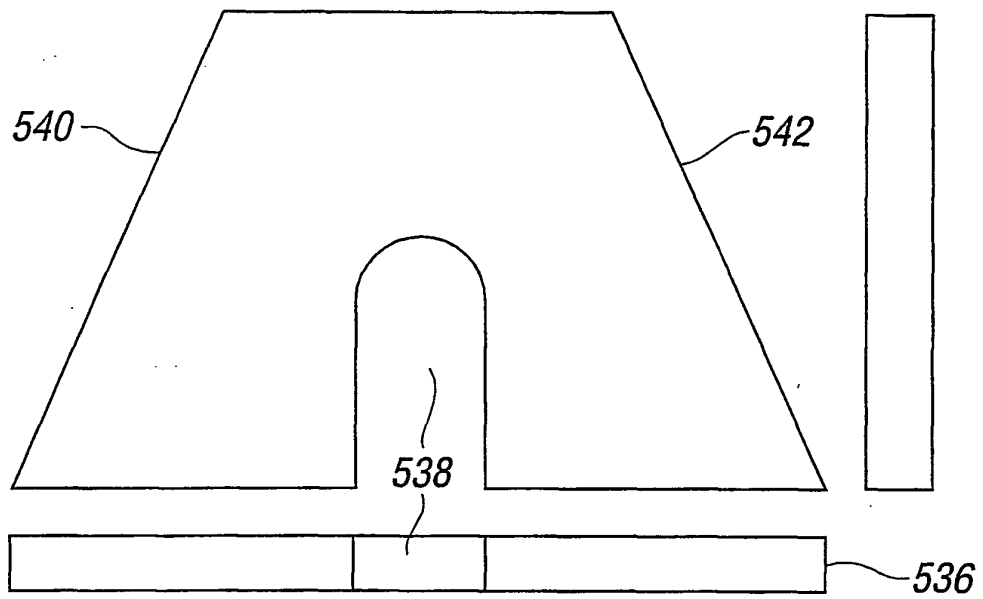
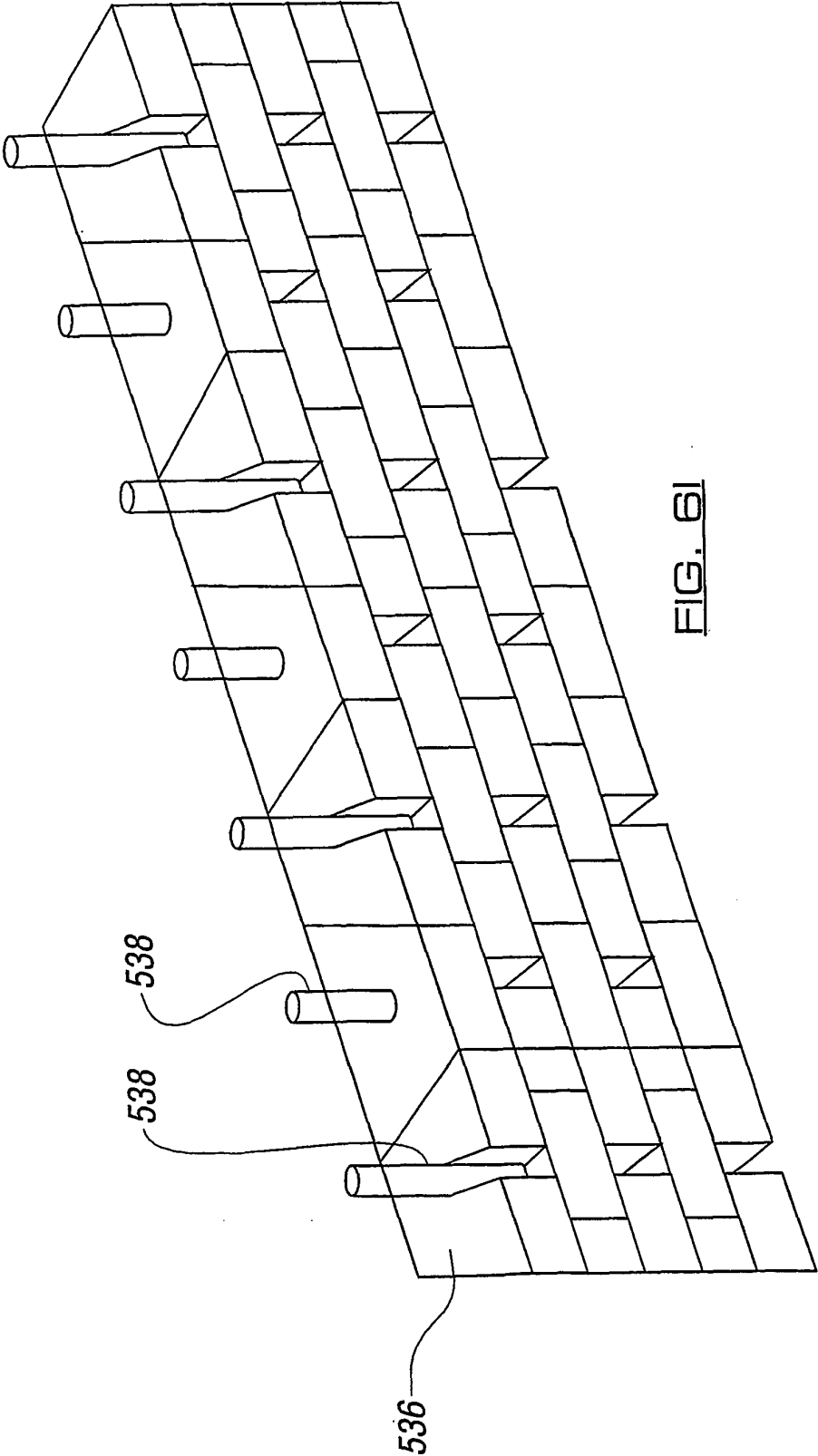


FIG. 6F



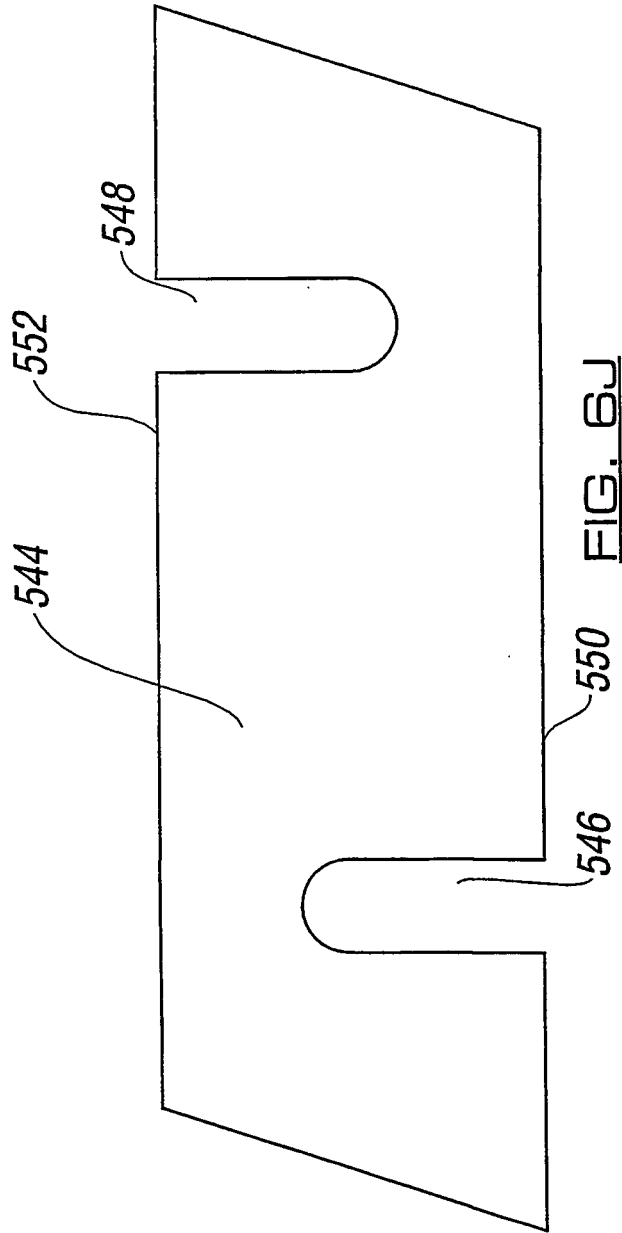


FIG. 6K

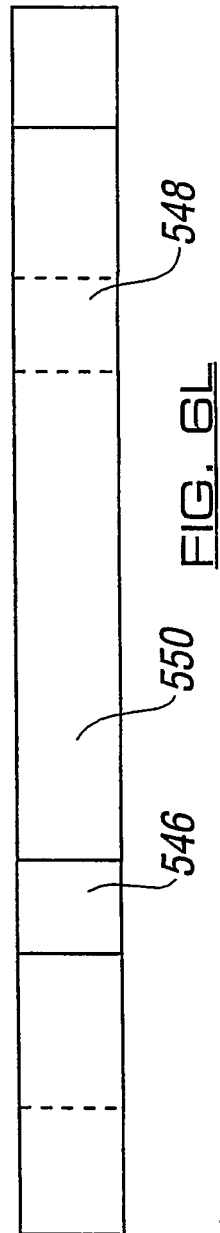




FIG. 6N

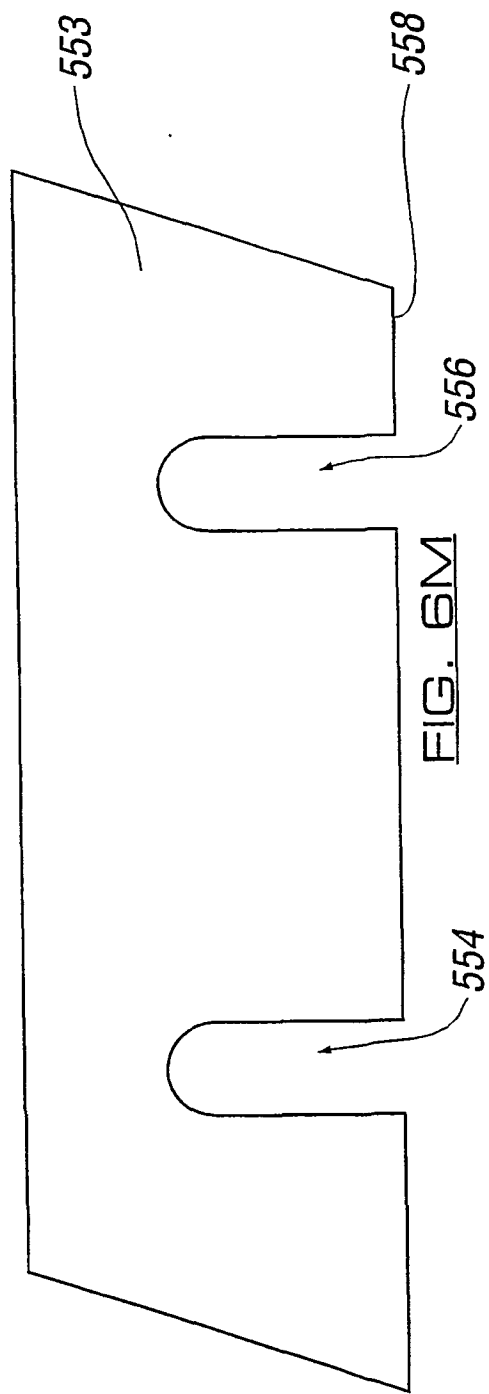


FIG. 6M

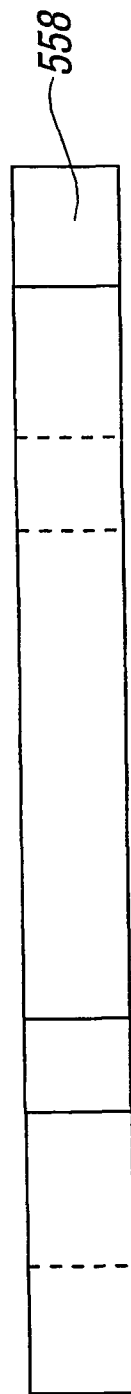


FIG. 6P

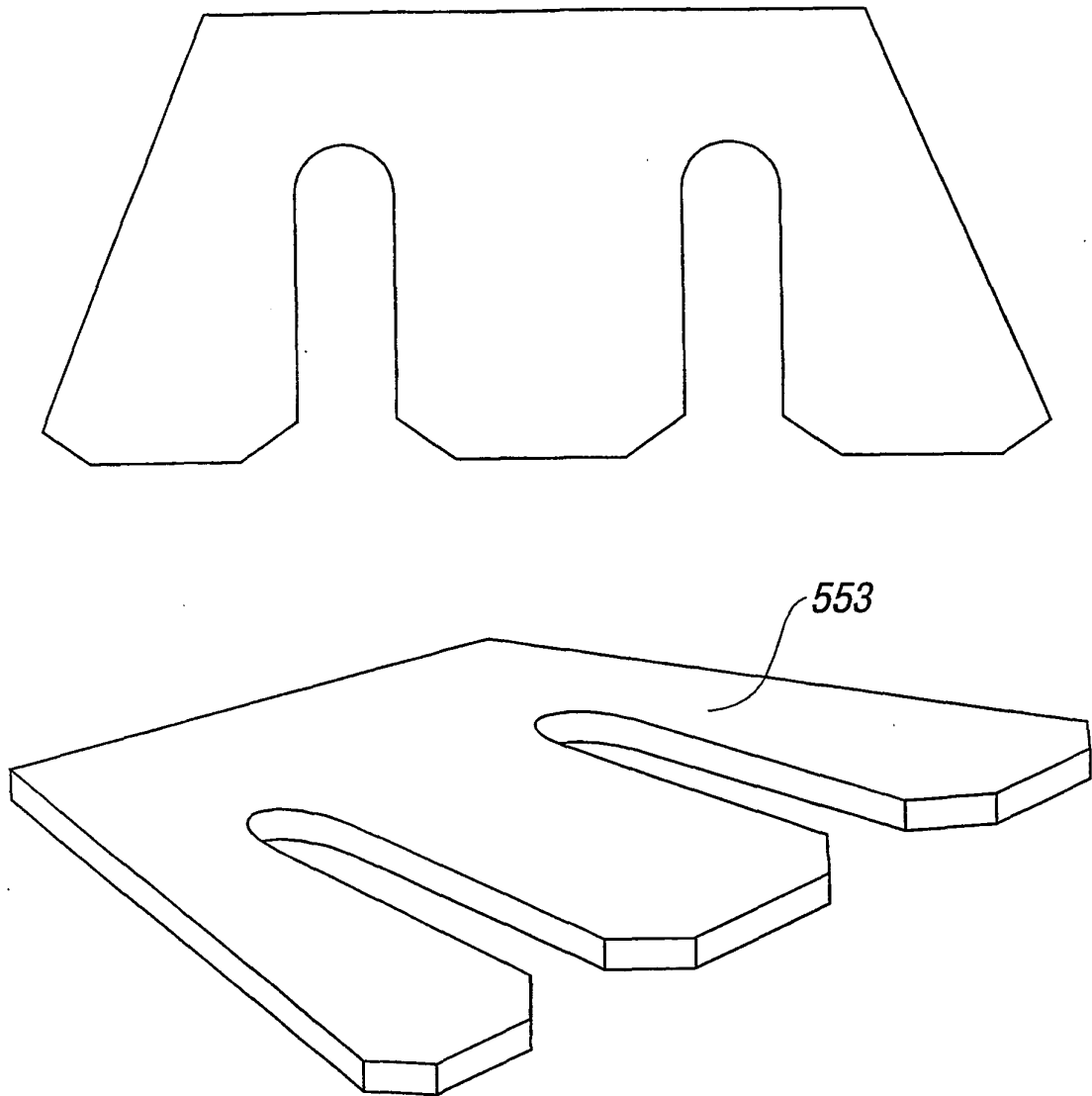
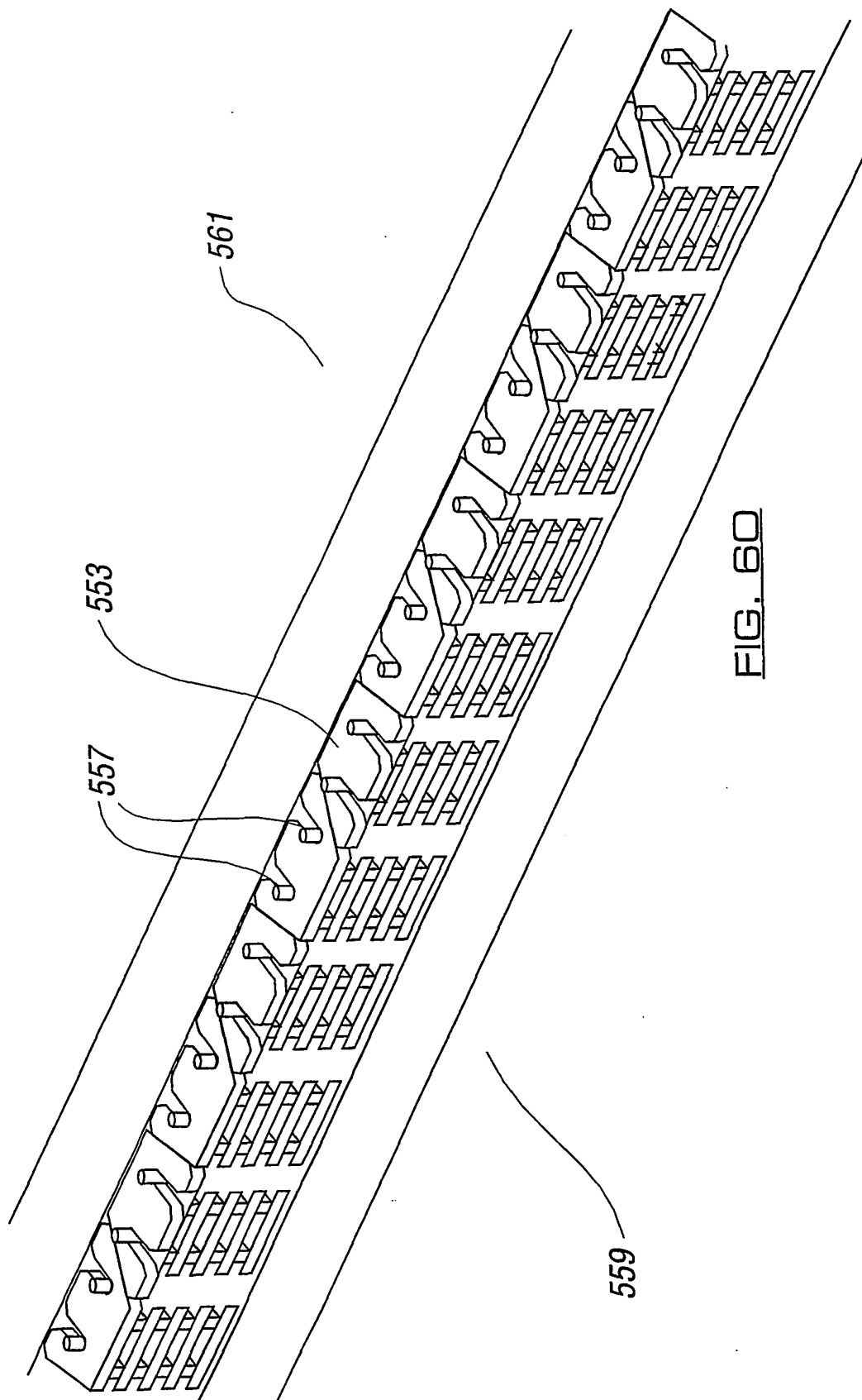
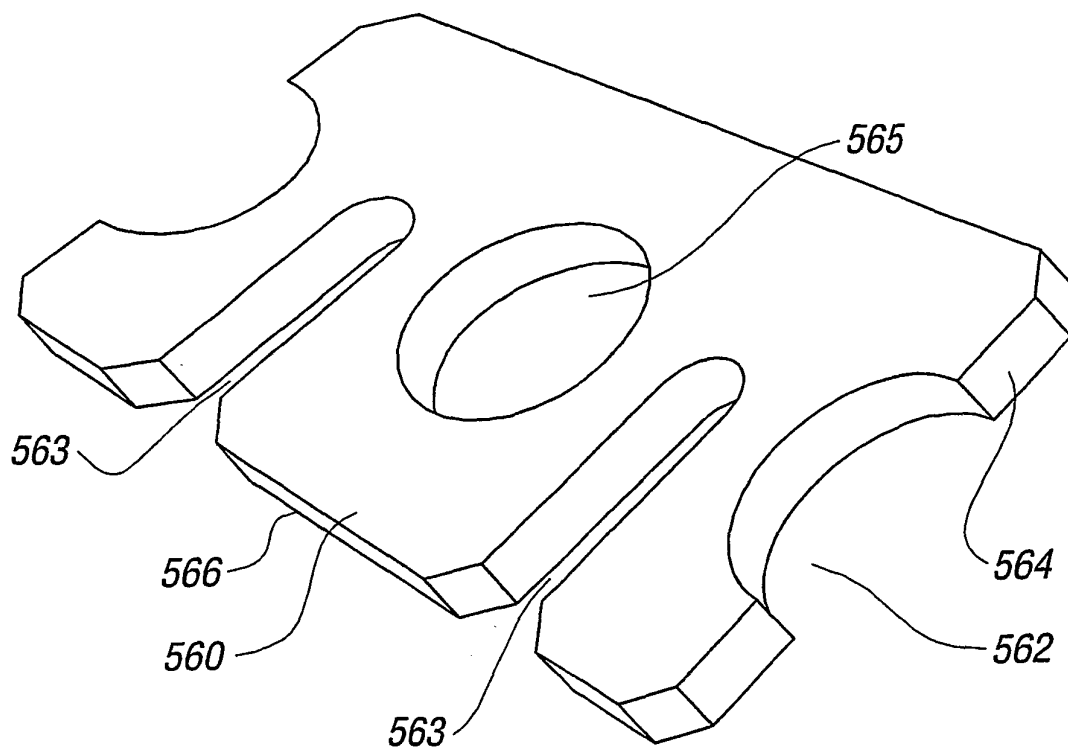
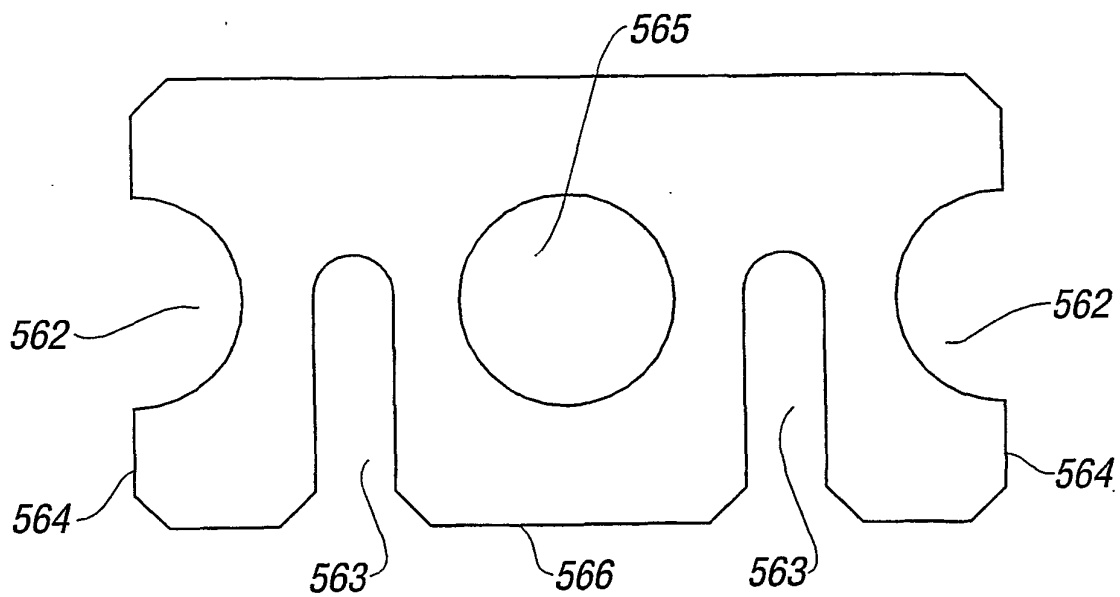
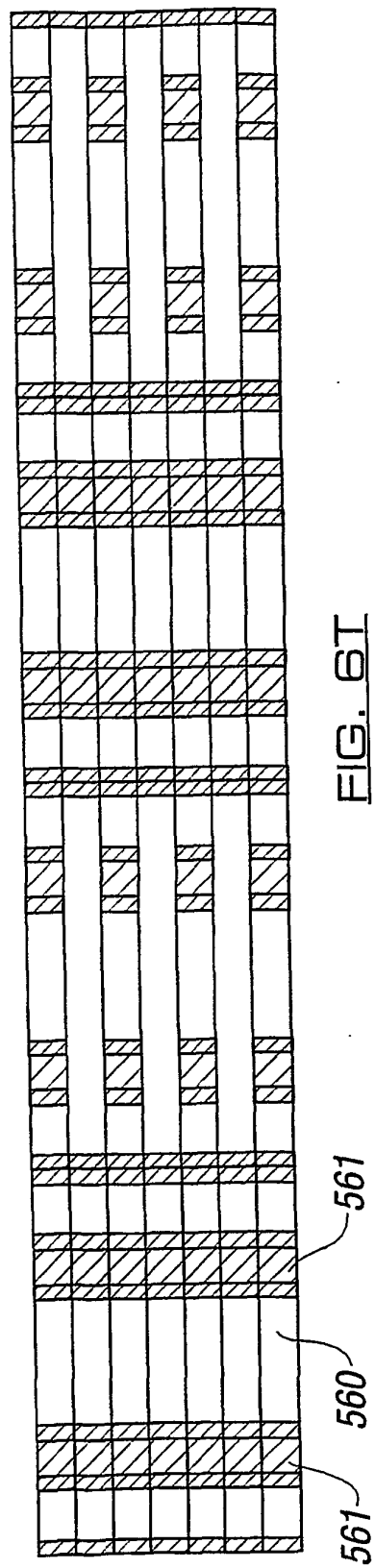
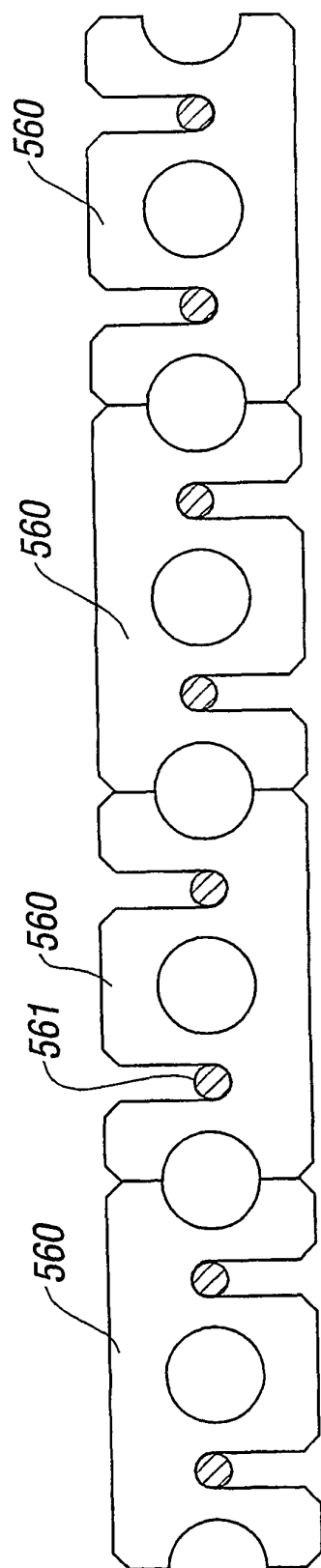


FIG. 6Q







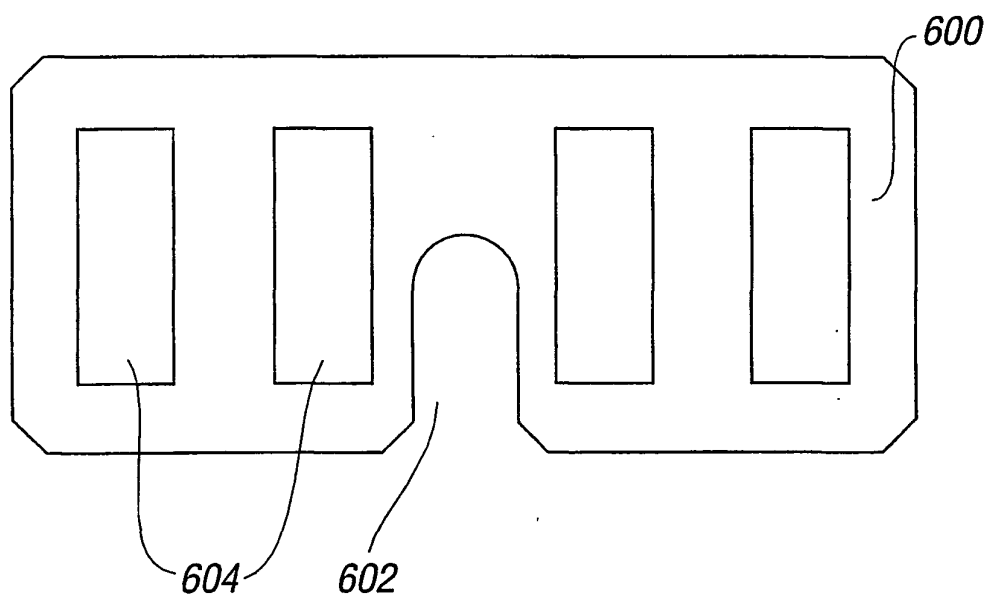


FIG. 7A

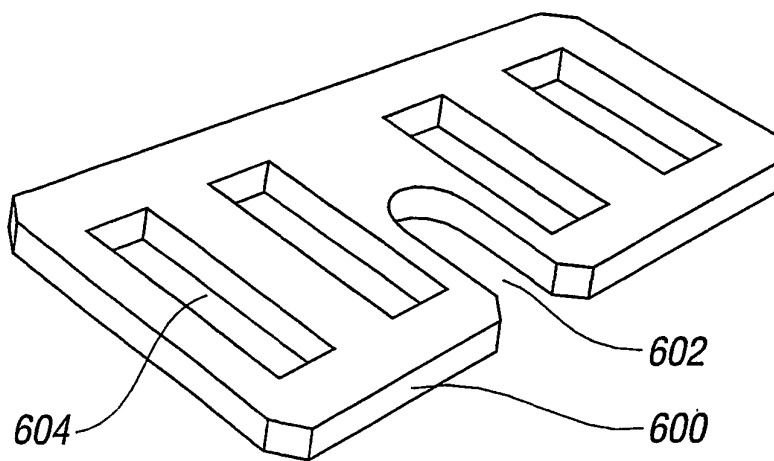
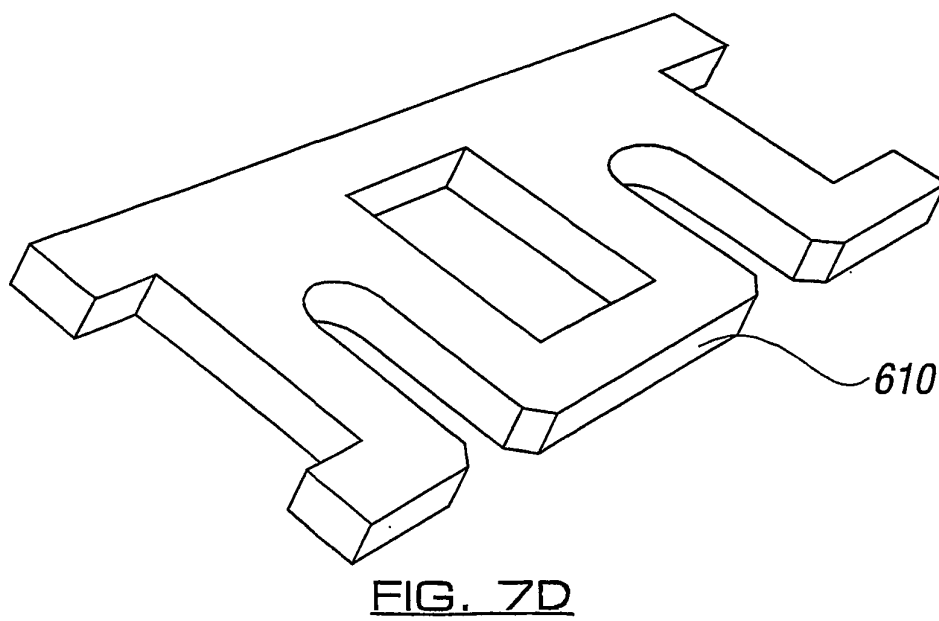
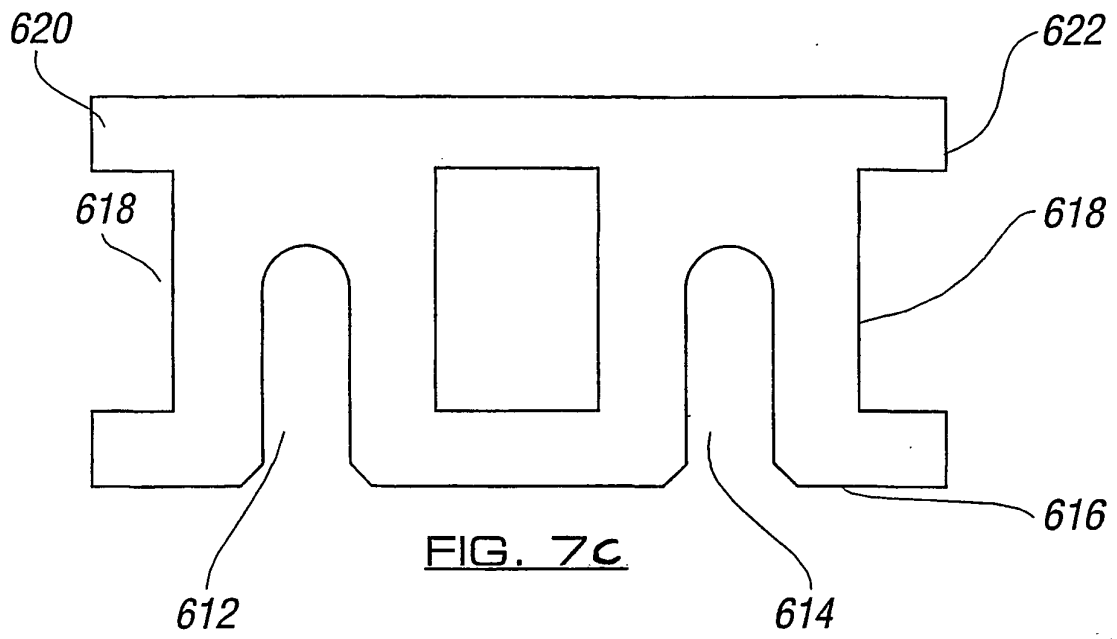


FIG. 7B



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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