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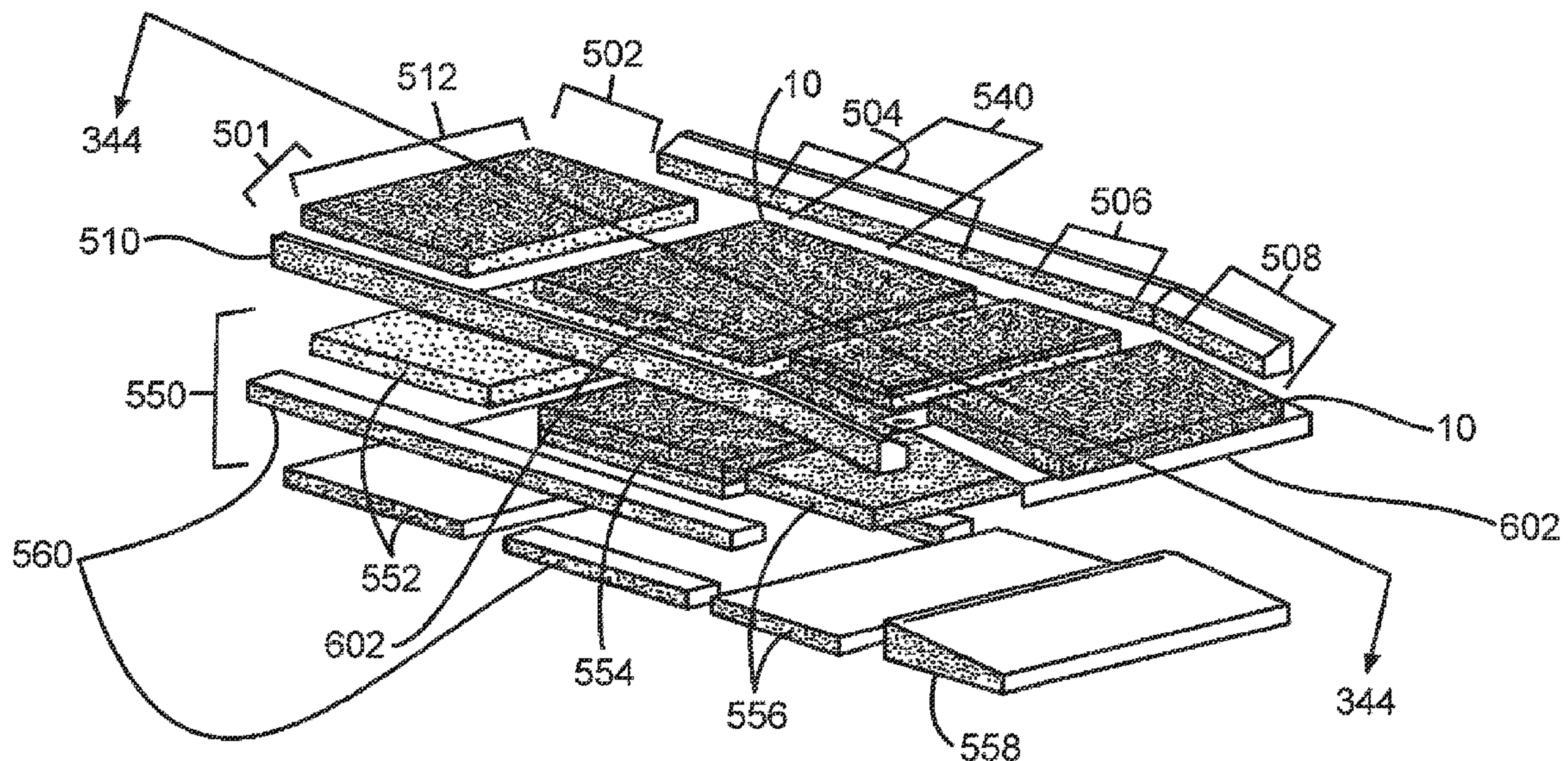
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(54) **Titre : SYSTEME DE MATELAS EN GEL ELASTIQUE A PLUSIEURS PAROIS**
(54) **Title: MULTI-WALLED GELASTIC MATTRESS SYSTEM**



(57) Abrégé/Abstract:

The present invention is directed to a gelastic cushion. The gelastic cushion is made from a conventional gelastic composition. The gelastic cushion has a structure having a first wall that defines an opening area and buckles when a force is applied to the first wall. When the first wall buckles a predetermined amount, a second wall, interconnected to the first wall, also buckles. The second wall decreases the chance that the first wall bottoms out. Bottoming out increases the pressure on the patient {a.k.a., the force) overlying the gelastic cushion. That increased pressure is undesirable.

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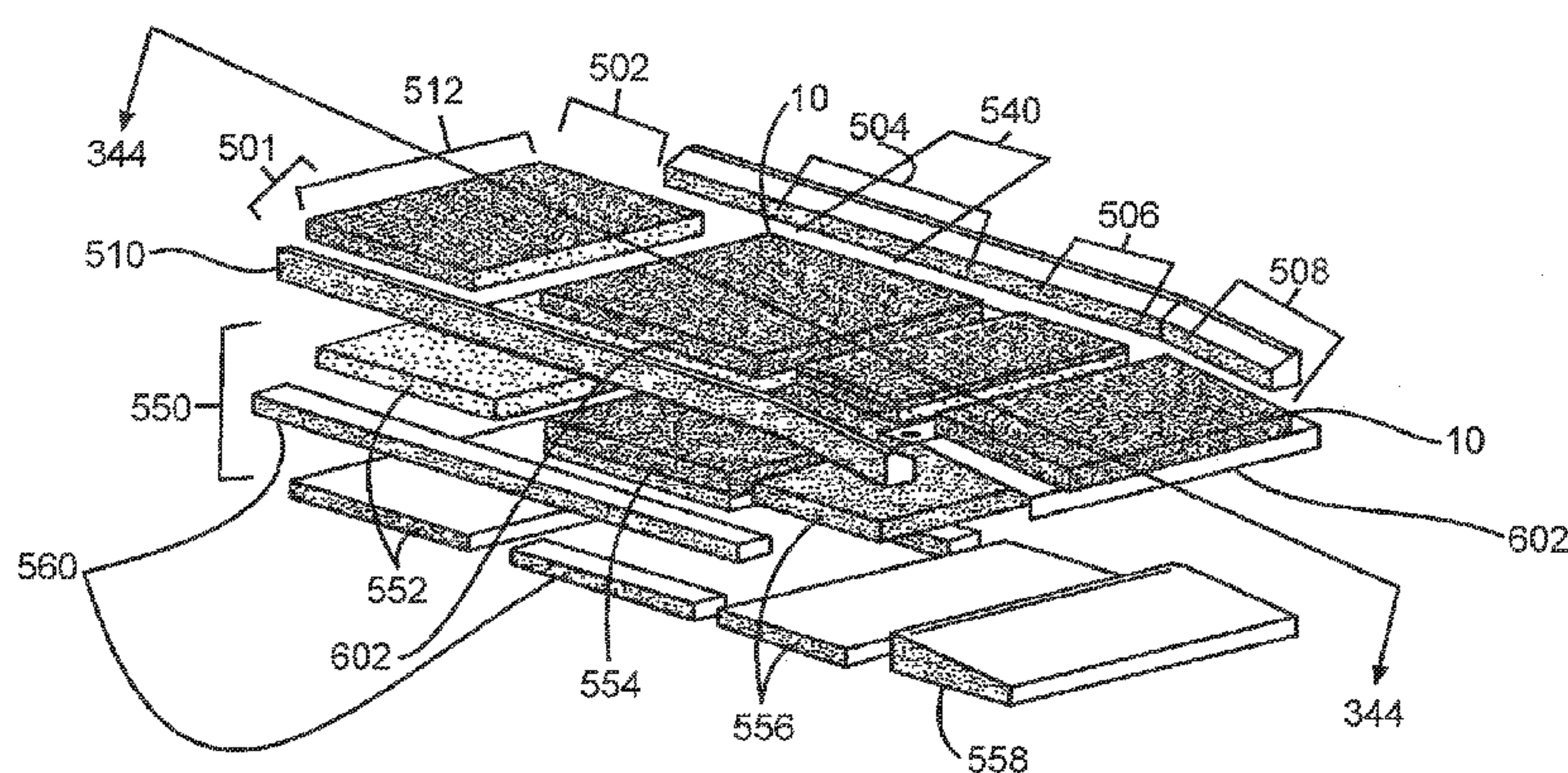


FIG. 34

(57) Abstract: The present invention is directed to a gelastic cushion. The gelastic cushion is made from a conventional gelastic composition. The gelastic cushion has a structure having a first wall that defines an opening area and buckles when a force is applied to the first wall. When the first wall buckles a predetermined amount, a second wall, interconnected to the first wall, also buckles. The second wall decreases the chance that the first wall bottoms out. Bottoming out increases the pressure on the patient {a.k.a., the force) overlying the gelastic cushion. That increased pressure is undesirable.

MULTI-WALLED GELASTIC MATTRESS SYSTEM

Field of the Invention

The present invention is directed to a mattress system
15 having gelastic material.

Background of the Invention

Gelastic Material

In U.S. patent number 7,076,822; Pearce discloses that
20 gelastic materials "are low durometer thermoplastic
elastomeric compounds and viscoelastomeric compounds which
include...an elastomeric block copolymer component and a
plasticizer component. [A plasticizer is a hydrocarbon
molecule which associates with the material into which they
25 are incorporated. Additives can also be inserted into the
formulation to obtain specific qualities.]

The elastomer component of the example gel material
includes a triblock polymer of the general configuration A-
B-A, wherein the A represents a crystalline polymer such as
30 a mono alkenylarene polymer, including but not limited to
polystyrene and functionalized polystyrene, and the B is an

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elastomeric polymer such as polyethylene, polybutylene, poly(ethylene/butylene), hydrogenated poly(isoprene), hydrogenated poly(butadiene), hydrogenated poly(isoprene+butadiene), poly(ethylene/propylene) or
5 hydrogenated poly(ethylene/butylene+ethylene/propylene), or others. The A components of the material link to each other to provide strength, while the B components provide elasticity. Polymers of greater molecular weight are achieved by combining many of the A components in the A
10 portions of each A-B-A structure and combining many of the B components in the B portion of the A-B-A structure, along with the networking of the A-B-A molecules into large polymer networks.

. . .

15 The elastomeric B portion of the example A-B-A polymers has an exceptional affinity for most plasticizing agents, including but not limited to several types of oils, resins, and others. When the network of A-B-A molecules is denatured, plasticizers which have an affinity for the B
20 block can readily associate: with the B blocks. Upon renaturation of the network of A-B-A molecules, the plasticizer remains highly associated with the B portions, reducing or even eliminating plasticizer bleed from the material when compared with similar materials in the prior
25 art, even at very high oil:elastomer ratios. . . .

The elastomer used in the example gel cushioning medium is preferably an ultra high molecular weight polystyrene-hydrogenated poly(isoprene+butadiene)-polystyrene, such as those sold under the brand names
30 SEPTON 4045, SEPTON 4055 and SEPTON 4077 by Kuraray, an ultra high molecular weight polystyrene-hydrogenated

polyisoprene-polystyrene such as the elastomers made by Kuraray and sold as SEPTON 2005 and SEPTON 2006, or an ultra high molecular weight polystyrene-hydrogenated polybutadiene-polystyrene, such as that sold as SEPTON 8006
5 by Kuraray. High to very high molecular weight polystyrene-hydrogenated poly(isoprene+butadiene)-polystyrene elastomers, such as that sold under the trade name SEPTON 4033 by Kuraray, are also useful in some formulations of the example gel material because they are
10 easier to process than the example ultra high molecular weight elastomers due to their effect on the melt viscosity of the material."

Other examples of gelastic material compositions are disclosed in other patents that identify Pearce as an
15 inventor or Chen as an inventor (for example U.S. patent number 5,336,708). The present invention is not directed toward the type of gelastic material being used. Instead the present invention is directed to how the gelastic material is formed and the desired shape of the material.

20

Cushion Material

Pearce also discloses the gelastic material can be formed into a cushion. The cushion may be used with many types of products, including furniture such as office
25 chairs, "sofas, love seats, kitchen chairs, mattresses, lawn furniture, automobile seats, theatre seats, padding found beneath carpet, padded walls for isolation rooms, padding for exercise equipment, wheelchair cushions, bed mattresses, and others." Selected cushion material is also
30 dependent on the Indentation Load Deflection (ILD) measurement. The ILD measurement represents how much

weight it takes to compress a cushioned material. The firmness of a piece of foam normally ranges from 10 to 100. The higher the ILD number the firmer the cushion material.

The thicker the cushion is, the firmer a particular
 5 type of cushion will feel. For example, where 2" foam at 65 ILD will feel perfectly comfortable, 5" foam at the same ILD will feel like you are sitting on a board. There is a general rule of thumb in deciding what firmness of foam to use in a given situation.

10	Seat cushions:
	2" foam-----65 ILD
	3" foam-----40 ILD
	4" foam -----34 ILD
	5" foam-----30-34 ILD
15	6" foam-----26-30 ILD
	7" foam-----20-26 ILD
	Back cushions:
	1" foam-----30 ILD
	2" foam-----25-30 ILD
20	3" foam-----20-25 ILD
	4" foam-----20 ILD

These figures are only approximations.

Conventional Gelastic Cushion Structure

25 Pearce further states, "the cushioning element . . . includes gel cushioning media formed generally into a rectangle with four sides, a top and a bottom, with the top and bottom being oriented toward the top and bottom of the page, respectively. The cushioning element has within its
 30 structure a plurality of hollow columns . . . As depicted, the hollow columns . . . contain only air. The

hollow columns . . . are open to the atmosphere and therefore readily permit air circulation through them, through the cover . . . fabric, and to the cushioned object. The columns . . . have column walls . . . which in the embodiment depicted are hexagonal in configuration. The total volume of the cushioning element may be occupied by not more than about 50% gel cushioning media, and that the rest of the volume of the cushioning element will be gas or air. The total volume of the cushioning element may be occupied by as little as about 9% cushioning media, and the rest of the volume of the cushion will be gas or air. This yields a lightweight cushion with a low overall rate of thermal transfer and a [low] overall thermal mass. It is not necessary that this percentage be complied with in every instance."

When a patient is positioned on the gelastic material, the patient's protuberances (the hip(s), shoulder(s), arm(s), buttock(s), shoulder blade(s), knee(s), and/or heel(s)) cause the column walls positioned below the patient's protuberances to buckle. Those buckled column walls are not supposed to collapse or fail because then the patient would bottom out on the underlying surface. Instead, the column walls positioned below and receiving the weight of the patient's protuberances buckle (bending and/or compressing) to redistribute and/or lessen the load of those buckled column walls to other column walls of the gelastic material. In other words, buckling the column (or side) walls permit the cushioning element to conform to the shape of the cushioned object while (a) evenly distributing a supporting force across the contact area of the cushioned object, (b) avoiding pressure peaks against the user, and

(c) decreasing the chance of the patient bottoming out. Bottoming out, however, sometimes occurs.

Stepped Column Gelastic Cushion Embodiment

5 To address the occasional bottoming out problem, it is our understanding that Pearce disclosed numerous cushion embodiments to solve that problem. One cushion embodiment depicts a cross section of a cushioning element using alternating stepped columns. The cushioning element . . .
10 has a plurality of columns . . . each having a longitudinal axis . . ., a column top . . . and a column bottom The column top . . . and column bottom . . . are open . . ., and the column interior or column passage . . . is unrestricted to permit air flow through the column
15 The column . . . depicted has side walls . . ., each of which has three distinct steps The columns are arranged so that the internal taper of a column due to the step on its walls is opposite to the taper of the next adjacent column. This type of cushioning element could be
20 made using a mold."

A problem with Pearce's stepped column embodiment is that the side walls do not uniformly buckle due to the varied thicknesses. As previously stated, buckling the column (or side) walls permit the cushioning element to
25 conform to the shape of the cushioned object while evenly distributing a supporting force across the contact area of the cushioned object and avoiding pressure peaks against the user. Buckling is difficult when the side walls are thick and tapered as disclosed in Pearce's stepped column
30 gelastic material embodiment. The thicker portion of the walls do not decrease pressure peaks, instead the thicker

portion of the walls maintain or increase the pressure peaks. Those pressure peaks are to be avoided and are not in Pearce's stepped column gelastic material embodiment.

5 Firmness Protrusion

Pearce also discloses a gelastic cushion having a firmness protrusion device positioned within the column walls to prevent the column walls from over-buckling (failing or collapsing so the patient bottoms out). In particular, Pearce wrote, "The cushioning element . . . has cushioning medium . . . formed into column walls The column walls . . . form a column interior The column . . . has an open column top . . . and a closed column bottom In the embodiment depicted, the column . . . has a firmness protrusion . . . protruding into the column interior . . . from the column bottom The firmness protrusion . . . depicted is wedge or cone shaped, but a firmness protrusion could be of an desired shape, such as cylindrical, square, or otherwise in cross section along its longitudinal axis. The purpose of the firmness protrusion . . . is to provide additional support within a buckled column for the portion of a cushioned object that is causing the buckling. When a column of this embodiment buckles, the cushioning element will readily yield until the cushioned object begins to compress the firmness protrusion. At that point, further movement of the cushioned object into the cushion is slowed, as the cushioning medium of the firmness support needs to be compressed or the firmness support itself needs to be caused to buckle in order to achieve further movement of the cushioned object into the cushioning medium." The

firmness protrusion is a block of material designed to inhibit further buckling of the column walls. At best due to its shape and function, the firmness protrusion does not buckle.

5

Stacked Gelastic Cushion Embodiment

Another cushion embodiment is a stacked gelastic cushion embodiment which was claimed in U.S. patent number 7,076,822. The stacked cushion embodiment as claimed has
10 the following limitations:

"(a) a first cushioning element and a second cushioning element stacked together in sequence to form a stacked cushion,

15

(b) said stacked cushion having a stacked cushion bottom;

(c) said first cushioning element including

20

(i) a quantity of first gel cushioning medium formed to have a first cushioning element top, a first cushioning element bottom, and a first outer periphery, said first gel cushioning medium being compressible so that it will deform under the compressive force of a cushioned object;

25

(ii) wherein said first gel cushioning media is flexible and resilient, having shape memory and being substantially solid and non-flowable at temperatures below 130° Fahrenheit;

30

(iii) a plurality of first hollow columns formed in said first gel cushioning

medium, each of said first hollow columns
having a first longitudinal axis along its
length, each of said first hollow columns
having a first column wall which defines a
first hollow column interior, and each of
said first hollow columns having two ends;

(iv) wherein each of said first column
ends is positioned at two different points
of said first longitudinal axis;

(v) wherein at least one of said first
hollow columns of said first cushioning
element is positioned within said first gel
cushioning medium such that said first
longitudinal axis is positioned generally
parallel to the direction of a compressive
force exerted on the stacked cushion by a
cushioned object in contact with the stacked
cushion;

[sic] (c) wherein the stacked cushion is
adapted to have a cushioned object placed in
contact with said stacked cushion top; and

(d) wherein at least one of said first
column walls of said first cushioning element is
capable of buckling beneath a protuberance that
is located on the cushioned object."

The stacked gelastic cushion embodiment is unstable unless
the first cushioning element and the second cushioning
element are secured to each other. Securing the two
cushions together can be accomplished by adhesives and/or
straps (rubber, cloth or equivalent) without fasteners

(like a rubber band) or with fasteners (i.e., hook and loop, buckles and/or tying). The present invention avoids those securing devices because that increases the potential pressure peaks applied to the patient.

5

How to Inhibit Gelastic Cushion from Moving

The gelastic cushion is known to move in response to patient's applying a force to the gelastic cushion. To decrease that problem, the users of gelastic cushion have heated a non-woven material on the bottom surface of the gelastic cushion. That non-woven can cover the entire bottom surface or just a particular area including and not limited to being near and at the perimeter of the bottom surface.

15 The non-woven can also extend beyond the bottom surface's perimeter. The non-woven material that extends beyond the bottom surface's perimeter is then normally attached to another part of the cushion and that attachment decreases the chances that the gelastic cushion will move when the patient applies a force to it. This embodiment is very effective for controlling the position of the gelastic cushion but it results in the gelastic cushion hammocking the patient. One embodiment of the present invention solves this problem.

25

Summary of the Present Invention

The present invention is directed to a gelastic cushion. The gelastic cushion is made from a conventional gelastic composition. The gelastic cushion has a structure having a first wall that defines an opening area and buckles when a force is applied to the first wall. When

30

the first wall buckles a predetermined amount, a second wall, interconnected to the first wall and made of a gelastic composition, also buckles. The second wall decreases the chance that the first wall bottoms out.

5 Bottoming out is when the patient essentially contacts the underlying surface which results in an increase of the pressure on the patient (a.k.a., the force) overlying the gelastic cushion. That increased pressure is undesirable.

10 **Brief Description of the Drawings**

Various cross-hatching lines are used in the figures to identify different structural components. Those structural components having different cross-hatching in the figures can be the same material or different materials.

Figure 1 illustrates an isometric view of the present invention.

Figure 2 is a top view of figure 1 taken only at box 2.

20 Figure 3 is a cross-sectional view of figure 2 taken along the lines 3-3.

Figure 4 illustrates a first embodiment of a top view of figure 2 when an object buckles just the first wall.

25 Figure 5 is a cross-sectional view of figure 4 taken along the lines 5-5.

Figure 6 illustrates a second embodiment of a top view of figure 2 when an object buckles the first wall and the second wall, not the third wall.

30 Figure 7 is a cross-sectional view of figure 6 taken along the lines 7-7.

Figure 8 is top view of mold components to form one embodiment of the present invention.

Figure 9 is front view of figure 8 taken along the lines 9-9 that illustrates component 102a and a portion of component 102d.

Figure 10 illustrates an alternative embodiment of figure 3.

Figure 11 illustrates figure 10 taken along the lines 11-11.

Figure 12 illustrates an alternative embodiment of figure 3.

Figure 13 illustrates figure 12 taken along the lines 13-13.

Figure 14 illustrates an alternative embodiment of figure 3.

Figure 15 illustrates figure 14 taken along the lines 15-15.

Figure 16 illustrates an alternative embodiment of figure 3.

Figure 17 illustrates figure 16 taken along the lines 17-17.

Figures 18a and b illustrate alternative embodiments of figure 3 with a bottom (skin) layer, an aperture, and an interconnector.

Figure 19 illustrates an alternative embodiment of figure 8 with an extra mold positioned on a mold component or an indentation in the mold component.

Figure 20 illustrates a front view of figure 19 taken from arrow 20.

Figure 21 illustrates an alternative embodiment of figure 2.

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Figure 22 illustrates a mattress configuration that uses the present invention.

Figure 23 illustrates an alternative embodiment of figure 3 wherein the cushion is used upside down.

5 Figure 24 illustrates an alternative embodiment of figure 2 using a jigsaw embodiment.

Figure 25 is a cross-sectional view of figure 24 taken along the lines 25-25.

10 Figure 26 is a view of figure 24 taken along the lines 24-24.

Figure 27 is a cross-sectional view of figure 24 taken along the lines 27-27 - a different embodiment when compared to figure 25.

15 Figure 28 is a view of figure 24 taken along the lines 28-28.

Figure 29 is an alternative embodiment of figure 26.

Figure 30 is an alternative embodiment of figure 28.

Figure 31 is a cross-sectional view of figure 19 taken along the lines 31-31.

20 Figure 32 is an alterative embodiment of figure 3.

Figure 33 is an alternative embodiment of figure 3.

Figure 34 illustrates an alternative embodiment of a cushion material.

25 Figure 35 is an enlarged view of Figure 34 taken from the box 340

Figure 36 illustrates a cross-sectional view of Figure 34 along the lines 344-344.

Figure 37 is an alternative embodiment of Figure 36.

30 Figure 38 illustrates an embodiment of Figure 34 in an exploded view of a mattress system.

Detailed Description of the Present Invention

Figure 1 illustrates a gelastic cushion 10 having a first wall 20 defining opening areas 12 positioned throughout the gelastic cushion 10. To understand and appreciate the present invention, we must look at (1) Figure 2 which is an overview of figure 1 at the area identified as box 2 (for illustration purposes only the first wall 20 in box 2 has been defined as first walls 20a-d and a portion of the opening area 12 in box 2 is defined as opening area 12a) and (2) figure 3 which is a cross-sectional view of Figure 2 taken along the lines 3-3.

Figures 2 and 3 illustrate three walls 20, 22, 24. The first wall 20 is the tallest wall and it defines the first opening area 12a (see figure 1) and has a height H1 (see figure 3). The first wall 20 has a width W1 that allows it to buckle into the first opening 12a, a second opening 12b (defined below), a third opening 12c (defined below) or alternatively in (a) a corresponding opening 12 (see figure 1) and/or (b) exterior to the perimeter of the gelastic cushion 10. The first wall 20 has a top surface 40 that receives a patient thereon.

The second wall 22 (a) is an intermediate wall height that has a height H2 and (b) defines with the first wall 20 at least two second openings 12b. The difference between H1 and H2 is distance D1. The second wall 22 has a width W2 that allows it to buckle into the second opening 12b or the third opening 12c if a patient's weight (and/or a force is applied to the gelastic material) is sufficient to buckle the first wall 20 a distance D1+. D1+ is any distance greater than D1 and W1 and W2 can be the same width or different widths.

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The third wall 24 (a) is a lower wall height and has a height H3 and (b) defines with the first wall 20 and the second wall 22 at least four third openings 12c. The difference between H1 and H3 is distance D3 and the difference between H2 and H3 is distance D2. The third wall has a width W3 that allows it to buckle if a patient's weight (and/or a force is applied to the gelastic material) is sufficient to buckle (a) the first wall 20 a distance D3+ and (b) the second wall 22 a distance D2+. D2+ is any distance greater than D2 and D3+ is any distance greater than D3. W1, W2 and W3 can be the same width, different widths or combinations thereof.

Operation of the Gelastic Cushion

Turning to figures 4 and 5, if an object (not shown) is positioned on the gelastic material 10 and the object's weight causes the first wall 20 (each portion of the first wall is identified individually as 20a, 20b, 20c and in other figures 20d) to buckle (B1) a distance D1-. D1- is a distance less than D1, or a distance D1. When the first wall 20 only buckles a distance D1- the second wall 22 and the third wall 24 do not buckle, as illustrated in figures 4 and 5. Instead the second wall 22 and the third wall 24 can be stretched (redistribution or lessening of the load) to accommodate the buckling (B1) of the first wall 20.

Figures 6 and 7 illustrate when an object (not shown) is positioned on the gelastic material 10 and the object's weight causes the first wall 20 to buckle (B2) a distance D1+ which then means that the second wall 22 buckles (B3). In figures 6 and 7 the second wall 22 buckles (B3) a distance D2- and the first wall buckles (B2) a distance D3-

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so that the third wall 24 does not buckle but can be stretched to accommodate the buckling of the first wall 20 and the second wall 22. D3- is a distance less than D3 and D2- is a distance less than D2. When the second wall 22
5 buckles, the second wall 22 provides increased support to the object to distribute the patient's weight when the first wall 20 buckles a predetermined distance D1+.

When the second wall 22 buckles, the present invention provides a similar support as the stacked cushion
10 embodiment that was disclosed in the prior art. The similarities between the present invention and the stacked cushion embodiment differ in that there is no material used to interconnect two different cushions. That interconnection could (a) increase pressure on the patient
15 or (b) be defective so the stacked cushions separate from each other. The present invention avoids those potential problems by having multiple height buckling walls within and surrounding each opening area 12.

In other words, the current invention has (a) a first
20 wall of the first set of buckling walls at a first interconnection area that extends from the first set of buckling walls' bottom surface a distance greater than zero along the first wall toward the first set of buckling walls' top surface and (b) a second wall of the first set
25 of buckling walls at a second interconnection area that extends from the first set of buckling walls' bottom surface a distance greater than zero along the second wall toward the first set of buckling walls' top surface wherein the first interconnection area is not the second
30 interconnection area.

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In addition to these structural changes, the multi-walled gelastic cushion offers a multi-ILD levels. The first and tallest buckling wall may have a first ILD, for example, of 35. The second tallest buckling wall, positioned within a column defined by a plurality of first walls and interconnected to the wall of at least two first walls, can have a second ILD. The second ILD can be the same as, greater than or less than the first ILD. The second wall supports the first wall when the patient's weight buckles both the first and second walls but does not support the first wall when only the first wall buckles. Thereby the invention provides multiple ILD cushions in one multi-walled gelastic material.

The multiple heights buckling walls within and surrounding each opening area 12 differs from the multi-tiered embodiment disclosed in the prior art. The multi-tiered embodiment does not have each tier buckle uniformly because the thicker sections do not buckle as well as the thinner section. The present invention has each wall of the multiple heights buckling wall buckle essentially uniformly when the appropriate force is applied to it which provides the desired distribution of weight and decreased pressure on the patient.

As indicated above, the third wall 24 buckles when the first wall 20 buckles a distance $D3+$ and the second wall 22 buckles a distance $D2+$. Even though not shown, when the third wall 24 buckles the third wall 24 provides further support to (1) decrease any pressure on the patient and (2) distribute the patient's weight when the first wall 20 buckles a predetermined distance $D3+$ and the second wall 22 buckles a distance $D2+$.

How Made

The example illustrated in figure 1 shows first walls in a rectangular shape (which includes a square). The first walls can be any shape including circles, pentagons, hexagons (as alluded to in figures 8 and 9) or any other desired shape that will allow the first wall and the second wall (and possible other walls) to buckle as desired.

Figures 8 and 9 illustrate four components 102a,b,c,d of a mold 100 that form an embodiment of the gelastic cushion 10 having multiple heights buckling walls within and surrounding an opening area. The mold 100 is a conventional mold having components that can withstand the gelastic material in a molten state. That material can be metal, polymeric and/or combinations thereof.

The mold 100 as illustrated in figure 8 shows four components 102a,b,c,d, in a hexagonal shape. The gelastic material is poured onto the mold 100 and the gelastic material that falls within (a) the gaps 120 form the first walls 20, (b) the gaps 122 form the second walls 22 and (c) the gaps 124 form the third walls 24. Figure 8 illustrates the top of the mold 100, which illustrates the gelastic cushion's bottom surface 90.

Figure 9 illustrates component 102a and a portion of component 102d from arrow 9 in figure 8. As alluded by figures 2 to 9, the first wall 20 is defined by (a) the gap 120 positioned between the various components 102 a,b,c,d and (b) a bottom surface 190 of the mold 100 (the top 90 of the gelastic material 10). In contrast the second wall 22 is defined entirely by the gap 122 in each component 102,

and the third wall 24 is defined entirely by the gap 124 in each component 102.

As illustrated in figures 3, 5, and 7, the second wall 22 has a top surface 42 that is level and the third wall 24 has a top surface 44 that is level. Those top surfaces 42, 44 can also be concave, convex, level or combinations thereof. Examples, and not limitations, of those embodiments are illustrated in figures 10 to 17. Those alternative embodiments for the top surfaces 42, 44 can be defined by altering the shape in the gaps 122, 124 in each component. It is well known that concave, convex and level top surfaces can strengthen, weaken or maintain the present support of the first wall 20, the second wall 22 and/or the third wall 24. By having various shaped top surfaces 42, 44 in different portions of the gelastic cushion, the gelastic cushion 10 can have various levels of support provided by the various walls 20, 22, 24 throughout the gelastic cushion 10.

20 Bottom Layer

The bottom 90 of the gelastic material 10 can have a bottom layer (a.k.a., skin layer) 150 as illustrated in figure 18a that extends beyond the bottom of the rest of the gelastic material, or as illustrated in figure 18b that is in the same plane as the bottom surface 90 of the gelastic material 10. That bottom layer 150 has a thickness TH1. The bottom layer 150 can provide additional support to the gelastic cushion 10. Adding the bottom layer 150 can be easily accomplished in the molding process by merely adding sufficient gelastic material over the components' 102 top surface 104 (see figure 9) to a desired

thickness, which is TH1. Alternatively, the molding process can have an indentation in certain areas of the mold components 102 for skin layer to have the desired thickness or just overflow the mold so the skin layer
5 obtains the desired thickness.

It should be noted that the bottom layer 150 can be positioned at certain desired bottom 90 areas of the gelastic cushion 20 or the entire bottom 90 area. The former embodiment can be accomplished by adding an excess
10 mold component 101a on the mold components 102e-f as illustrated at figures 19 and 20, or an indentation 101b in the mold components 120e-f as illustrated at figures 19 and 31 to desired area of the top surface 104 of the mold components 120 to allow the manufacturer to add additional
15 gelastic material to that certain area and not others. In the embodiment illustrated, the extra material is referred to as a skin layer or a bottom layer 150.

Connectors and/or Apertures

20 The bottom layer 150 can have apertures 152 as illustrated in figures 18a and 18b. Those apertures 152 can be formed in the molding process and/or by insertion of connectors 154 through the bottom layer 150. The connectors 154 connect the gelastic cushion 10 to a desired
25 apparatus 156 - another cushion (foam, bladders), support frame (furniture like chairs and mattresses, or crib materials), or combinations thereof. The connectors 154 can be metal, plastic or combinations thereof. Examples of connectors 154 include nails, screws, rivets, hooks, loops,
30 or equivalents thereof.

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By utilizing the bottom layer 150 with the connectors 154, the present invention does not have the gelastic cushion adhere to a non-woven or other material as done in the prior art. The connectors 154 ensure the gelastic material does not move around with less materials than needed than the prior art method.

Independent Column Walls

In some embodiments, it is desired that each column wall (for example first wall 20a) is independent from the other column walls (first walls 20b,d) by apertures (or gaps) 112 positioned between the respective column walls as illustrated in figure 21. That independence is limited in that the column walls are interconnected to the second wall 22 and/or the third wall 24. The aperture 112 can be any sized aperture so long as the column walls are independent from each other. This embodiment decreases excessive buckling and therefore decreases undesired hammocking effect.

Tailored Top

It is well known that a patient normally applies more pressure to a mattress cushion in the pelvic and torso areas than the foot or the head areas. In view of this information, the applicants have designed a tailored top cushion 300 as illustrated in figure 22. The tailored top cushion 300 can be divided into at least three zones. The first zone 302 provides support to a patient's head area, the second zone 304 provides support to the patient's foot area, and the third zone 306 supports the patient's heavy area - the pelvis and torso area.

Since the third zone 306 supports the patient's heavy area, the third zone 306 uses the gelastic cushion structures of the present invention. The gelastic cushion structures of the present invention have (1) a first wall 20 (a) having a height H1, (b) able to be buckled when a force is applied, and (c) defines an opening 12 even though the first wall 20 may have gaps at certain points and (2) within the opening 12 is a second wall 22 (a) having a height less than H1, (b) able to be buckled when the first wall buckles beyond a predetermined point, and (c) that interconnects to two locations on the first wall 20.

The first and second zones 302, 304 can use conventional gelastic cushion structures that are used in the prior art or the gelastic cushion structures of the present invention. That way, mattress 300 does not have to use as much gelastic material.

Alternatively, the third zone 306 can have a thickness of T1 while the first zone 302 and the second zone 304 can have a thickness of T2, which is less than T1. That increased thickness in the third zone 306 provides increased locations for the second wall 22 and additional walls including the third wall 24 to be positioned within the respective opening areas 12.

25 How Used

The present gelastic cushion material can be flipped over when used. By flipped over, the above-identified bottom layer 90 becomes the layer that the patient contacts. That way the present gelastic cushion material has increased surface area applied to the patient which can decrease the pressure applied to the patient. When the

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cushion material is flipped over, as illustrated in figure 23, the first wall, the second wall and the third wall buckle in the same way as described and illustrated above, except upside down.

5

Jigsaw Embodiment

The present gelastic cushion material can also be made of parts interconnected together. This jigsaw embodiment allows (1) the first wall 20 to be made of a first gelastic material having a durometer value of a; (2) the second wall 22 to be made of the first gelastic material or a second gelastic material having (i) a durometer value of a or b (wherein durometer value of b is different from the durometer value of a) and/or (ii) a composition different from the first gelastic material; and (3) the third wall 24 to be made of the first gelastic material, the second gelastic material or a third gelastic material having (i) a durometer value of a, b or c (wherein the durometer value of c is different from the durometer values of a and b) and/or (ii) a composition different from the first and second gelastic materials. Each wall material 20, 22, 24 interconnects to each other wall like a three dimensional jigsaw puzzle. Examples of such three dimensional jigsaw puzzle embodiments are illustrated in figures 24 to 30. In particular, figure 24 illustrates an alternative embodiment of figure 2 -- a top view of a designated top section 40 of the present multi-walled of different height gelastic cushion material. Figure 25 is a cross-sectional view of figure 24 taken along the lines 25-25. In figure 25, the third wall 24 retains its height (h3) between the interior section of first wall 20b and 20c. Implicitly illustrated

30

in figure 25 is the fact that second wall 22 has a gap area 224 (a high gap area) that allows the third wall 24 to retain its height between the interior section of first wall 20b and 20d.

5 Figures 25, 26 (a view of figure 24 taken along the lines 26-26) and 29 (an alternative embodiment of figure 26) illustrate the third wall 24 has projections 242 having a height (Q1). The height Q1 can be any level that allows the third wall 24 to interconnect with the first wall 20 as
10 illustrated in figures 26 and 29.

Figure 27 illustrates an alternative embodiment of figure 24 taken along the lines 27-27 wherein the second wall 22 has a small gap area 224 that requires the third wall 24 to not retain its height (h3) between the interior
15 section of first wall 20b and 20d. Figures 27, 28 and 30 illustrate the second wall 22 has projections 222 having a height (Q2). The height Q2 can be any level that allows the second wall 22 to interconnect with the first wall 20 as illustrated in figures 28 and 30.

20 If this embodiment is used, each wall 20, 22, 24 is to be molded individually if the gelastic materials are all different gelastic compositions and/or durometer strengths. If two of the walls are of the same material and durometer strength, then those two walls can be molded together while
25 the last wall is molded individually and then later interconnected with the two walls.

Filler

30 The gelastic cushion material can have filler positioned within the opening areas 12. The filler can be a fluid like water or an aqueous liquid, a gel material,

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bead material like polyethylene beads, down, horsehair, and combinations thereof. The filler can strengthen, maintain, or weaken the gelastic walls material.

5 Adjusting Wall Strength

If the embodiment with a skin layer 150 is used, the walls 20, 22, 24 of the present gelastic cushion material can be strengthened by positioning a peg 600, as illustrated in figure 32 under the skin layer 150.

10 Depending on the size of the peg 600, the gelastic cushion material's walls can be strengthened by pulling the walls closer together when the skin layer 150 is positioned over the peg 600. The peg 600 can be any material like wood, gelastic material, metallic, polymeric or combinations
15 thereof.

Alternatively, the peg 600 can be positioned below a gelastic material without any skin layer 150 but having the peg positioned below the first wall 20, the second wall 22, the third wall 24 or combinations thereof.

20 Another embodiment of using the peg 600 is illustrated at figure 33, the peg 600 material can be positioned on and attached to a non-woven material 602 or equivalent thereof. The non-woven material 602 with the peg 600 material can be positioned below the gelastic material and/or attached to
25 the bottom surface 90 of the gelastic material. One example in which the non-woven can be attached to the gelastic cushion is by ironing (heating) the non-woven material to the gelastic material.

Another embodiment of the present invention occurs
30 when different sized and/or shaped pegs are positioned below certain locations of the gelastic material in order

to strengthen some areas and not others. This embodiment is a variation of the embodiments illustrated in figures 32 and 33 but with more pegs of different shapes and/or sizes for different areas of the gelastic material.

5

Alternative Cushion Configuration

Figure 34 illustrates an alternative cushion configuration 500. The cushion configuration 500 has an upper cushion surface area 501 having a left/right side rail area 510 and a central area 512 divided into four sections. The four sections in the central area 512 include a head area 502, a torso area 504, a thigh area 506, and a lower leg/foot area 508.

The torso area 504 and the lower leg/foot area 508 have the multi-walled gelastic material 10 defined above. The multi-walled gelastic material 10 can have the first wall have a first ILD value, for example 20-50 and preferably 35; and the second wall have a second ILD, for example 20-40 and preferably 30, 35, or 40. The multi-walled gelastic material 10 attaches to the non-woven material 602. The non-woven material 602 can be interconnected to the lower cushion surface materials 550.

The head area 502 and the thigh area 506 do not require as much cushioning as the torso and foot areas. Accordingly the head area 502 and the thigh area 506 can use convoluted foam, foam, fluid bladders (interconnected to pumps or not), or combinations thereof.

The left/right side rail area 510 each have a side rail cushion 802. The side rail cushion on the right side is a mirror image of the side rail cushion on the left side. Each side rail cushion 802, as illustrated at Figure

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35, has a planar bottom surface 804, a vertical exterior surface 806 (does not contact the central area 512), a vertical interior surface 808 (contacts the central area 512), a horizontal top surface 810 that extends from the top of the vertical exterior surface 806 towards the central area 512 and is one-half or less than one-half the width (vertical exterior surface 806 to vertical interior surface 808) of the planar bottom surface 804, and a tapered top surface 812 that interconnects the horizontal top surface 810 and the vertical interior surface 808 and having a fall line to create an uphill slope in relation from the central area 512 to the horizontal top surface 810. The side rail cushion 802 must have an ILD value (for example 65) greater than the ILD value of the first buckling wall of the multi-walled gelastic material 10 (for example 35).

In a preferred embodiment the vertical interior surface 808 has a height (a) equal to or greater than the second wall's height in the multi-walled gelastic material 10 in the torso area 504 of the central area 512 and (b) less than the first wall's height in the multi-walled gelastic material 10 in the torso area 504 of the central area 512. That height is about 1 inch.

It is also preferred the plane of horizontal top surface 810, and by default the height of the vertical exterior surface 806, is above the plane of the multi-walled gelastic material's top surface. Thereby the tapered top surface's 812 uphill slope is maintained. The preferred slope ranges from 15 to 30 degrees as measured from an imaginary line extending from the vertical interior surface 808 to the tapered top surface 812.

The combination of (a) the ILD differential between the side rail cushion 802 and the multi-walled gelastic material 10 in the torso area 504 of the central area 512 where the patient's weight is greatest, and (b) the tapered top surface 812 is required for the current embodiment. That combination is required so that when the patient gets close to the edge of the gelastic material 10 (in the torso area 504 of the central area 512) toward the side rail area 510, the patient will sink into the lower ILD material and be positioned below the tapered top surface 812. Thereby the patient will have difficulty rolling out of the cushion material since the patient would have to go uphill to get over the side rail material. Please be advised that it is expected that conventional bed side rails will continue to be used in a mattress frame system.

This mattress embodiment illustrated in Figures 34 and 35 have an average tissue interface pressure less than 50mm Hg. This tissue interface pressure is obtained by using the various cushion materials on the upper cushion surface 501.

The lower cushion surface area 550 is positioned below the upper cushion surface area 501. The lower cushion surface area 550 also has a left/right side rail area 560 and a central area 562 divided into four sections. The four sections in the central area 562 include a head area 552, a torso area 554, a thigh area 556, and a lower leg/foot area 558 that correspond to the upper cushion surface. In addition, the lower cushion surface 550 can be divided into layers. As illustrated in Figure 34, the lower cushion surface area in the head area 552, the torso area 554, the thigh area 556, and the lower leg/foot area

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558 each can be foam material 570 which includes layered foam 572, convoluted foam, conventional foam; gelastic materials as disclosed in commonly assigned U.S. patent numbers 6,606,754; 6,871,365; 6,843,873; 6,767,621; and 5 6,099,951 which are hereby incorporated by reference); fluid bladder systems 662 which include rotating bladders, percussion bladders, wave motion bladders, low-air loss bladders that release air to the multi-walled or conventional gelastic material's columns which further 10 directs the air to the patient to decrease the patient's tissue interface pressure on the mattress; non-powered self-adjusting bladders (see commonly assigned U.S. patent number 6,813,790 which is hereby incorporated by reference) having non-powered air cylinders in specific zones that 15 automatically adjust to patient size and weight and relies on an internal air supply that eliminates the need for external air valves, pumps or cords; sof-care bladders that combine twin layers of interlocking air cells to create a comfortably contoured support surface; zoned sof-care 20 bladders having overlapping zones to decrease bottoming out, or combinations thereof.

Depending on the bladders, the fluid pump system 660 is positioned in a cavity of the cushion material for the head area 552 or the lower leg/foot area 558 as illustrated 25 at Figure 36. The fluid pump system 660 may operate hourly, daily, weekly, bi-weekly - it all depends on the bladders used in the cushion 500. Conventional conduits 664 interconnect the pump system 660 to the fluid bladders 662, and preferably the conduits 664 are within the 30 mattress system.

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It is preferred that the lower leg/foot area 558 is tapered toward the ground. The lower leg/foot area's proximal end that contacts the thigh area 556 is about 3 to 4 inches in height and the distal end is about 1 to 2 inches in height. That tapering as illustrated in Figures 34 and 36 is known to decrease the tissue interface pressure of the patient's foot (in particular the heel) when applied to the cushion material.

The left/right side rail areas 560 are normally foam materials that secure the left/right side rail cushions 802 in place, and act as a crib or partial crib in relation to the central areas.

Alternatively the central areas 512, 562 of the cushion configurations 500 can be divided into three sections in the upper area 501 and the lower area 550 -- respectively a head area 502, 552; a torso area 504, 554, and a lower leg/foot area 508, 558 as illustrated in Figure 37. In this embodiment, the cushions are made of the same material except the torso area 504 is a structured tapered gel configuration (similar to Figure 22). The bottom torso area 554 is designed to receive the structured tapered gel configuration. This structured tapered gel configuration provides greater latitude in the formation of multi-walled gelastic material.

The cushion configurations 500 are normally positioned within a conventional fire barrier material 900 and the cushion and fire barrier are encased within a crib barrier 902, which is then encased with a cover assembly 904 to form a mattress system 950 as illustrated in Figure 38. The cover assembly 904 may have hooks and loops 940 at the

corners to securely attach the mattress system to a bed frame or other support surface.

While the invention has been illustrated and described in detail in the drawings and foregoing description, the
5 same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiments have been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

We claim:

1. A gelastic cushion comprising:

a first set of buckling walls formed from a gelastic material having a triblock polymer of the general configuration A-B-A and a plasticizer, the buckling walls of the first set defining a first opening area at a first side of the cushion and a second opening area at an opposed side of said cushion, the first set of buckling walls having a first height extending from the first side of the cushion to the opposed side of the cushion and being the tallest walls in the gelastic cushion, the buckling walls of the first set further having a first width that allows the first set of buckling walls to buckle when a force is applied at the first side or the opposed side of the cushion, and the first opening area comprising an open-ended opening area wherein the cushion is free of gelastic skin material extending across and enclosing the first set of buckling walls at the first side of the cushion; and

a second buckling wall formed from a gelastic material, the second buckling wall positioned within the first opening area and interconnecting to (a) a first wall of the first set of buckling walls at a first interconnection area that extends from a distance greater than zero along the first height of the first wall of the first set of buckling walls and (b) a second wall of the first set of buckling walls at a second interconnection area that extends from a distance greater than zero along the first height of the second wall of the first set of buckling walls, and the second buckling wall further having a second height less than the first height of the first set of buckling walls wherein the difference between the first height of the first set of buckling walls and the second height of the second buckling wall defines a first

differential distance, and the second buckling wall having a second width that allows the second buckling wall to buckle into the first opening area if the force applied to the first set of buckling walls buckles the first set of buckling walls a distance greater than the first differential distance.

2. The gelastic cushion of claim 1 wherein the first width and the second width are the same width.

3. The gelastic cushion of claim 1 wherein the second buckling wall has a distal surface having a shape selected from the group consisting of convex, concave, planar, and combinations thereof.

4. The gelastic cushion of claim 1 wherein the second buckling wall has a planar surface extending between the first interconnection area and the second interconnection area.

5. The gelastic cushion of claim 1 further comprising a third buckling wall formed from a gelastic material positioned within the first opening area and interconnecting to a third wall of the first set of buckling walls at a third interconnection area that extends a distance greater than zero along the first height of the third wall of the first set of buckling walls.

6. The gelastic cushion of claim 5 wherein the third buckling wall has a third height less than the first height and the second height, and the difference between the first height and the third height is a second differential distance and the difference between the second height and the third height is a third differential distance.

7. The gelastic cushion of claim 6 wherein the third buckling wall has a third width that allows the third buckling wall to buckle into the first opening area if the force applied to the first set of buckling walls buckles the first set of buckling walls a distance greater than the second differential distance and the second buckling wall buckles a distance greater than the third differential distance.

8. The gelastic cushion of claim 6 further comprising a fourth buckling wall formed from a gelastic material positioned within the first opening area and interconnecting to a fourth wall of the first set of buckling walls at a fourth interconnection area that extends a distance greater than zero along the first height of the fourth wall of the first set of buckling walls, and the third interconnection area being opposed from the fourth interconnection area.

9. The gelastic cushion of claim 6 wherein the fourth buckling wall has a fourth width that allows the fourth buckling wall to buckle into the first opening area if the force applied to the first set of buckling walls buckles the first set of buckling walls a distance greater than the second differential distance and the second buckling wall buckles a distance greater than the third differential distance.

10. The gelastic cushion of claim 5 wherein the third buckling wall has a distal surface having a shape selected from the group consisting of convex, concave, planar, and combinations thereof.

11. The gelastic cushion of claim 1 wherein the first interconnection area extends along the first wall of the first

set of buckling walls starting from the opposed side of the cushion, and the second interconnection area extends along the second wall of the first set of buckling walls starting from the opposed side of the cushion.

12. The gelastic cushion of claim 5 wherein the third interconnection area extends along the third wall of the first set of buckling walls starting from the opposed side of the cushion, and the fourth interconnection area extends along the fourth wall of the first set of buckling walls starting from the opposed side of the cushion.

13. The gelastic cushion of claim 1, wherein the first set of buckling walls is formed from a first gelastic material having a first triblock polymer of the general configuration A-B-A and a first plasticizer, and the second buckling wall is formed from a second gelastic material different than said first gelastic material.

14. The gelastic cushion of claim 5, wherein the first set of buckling walls is formed from a first gelastic material having a first triblock polymer of the general configuration A-B-A and a first plasticizer, and the third buckling wall is formed from a gelastic material different than said first gelastic material.

15. The gelastic cushion of claim 8, wherein the first set of buckling walls is formed from a first gelastic material having a first triblock polymer of the general configuration A-B-A and a first plasticizer, and the fourth buckling wall is formed from a gelastic material different than said first gelastic material.

16. The gelastic cushion of claim 1, wherein the cushion is incorporated into a portion of a mattress.

17. The gelastic cushion of claim 1, wherein the cushion forms a head section, a foot section and a torso/pelvic section.

18. The gelastic cushion of claim 1, wherein the second opening area comprising an open-ended opening area wherein the cushion is free of gelastic skin material extending across and enclosing the first set of buckling walls at the opposed side.

19. A method of forming a gelastic cushion comprising:

forming a first set of buckling walls from a gelastic material having a triblock polymer of the general configuration A-B-A and a plasticizer;

forming a first opening area at a first side of the cushion and a second opening area at an opposed side of said cushion with the buckling walls of the first set, the first opening area being formed free of gelastic skin material extending across and enclosing the first set of buckling walls at the first side of the cushion;

extending the buckling walls of the first set of buckling walls a first height from the first side of the cushion to the opposed side of the cushion;

said forming a first set of buckling walls includes forming the first set of buckling walls as the tallest walls in the gelastic cushion and forming the bucking walls of the first set of buckling walls with a first width that allows the first set of buckling walls to buckle when a force is applied at the first side or the opposed side of the cushion; and

forming a second buckling wall formed from a gelastic material;

locating the second buckling wall within the first opening area;

interconnecting the second buckling wall to (a) a first wall of the first set of buckling walls at a first interconnection area that extends from a distance greater than zero along the first height of the first wall of the first set of buckling walls and (b) a second wall of the first set of buckling walls at a second interconnection area that extends from a distance greater than zero along the first height of the second wall of the first set of buckling walls; and

said forming a second buckling wall includes forming the second buckling wall with a second height less than the first height of the first set of buckling walls wherein the difference between the first height of the first set of buckling walls and the second height of the second buckling wall defines a first differential distance and forming the second buckling wall with a second width that allows the second buckling wall to buckle into the first opening area if the force applied to the first set of buckling walls buckles the first set of buckling walls a distance greater than the first differential distance.

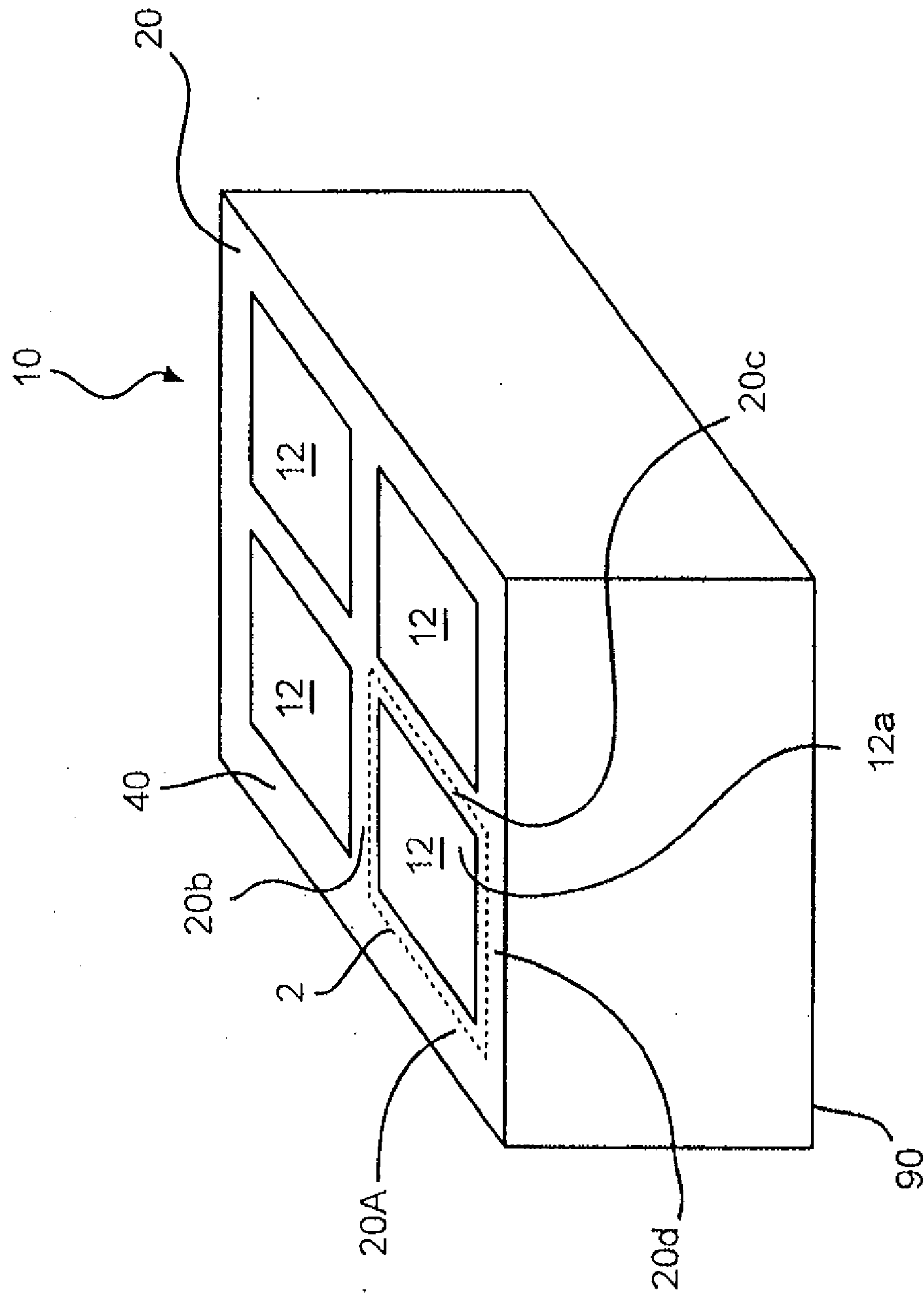


FIG. 1

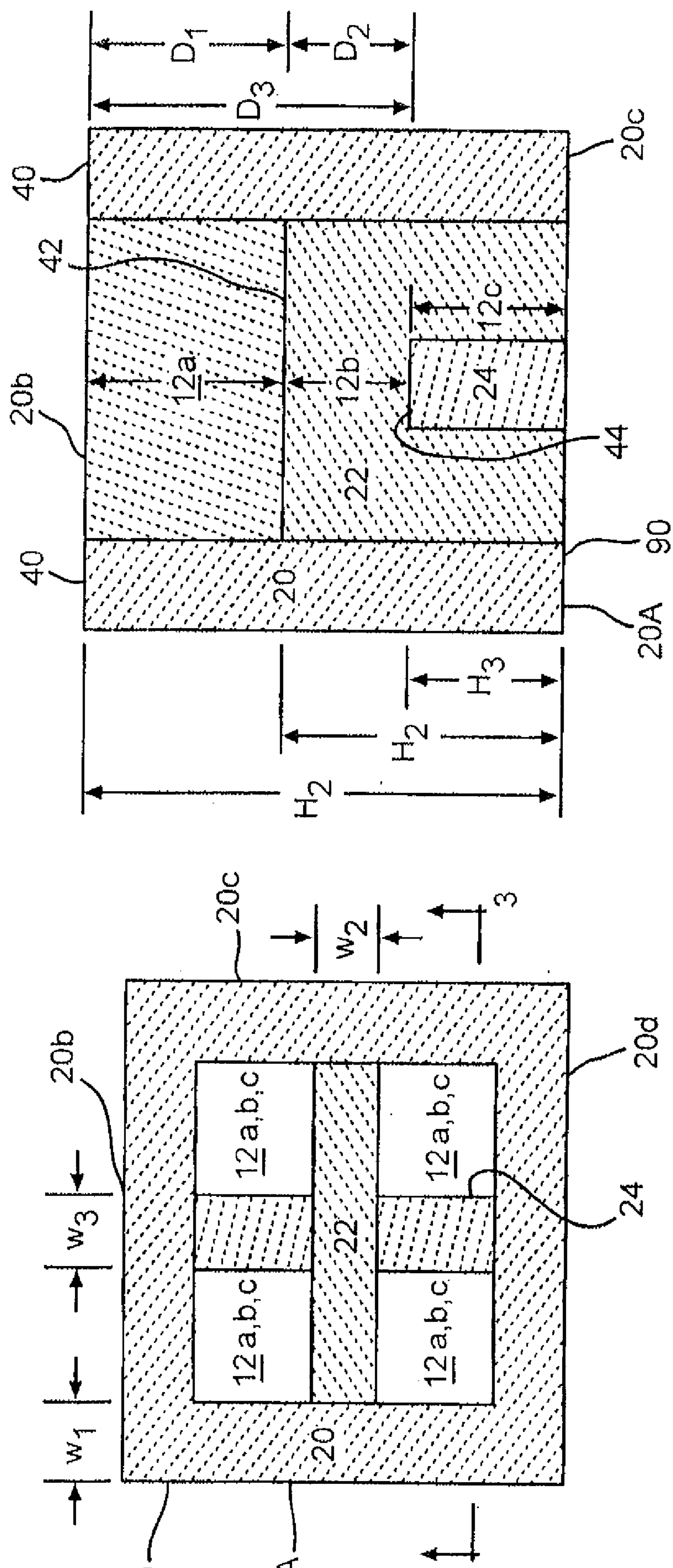


FIG. 2

FIG. 3

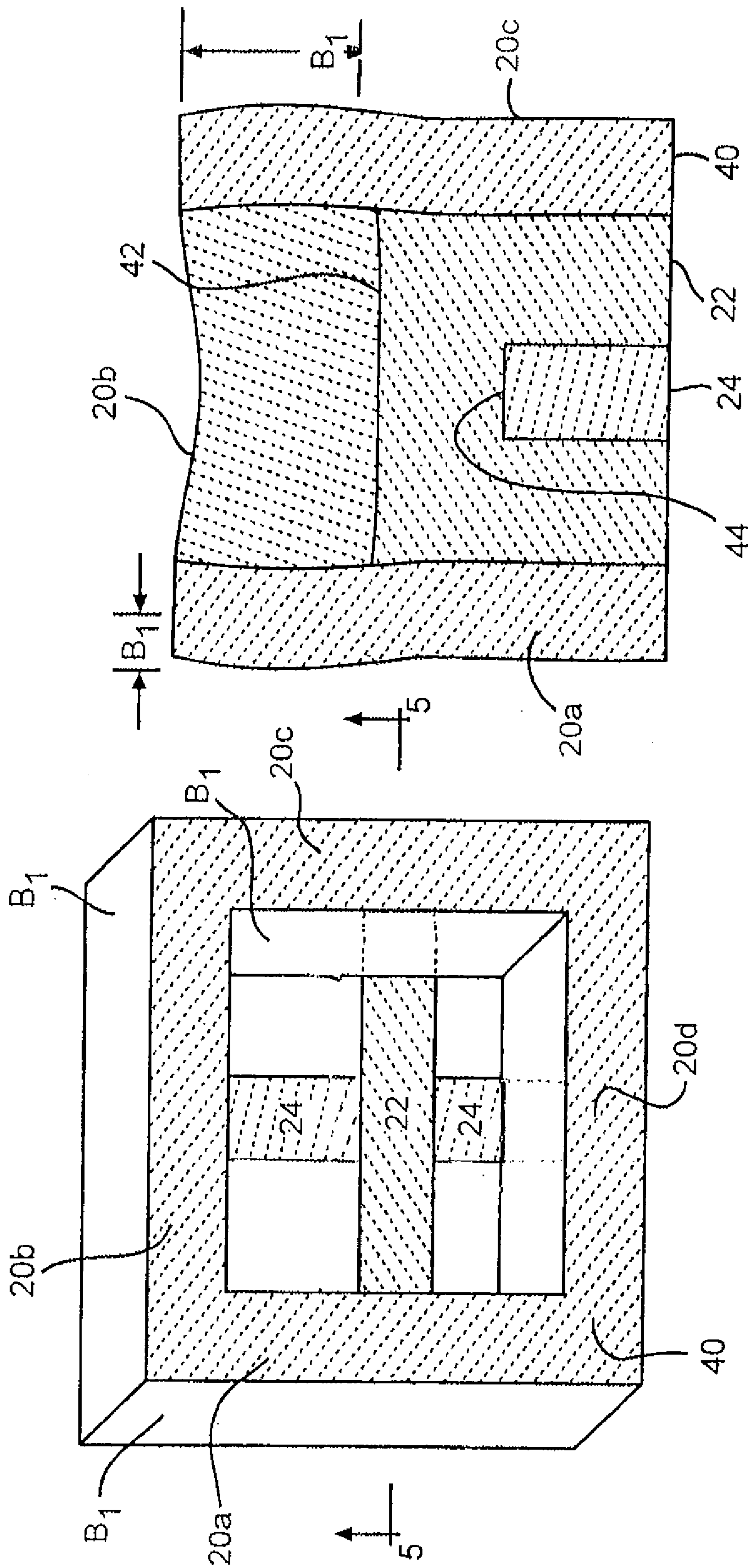


FIG. 4

FIG. 5

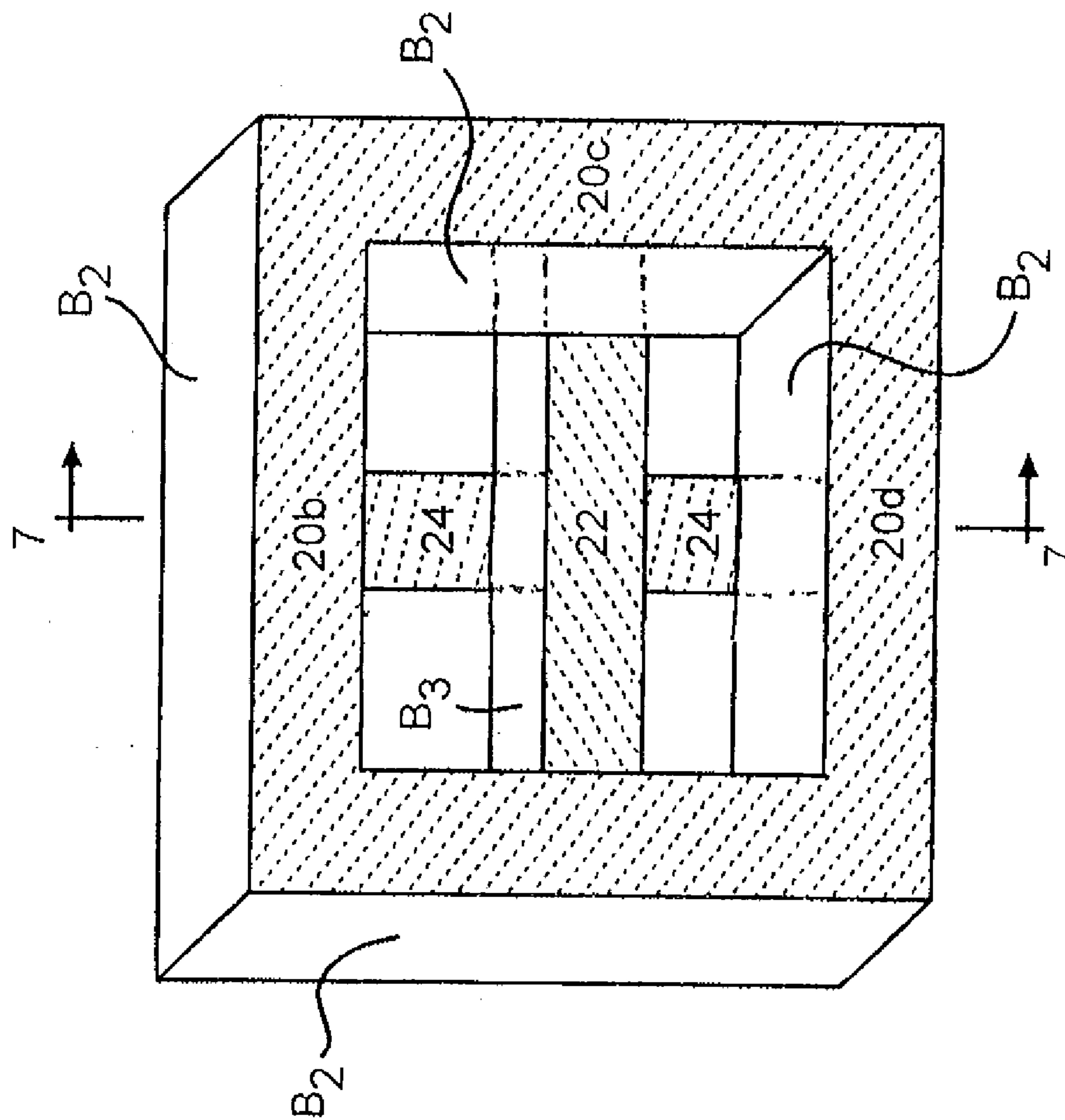


FIG. 6

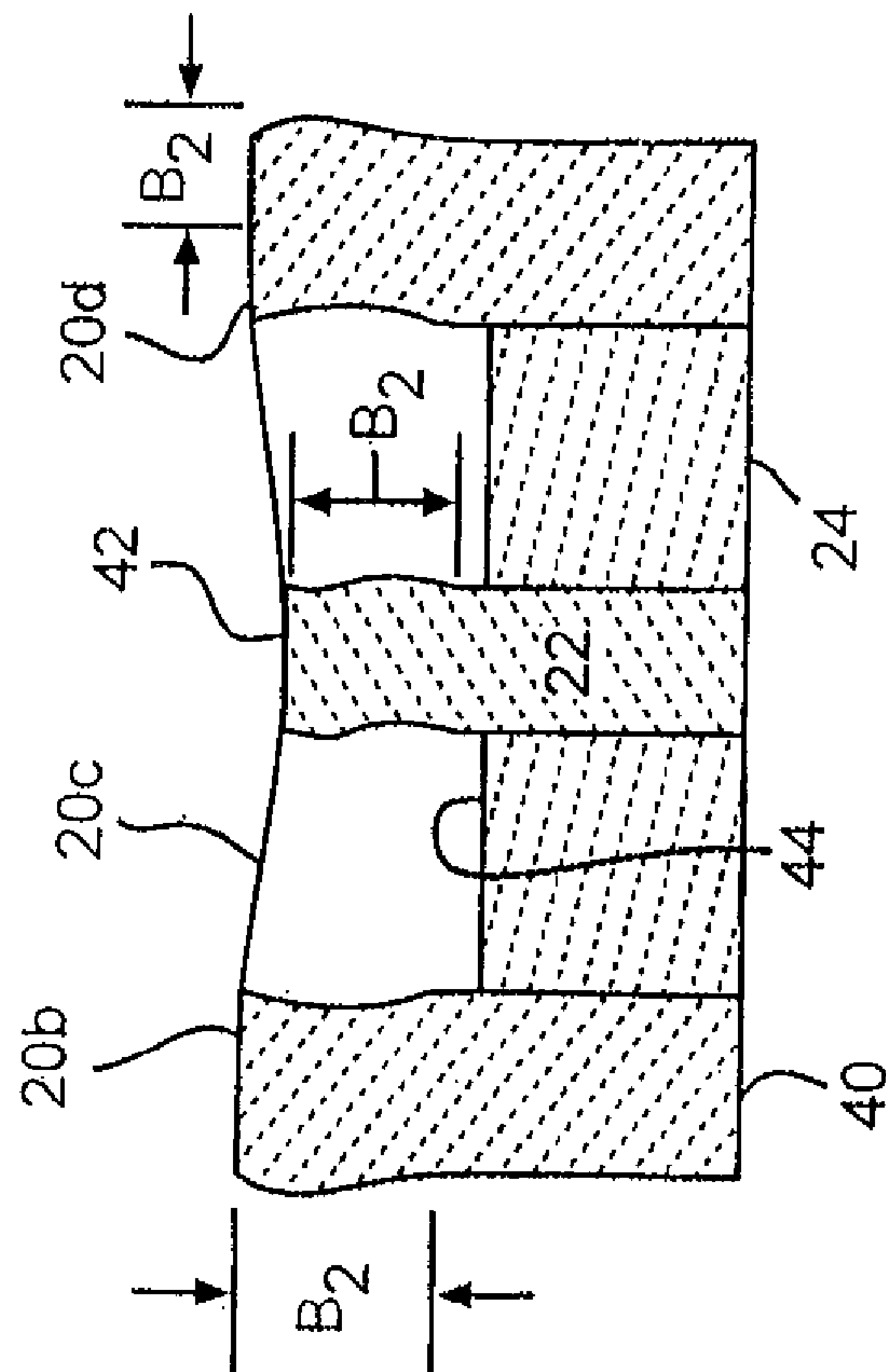


FIG. 7

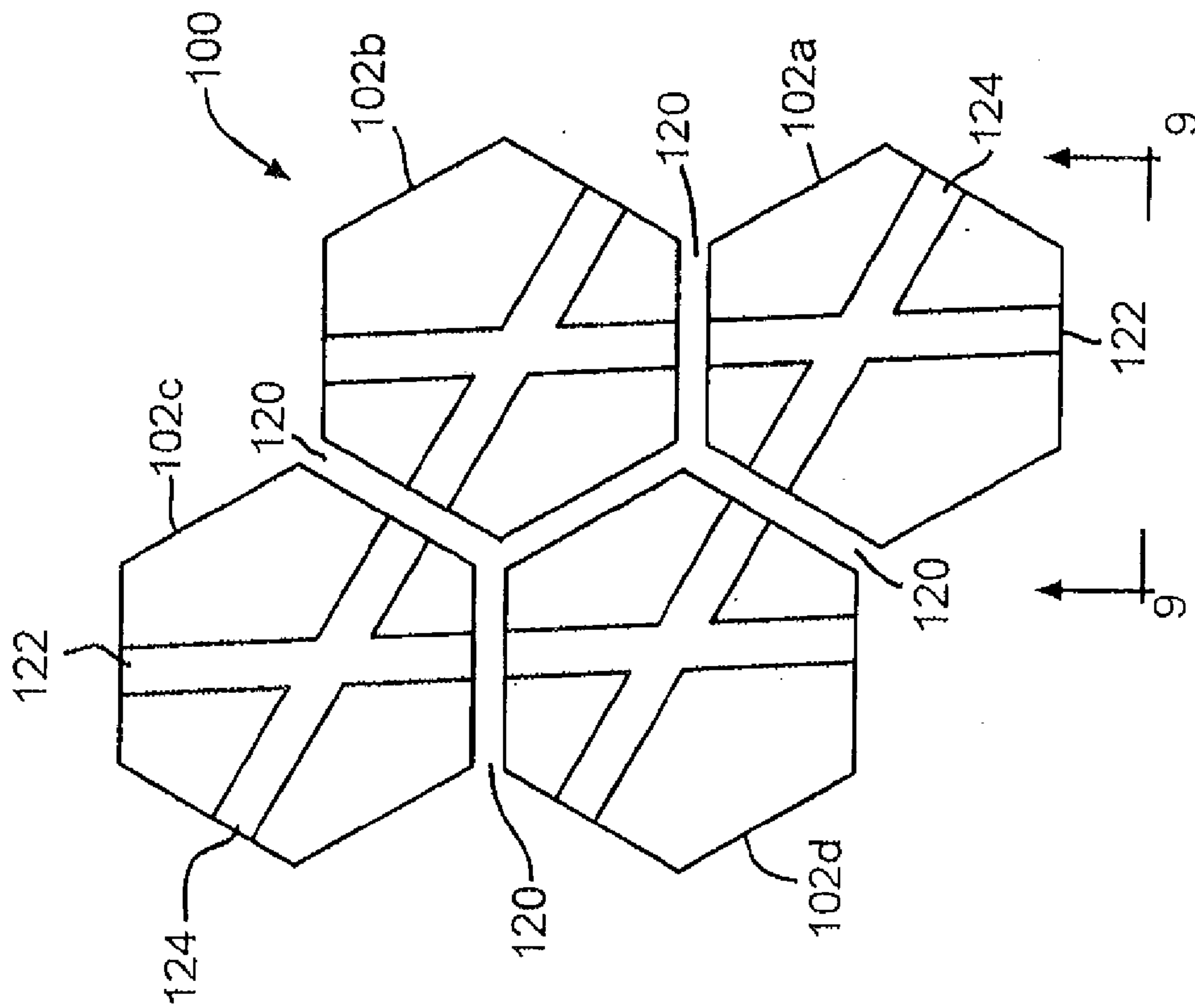


FIG. 8

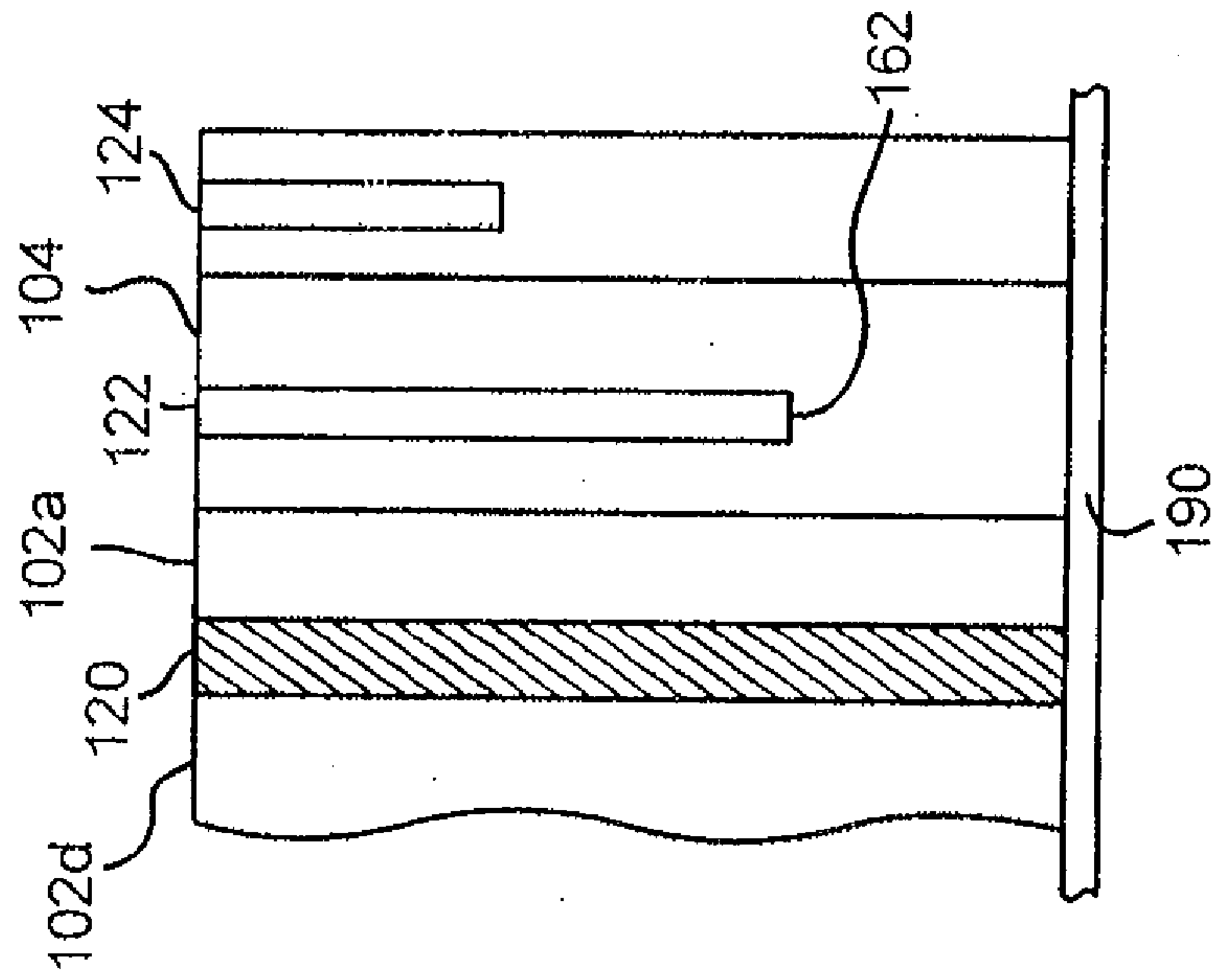


FIG. 9

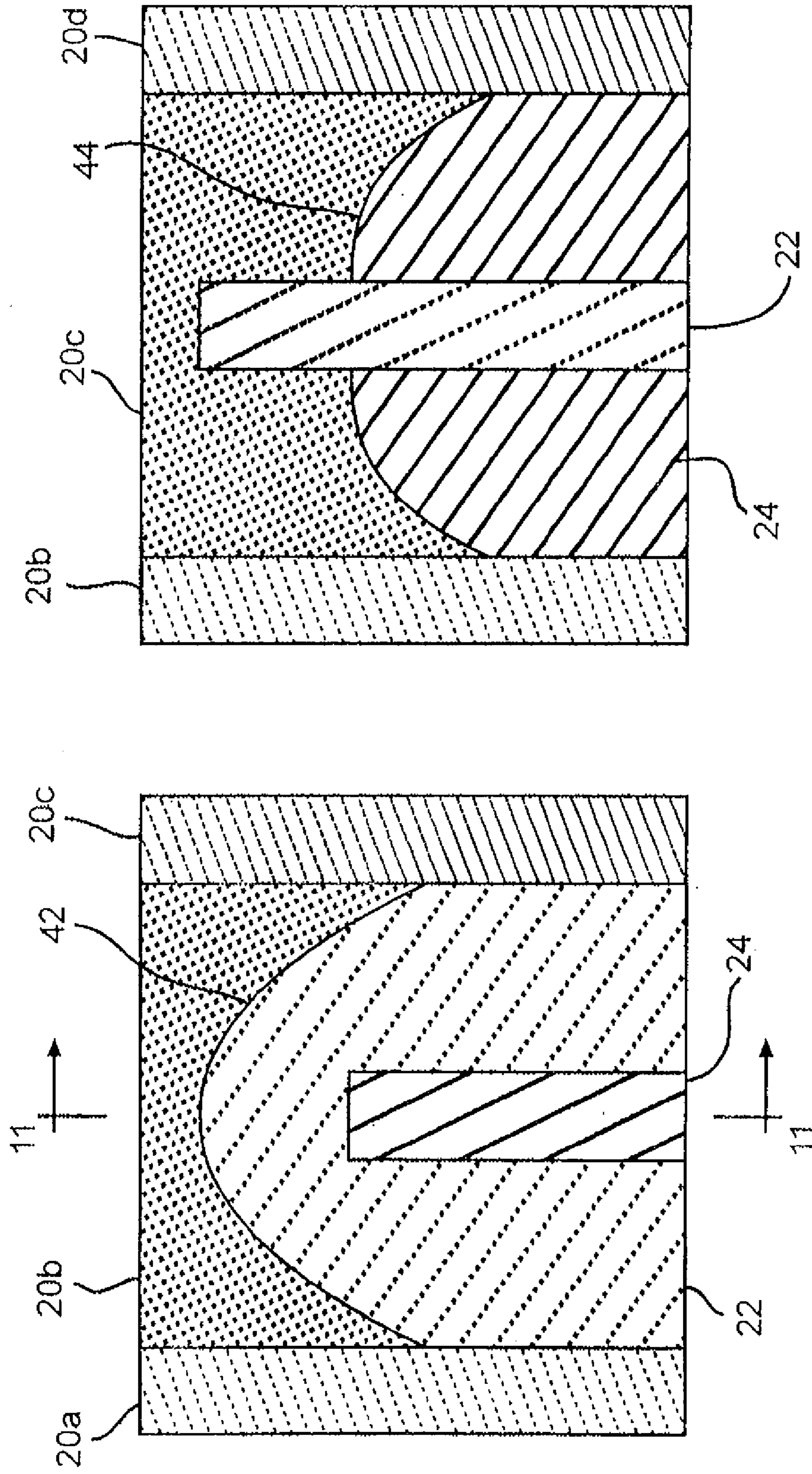


FIG. 10

FIG. 11

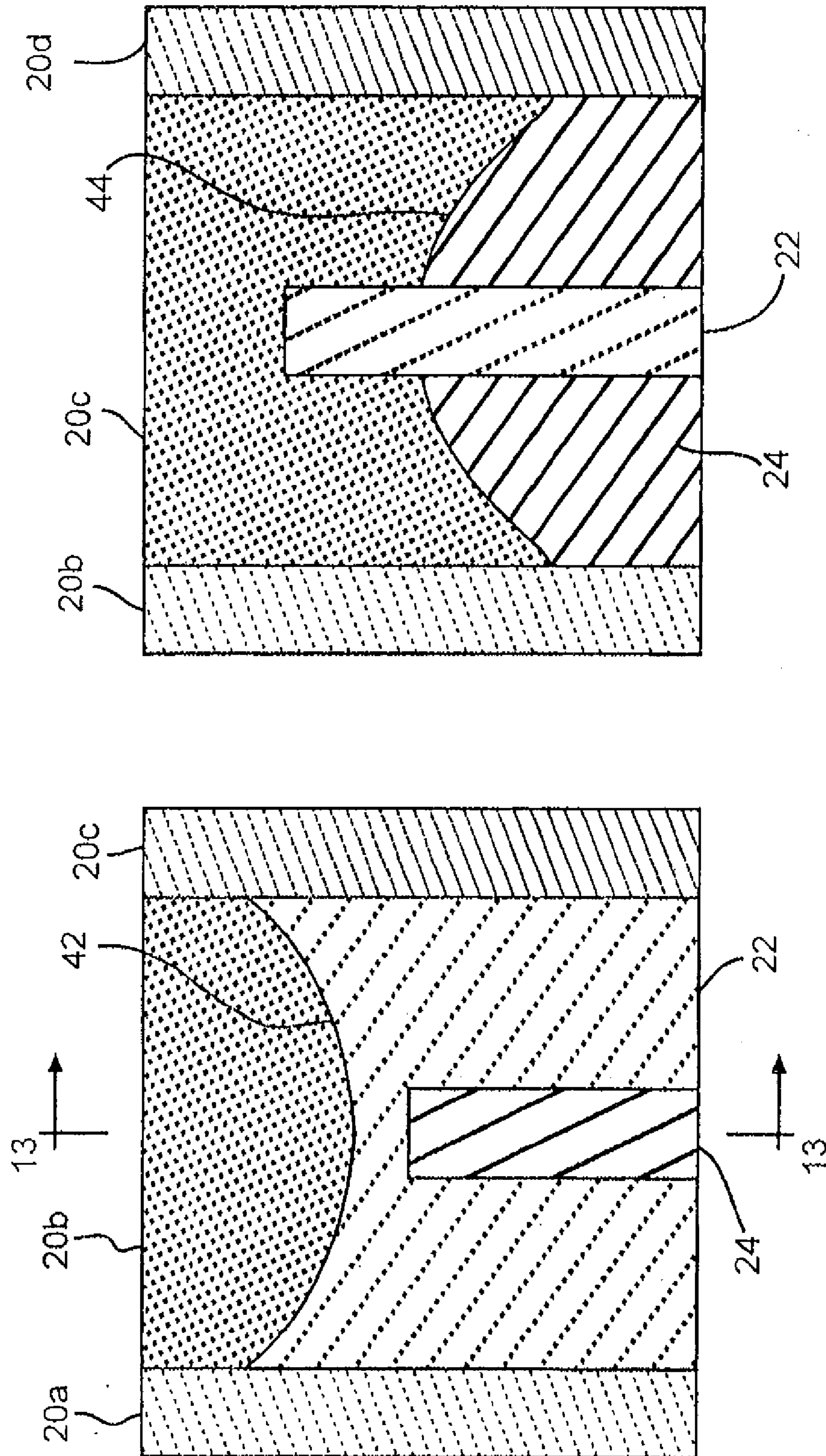


FIG. 12

FIG. 13

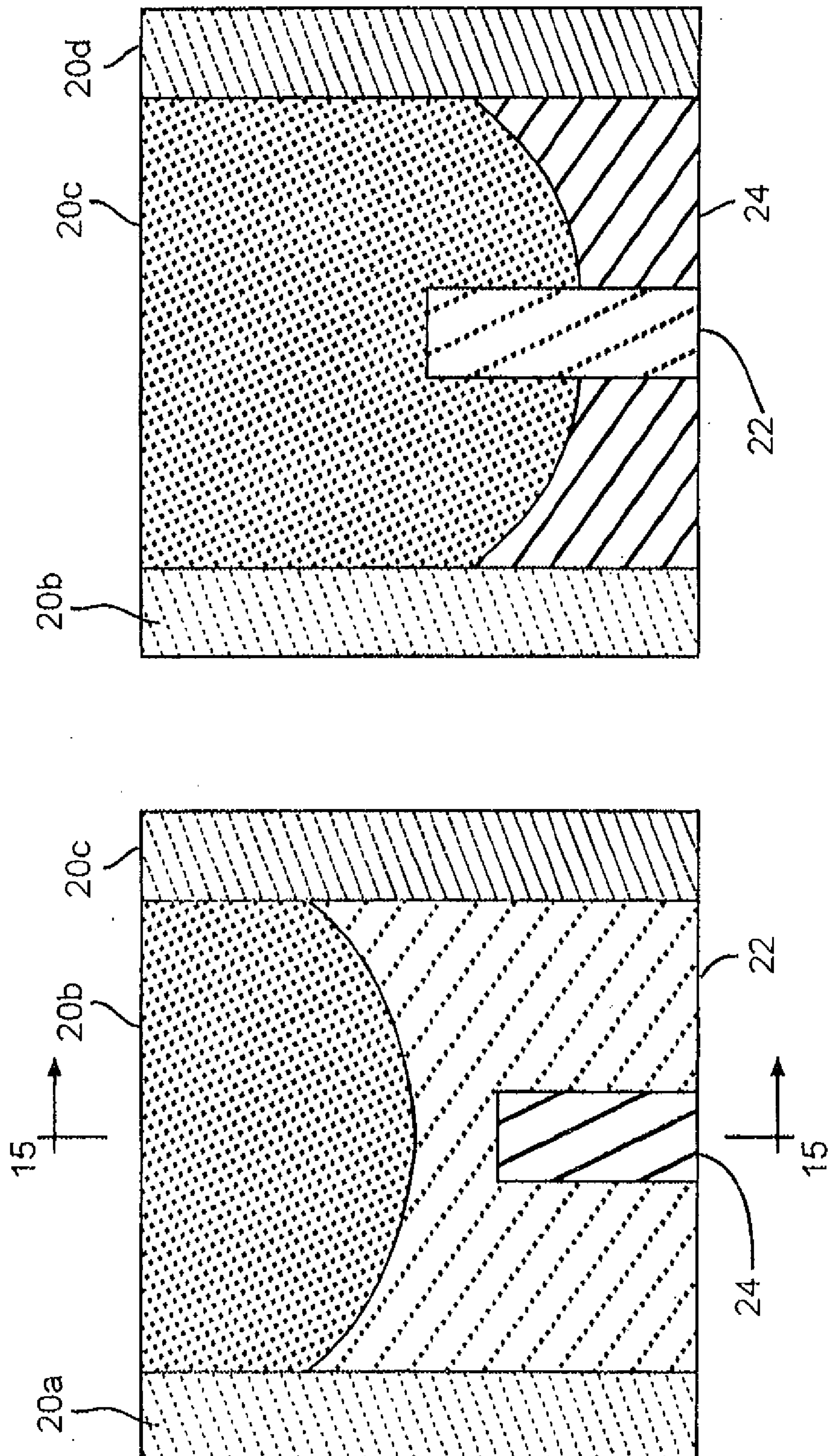


FIG. 14

FIG. 15

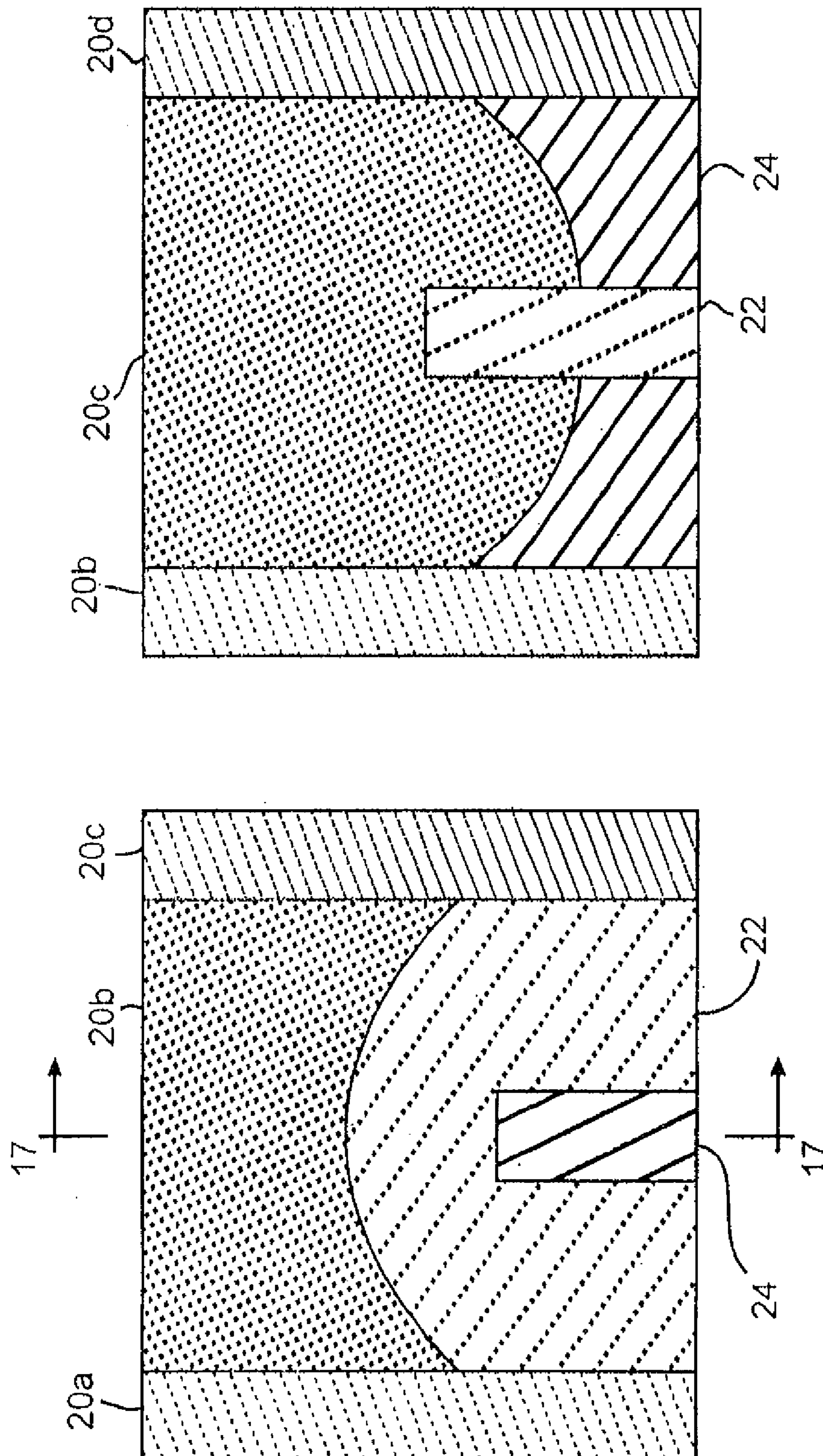


FIG. 16

FIG. 17

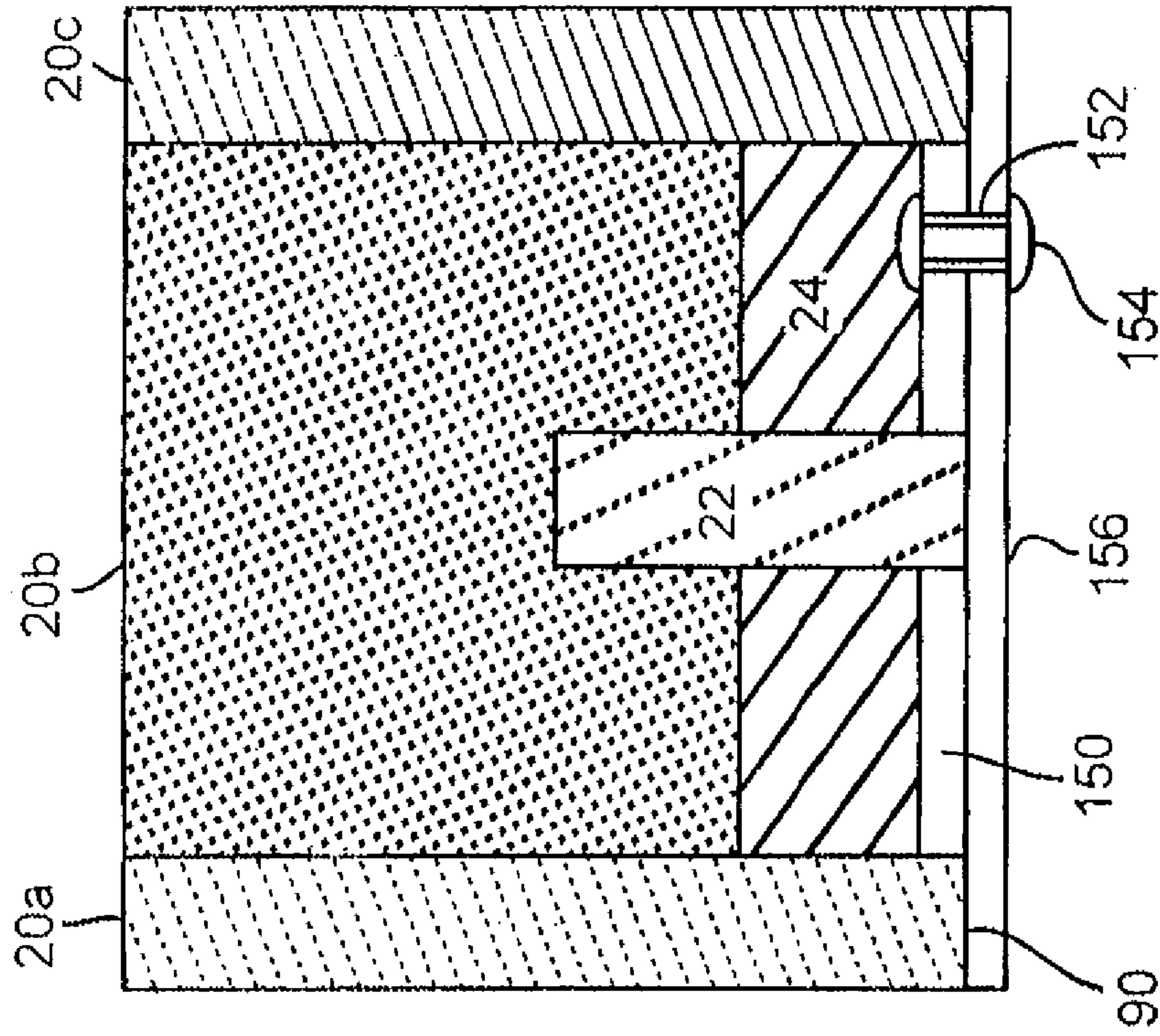


FIG. 18A

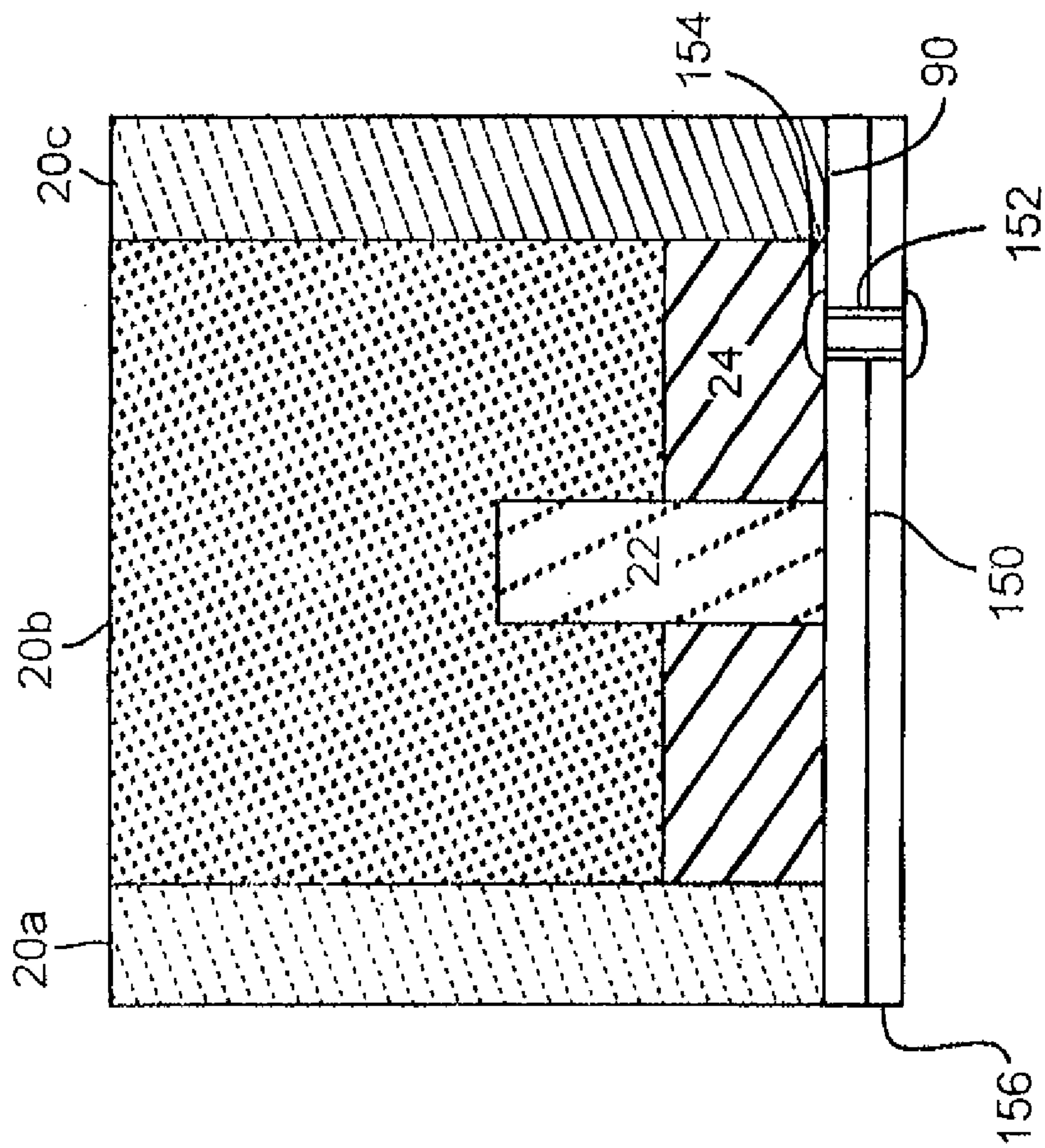


FIG. 18B

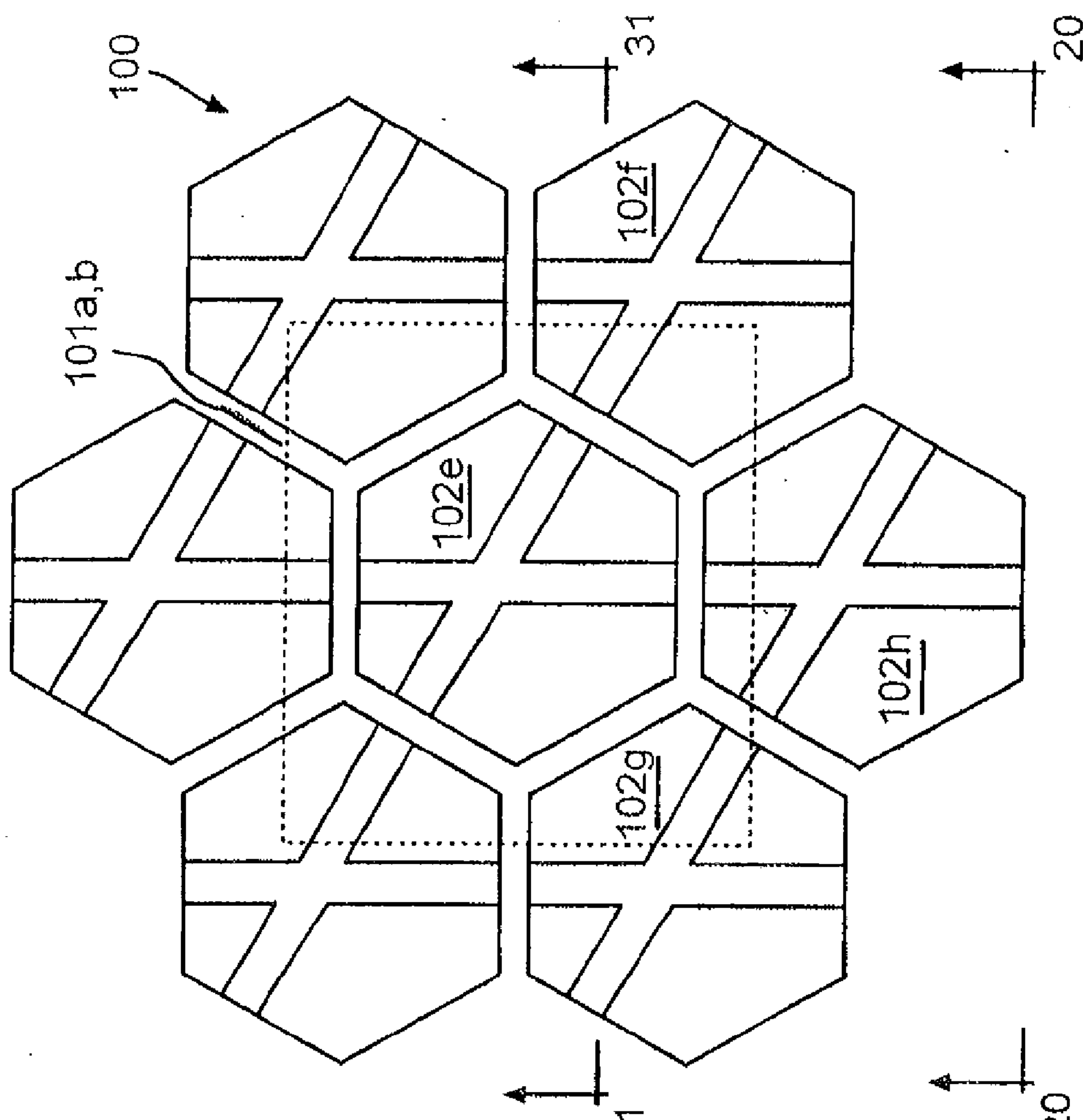


FIG. 19

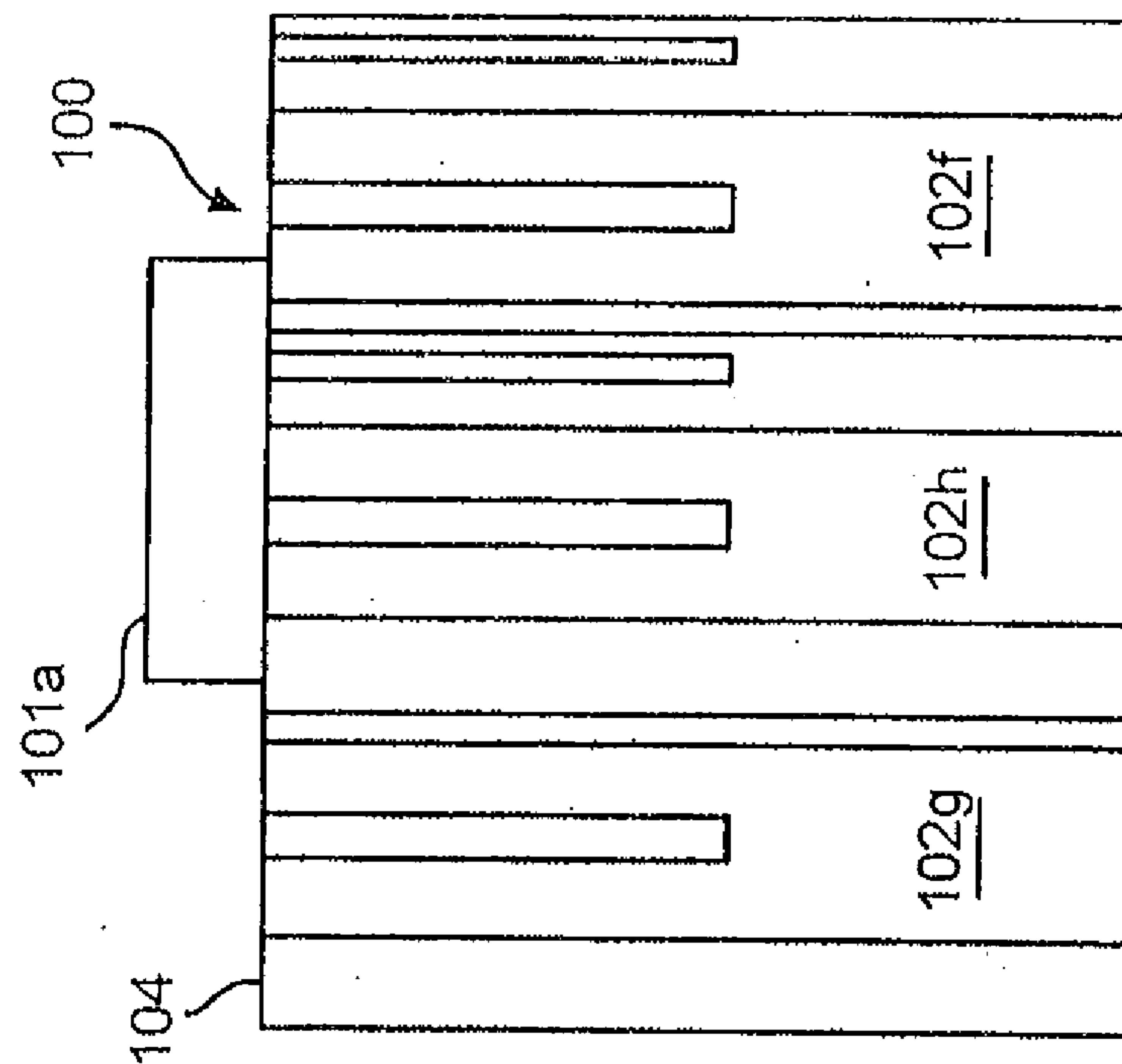


FIG. 20

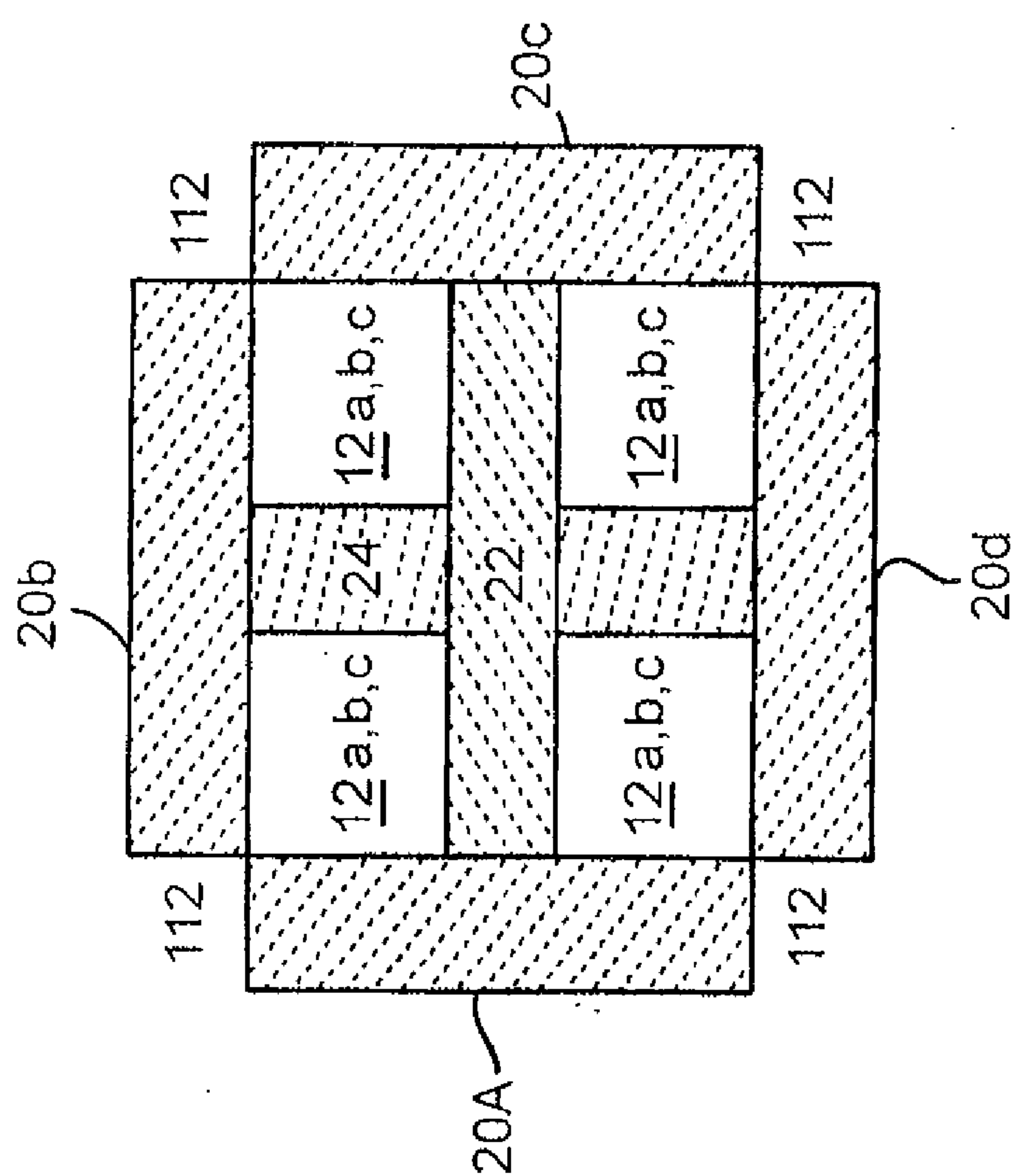


FIG. 21

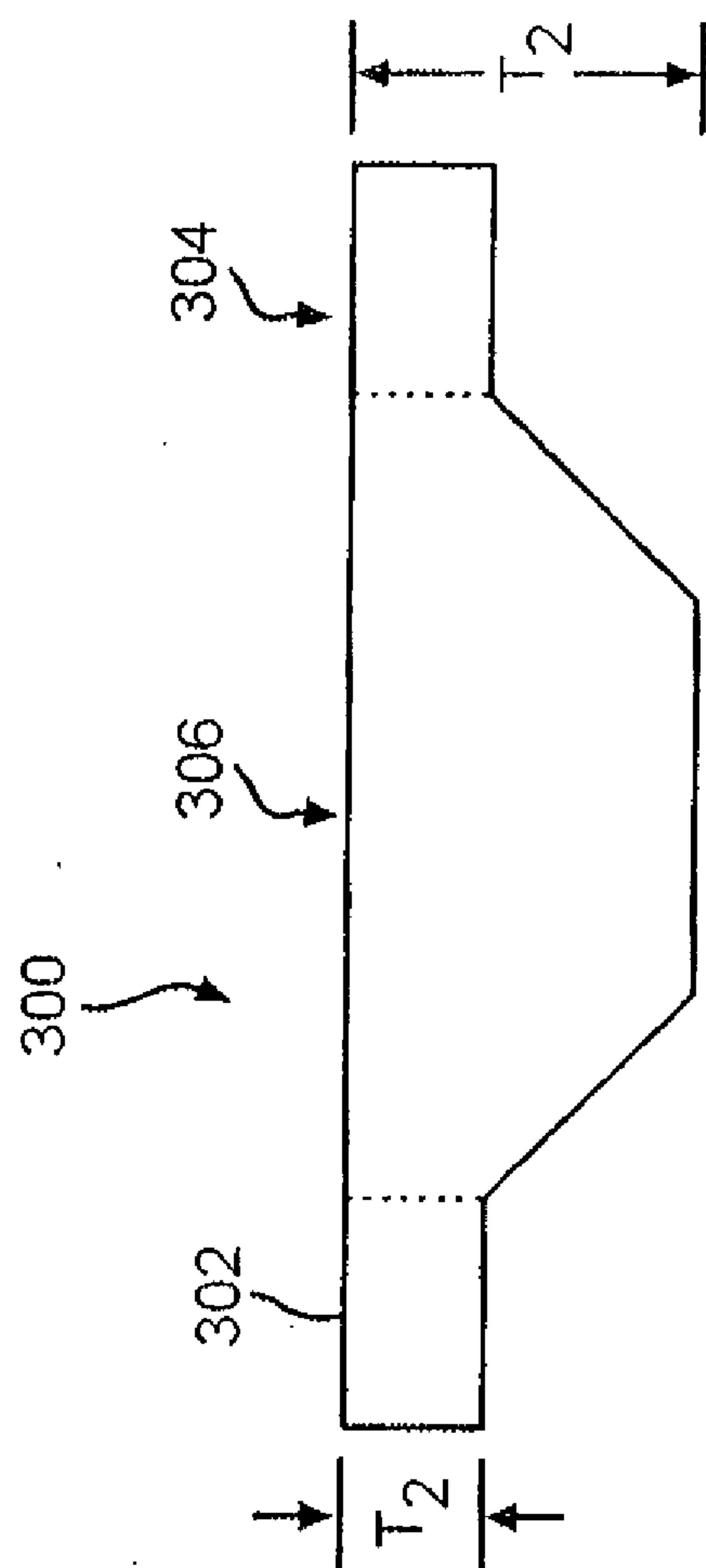


FIG. 22

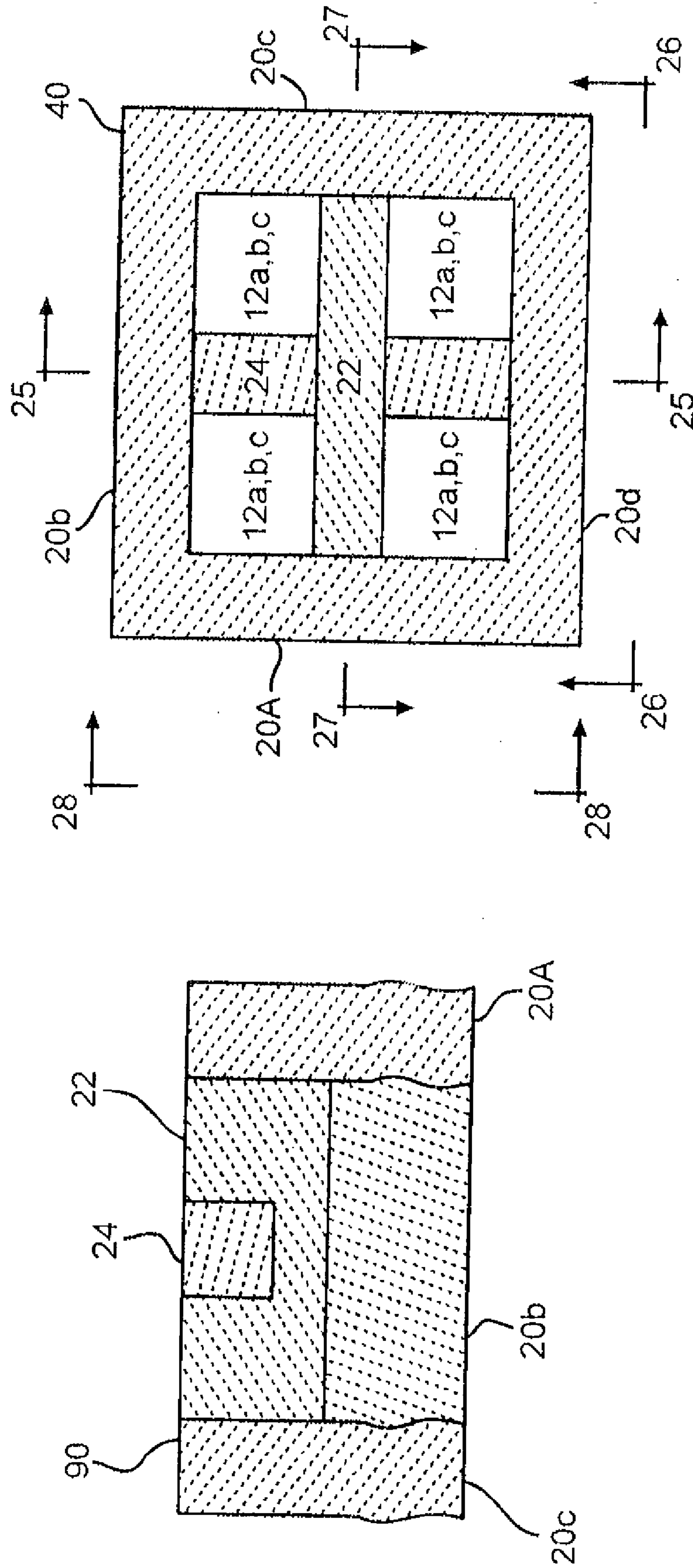


FIG. 23

FIG. 24

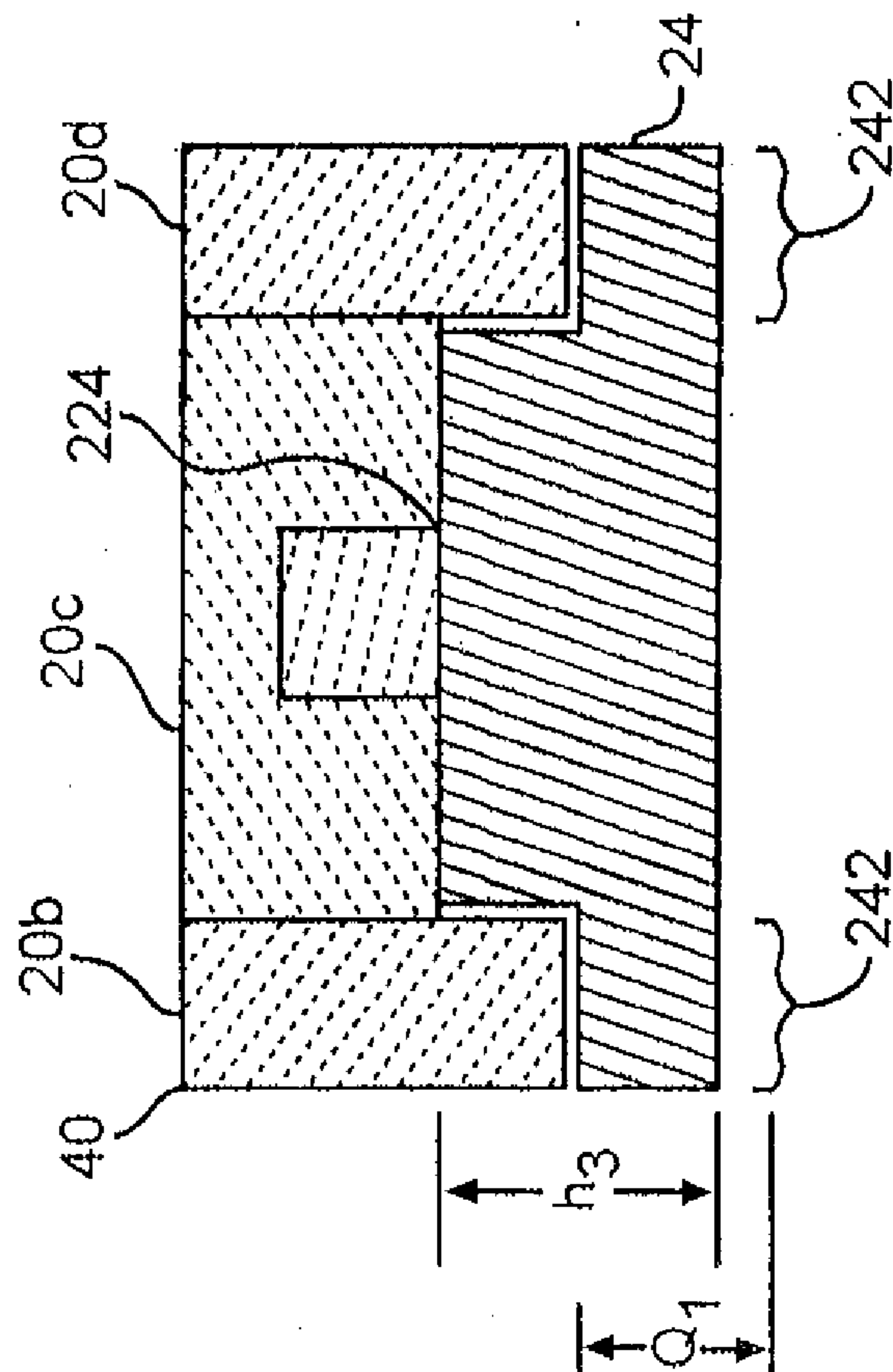


FIG. 25

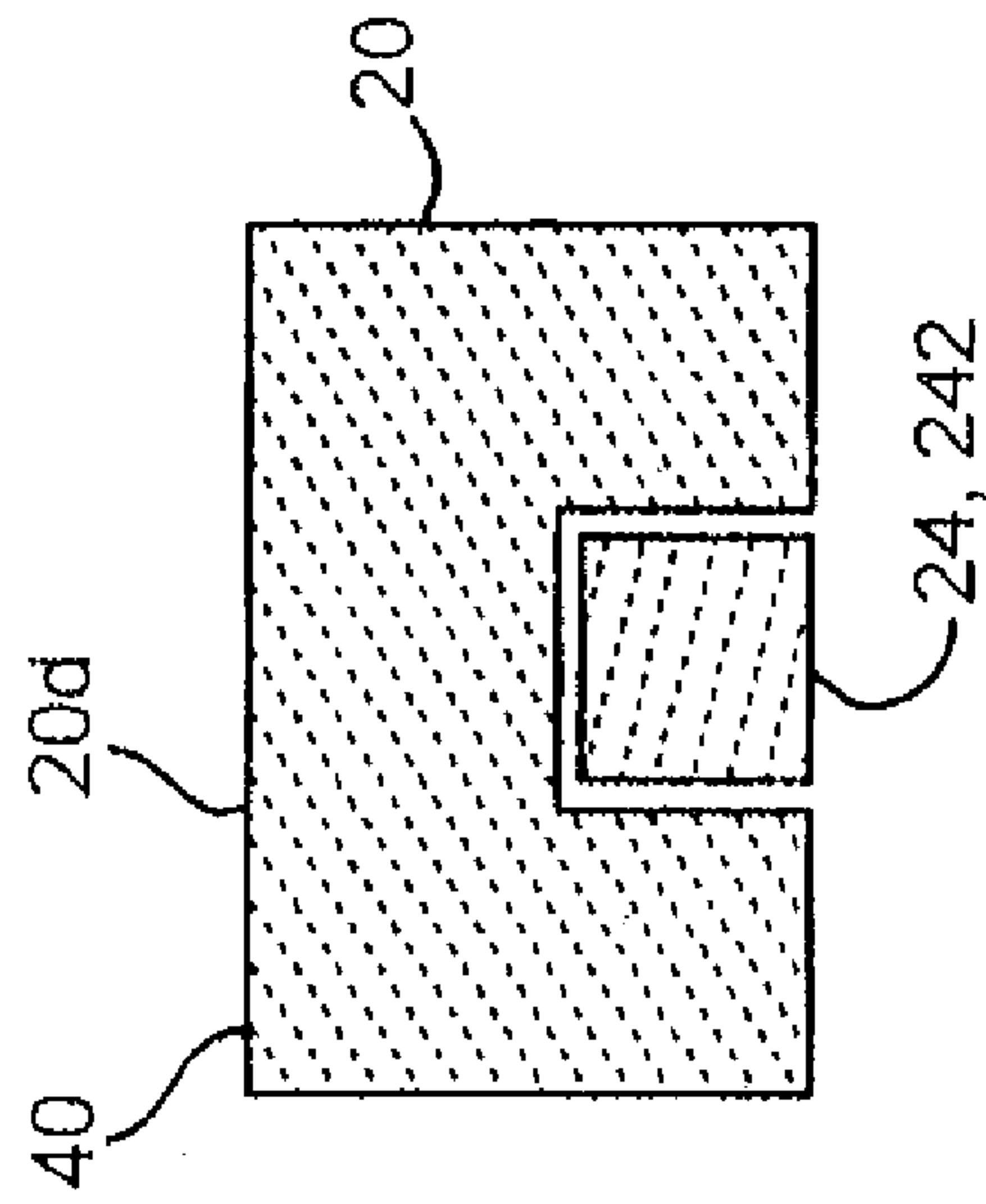


FIG. 26

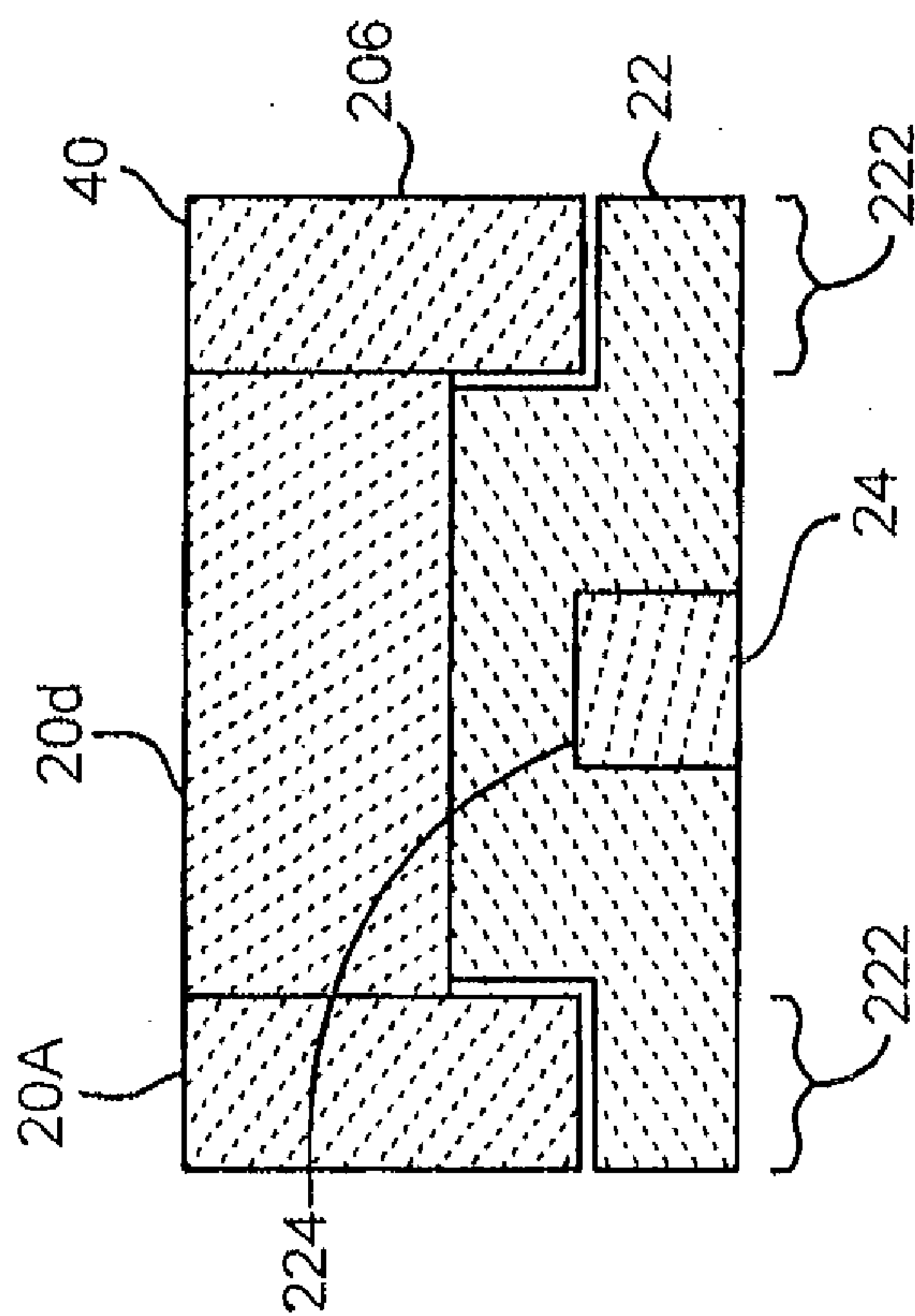


FIG. 27

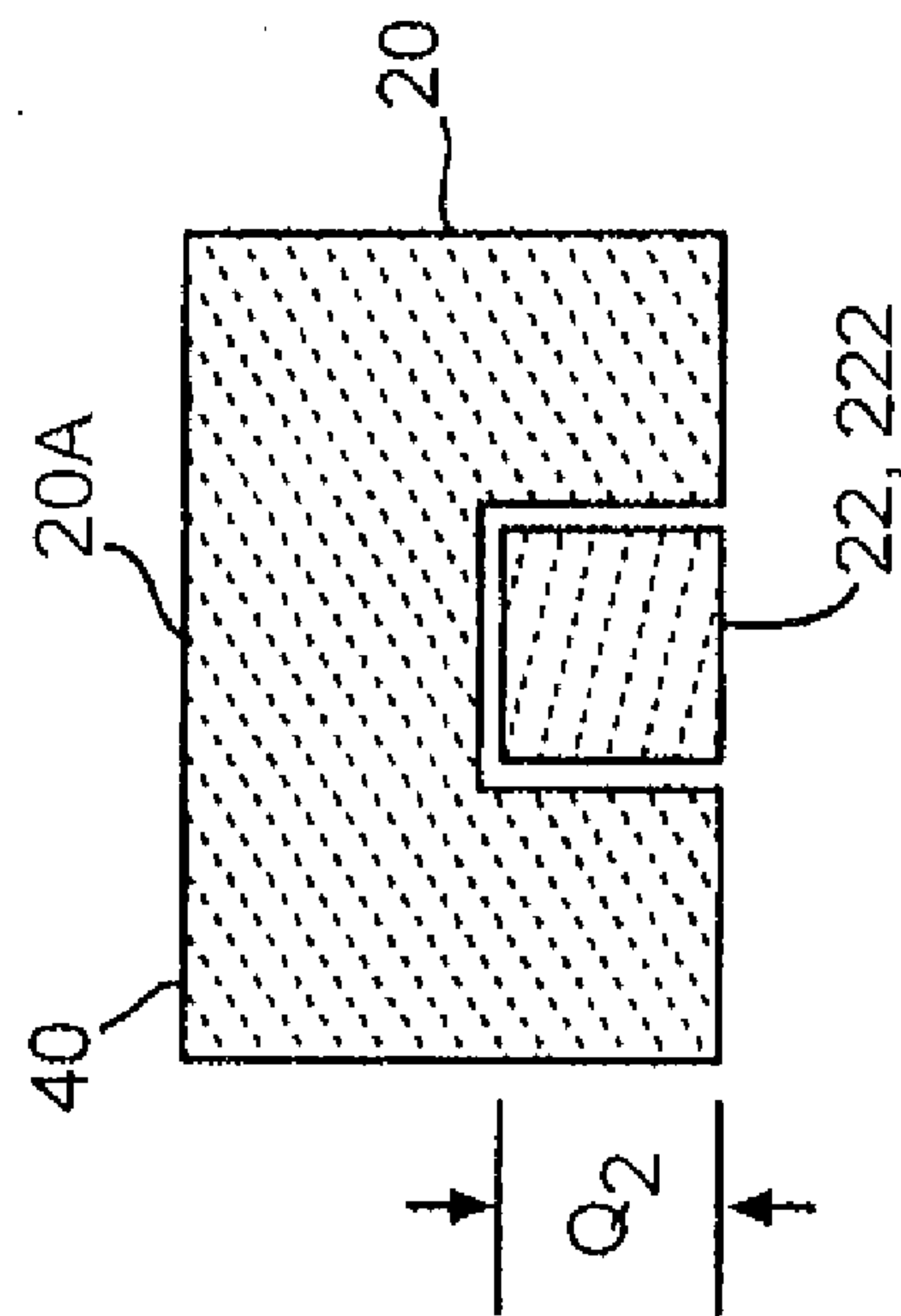


FIG. 28

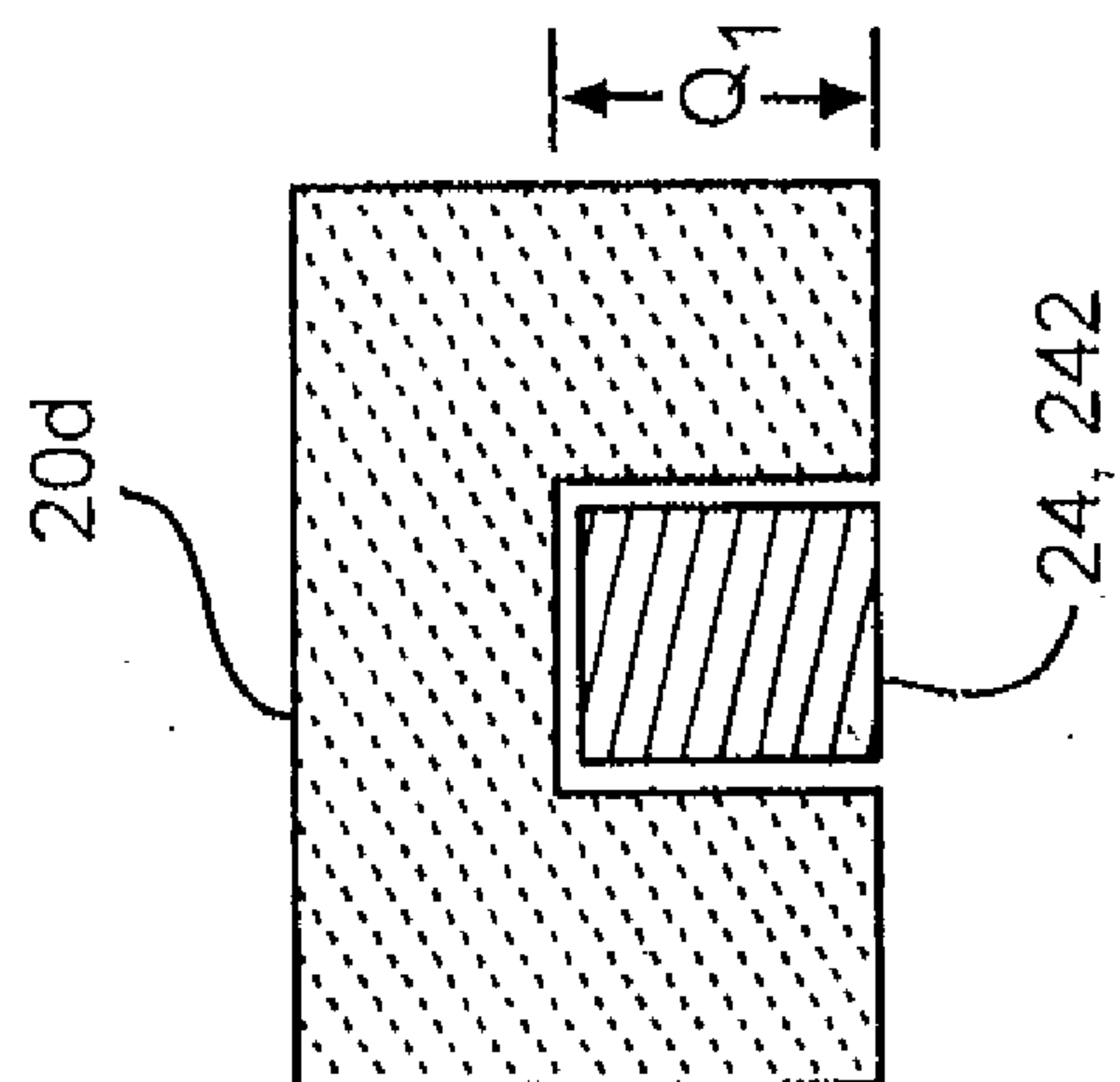


FIG. 29

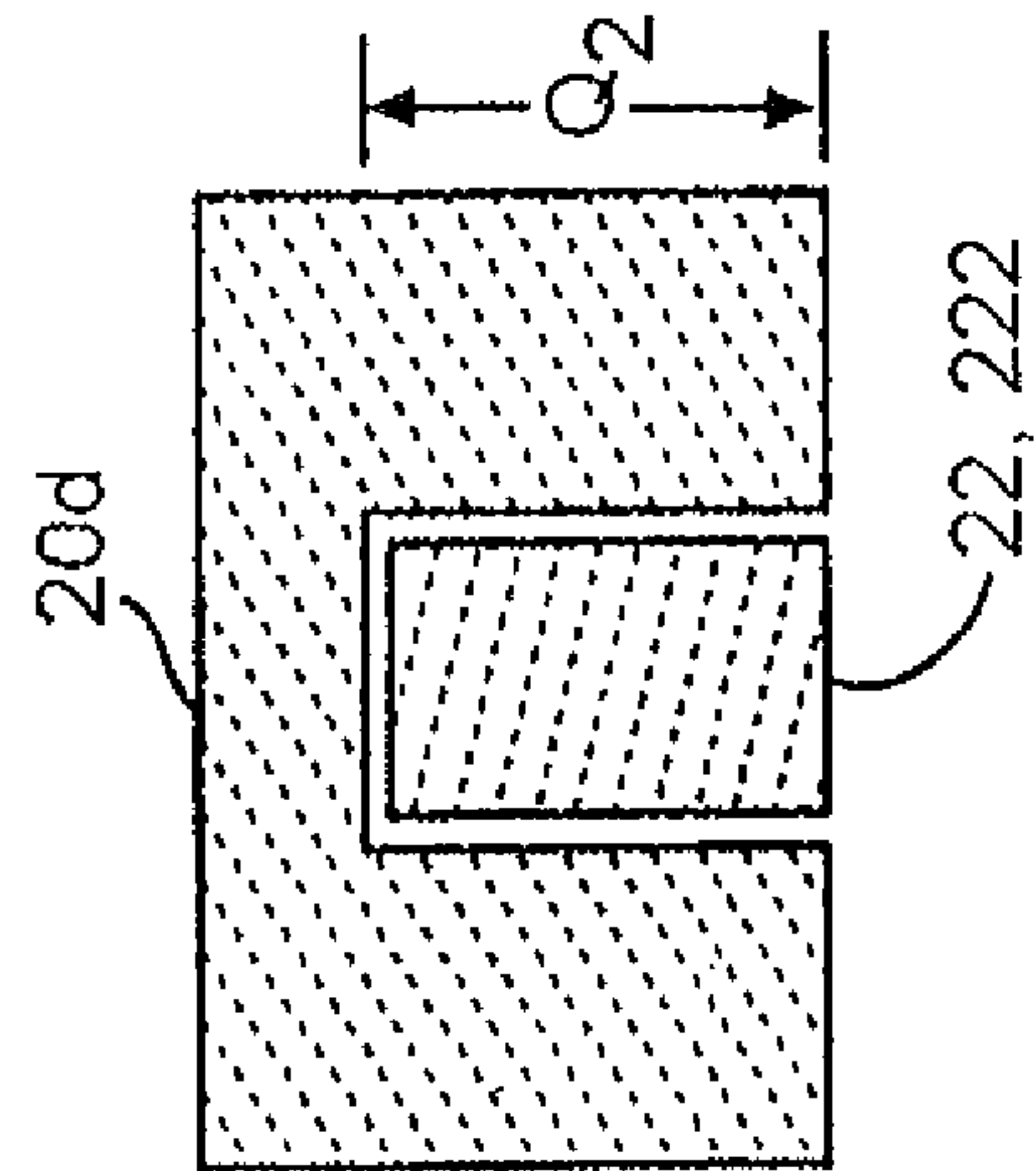


FIG. 30

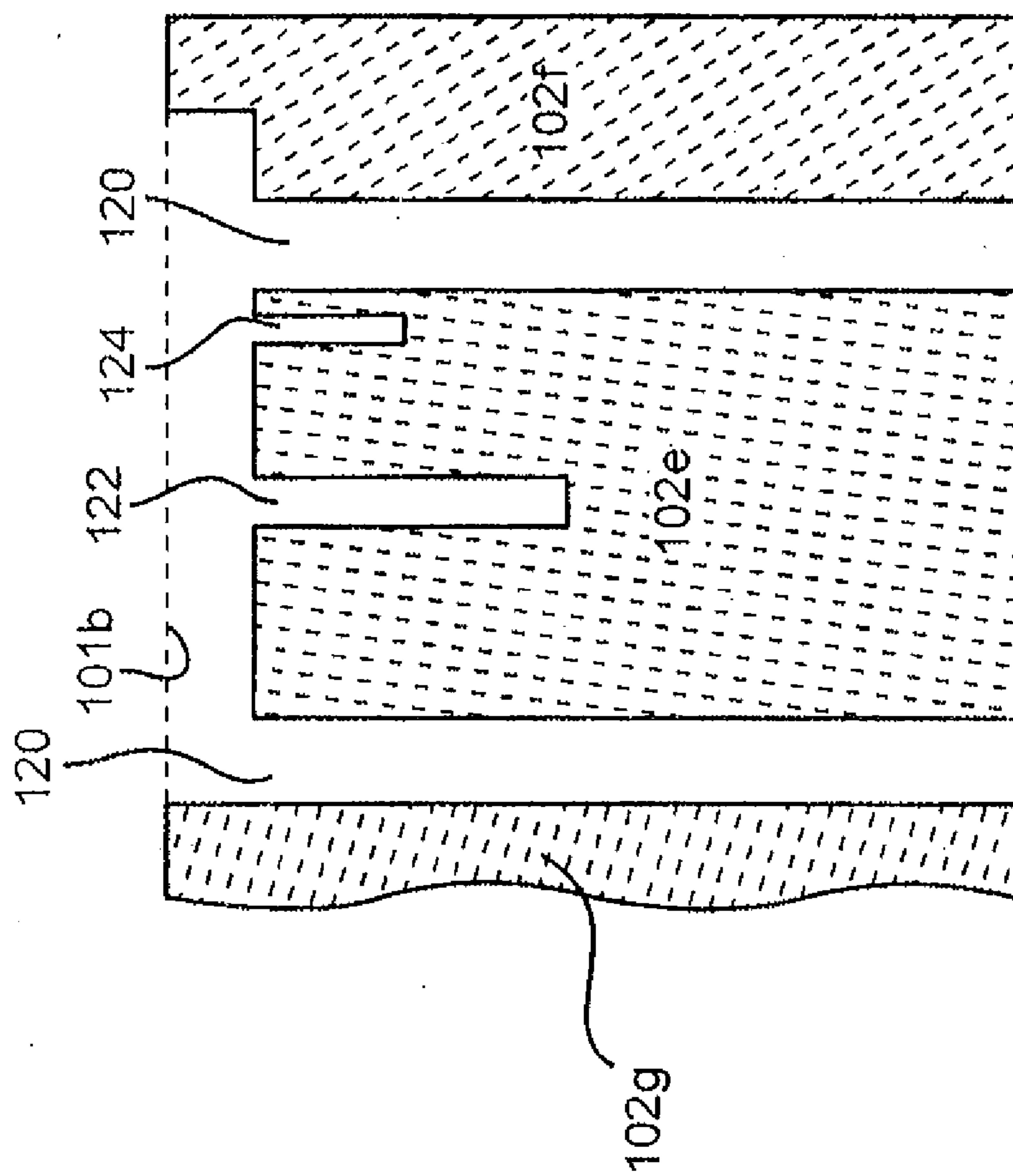


FIG. 31

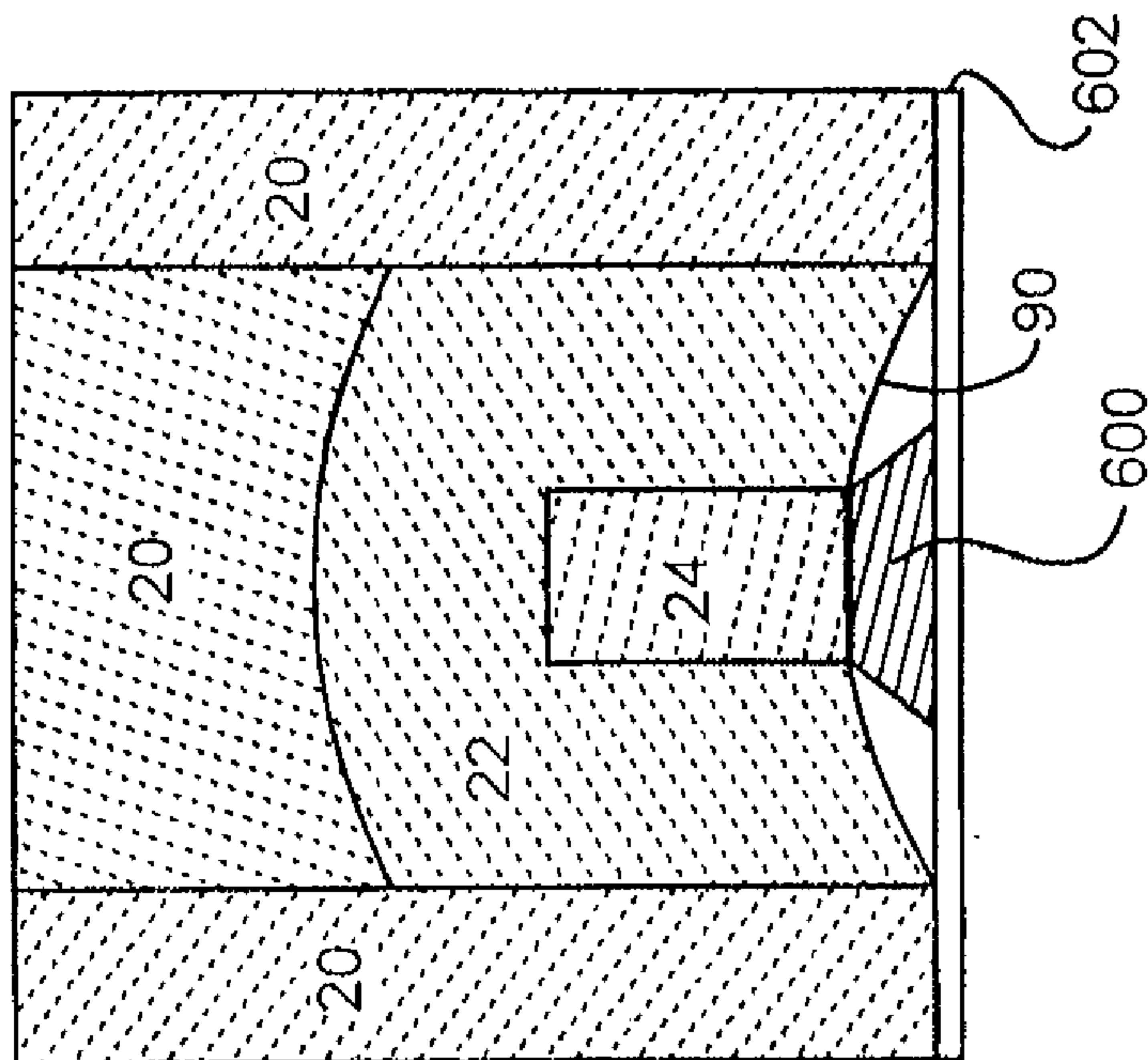


FIG. 33

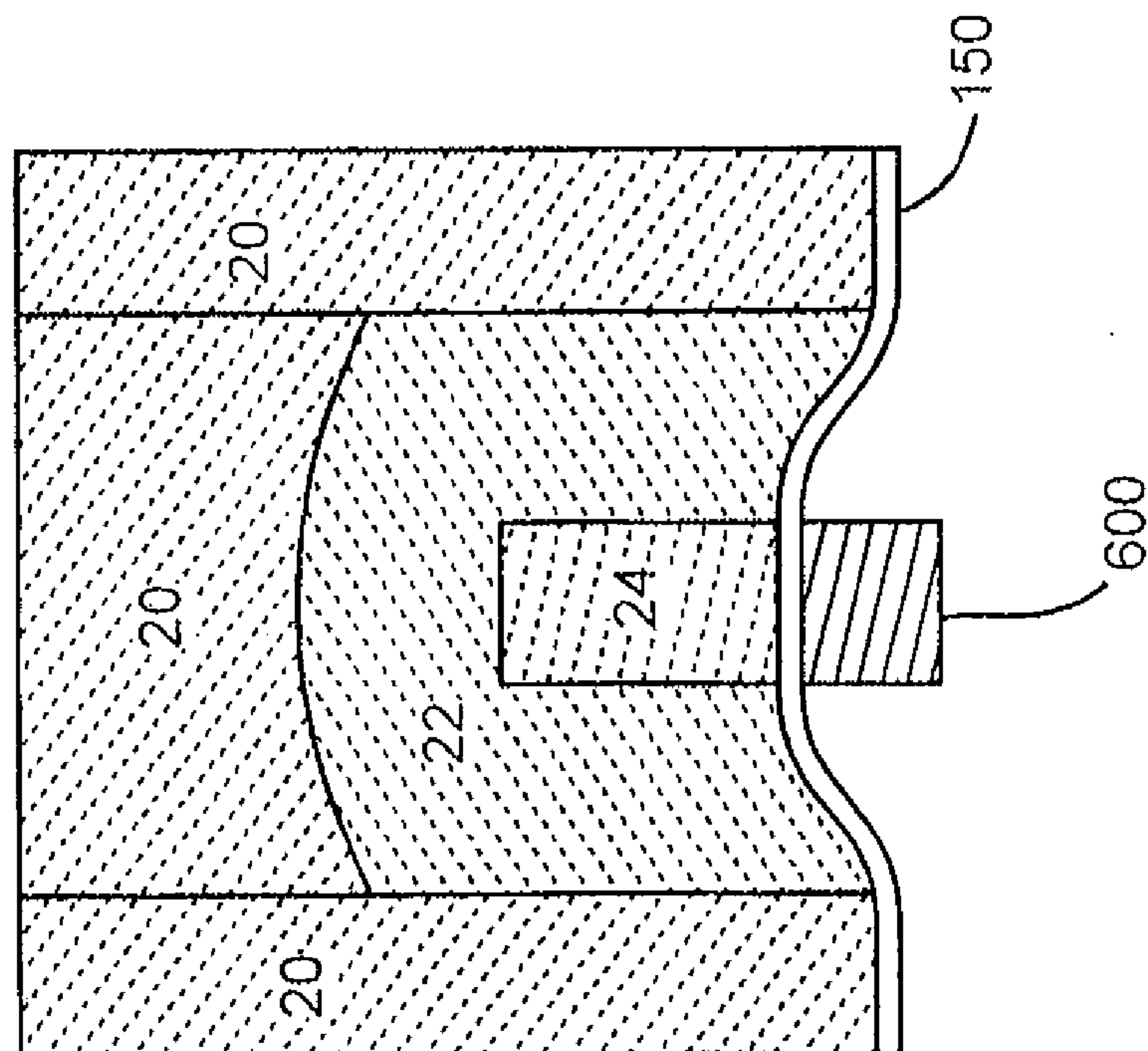


FIG. 32

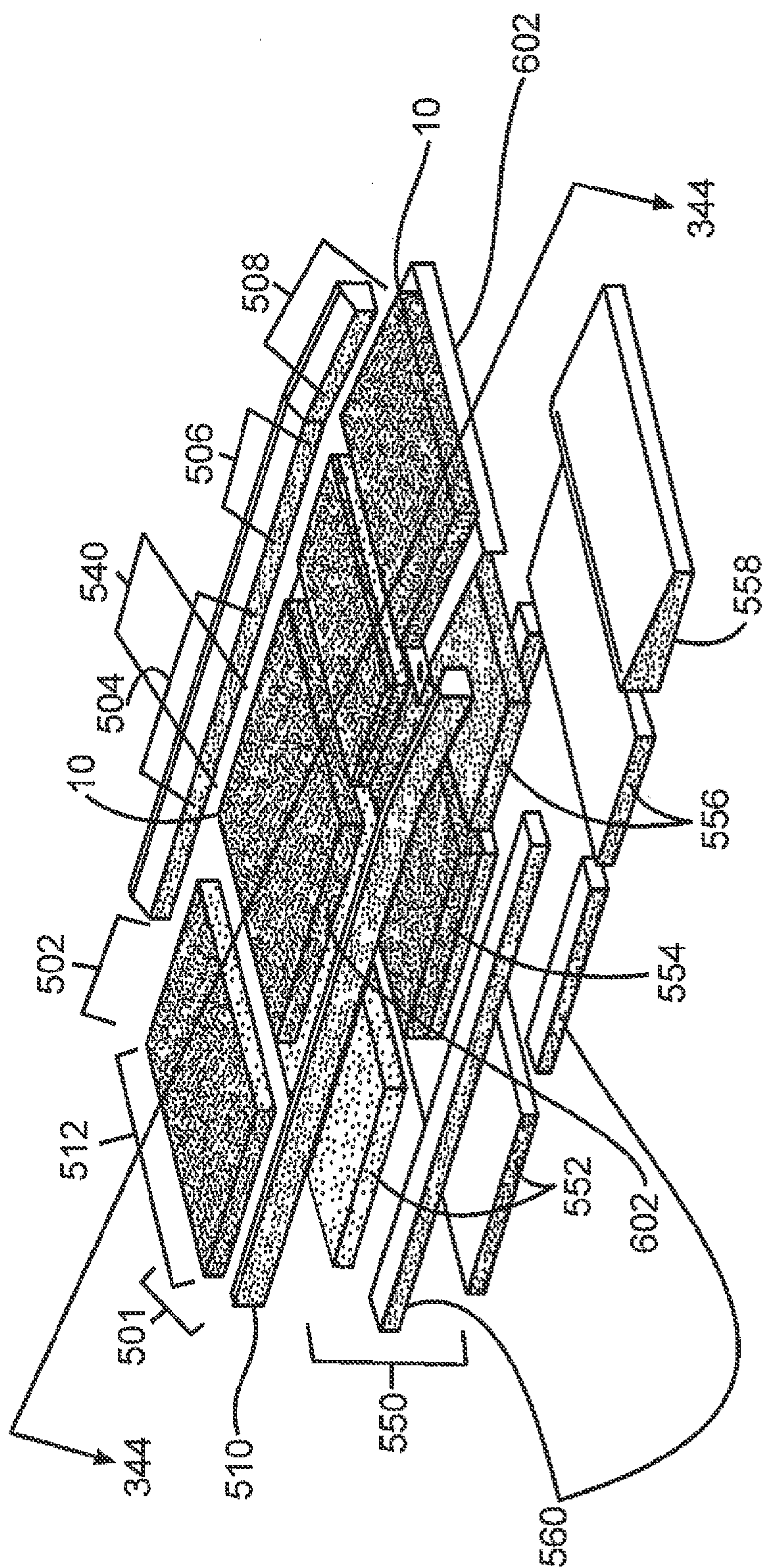


FIG. 34

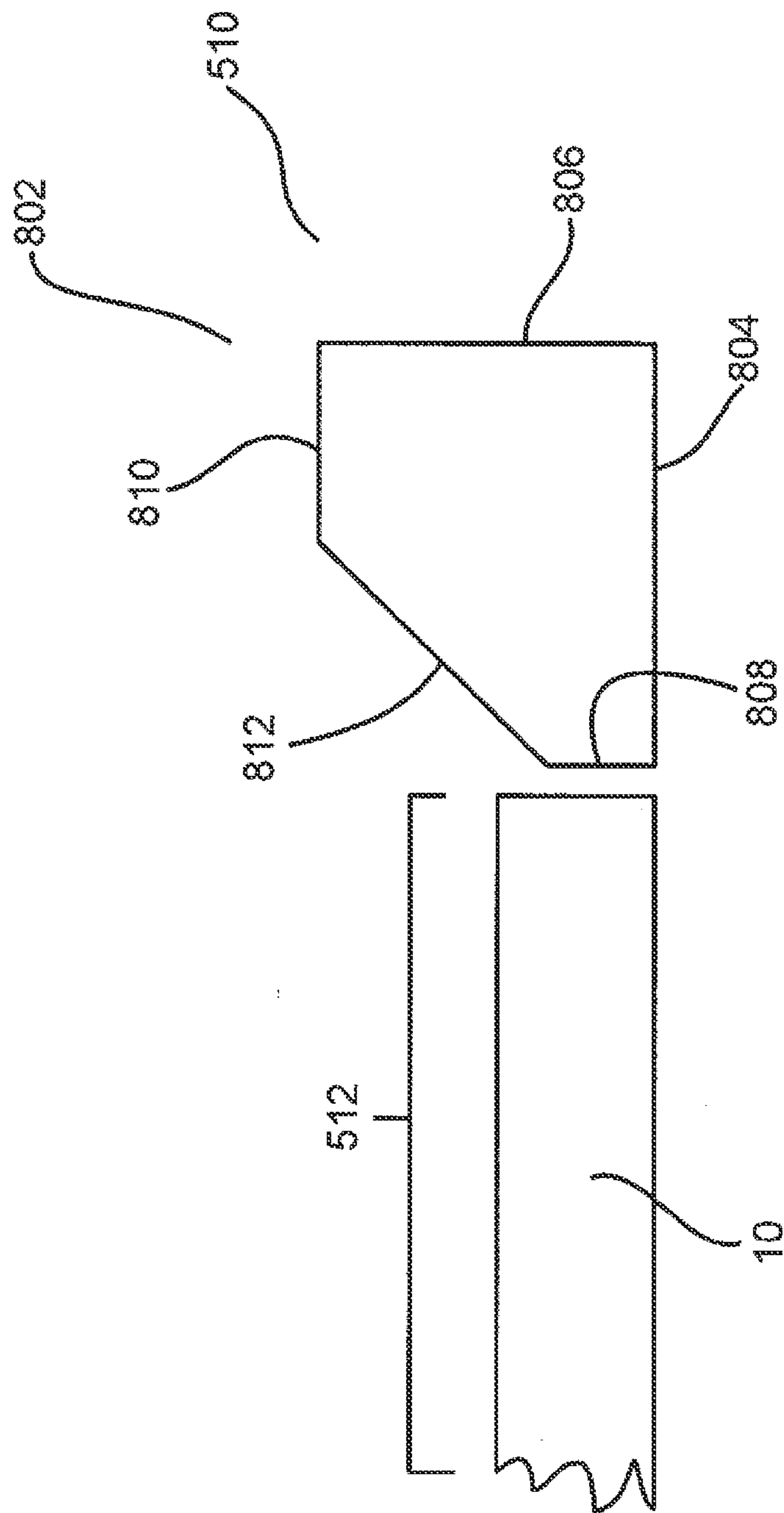


FIG. 35

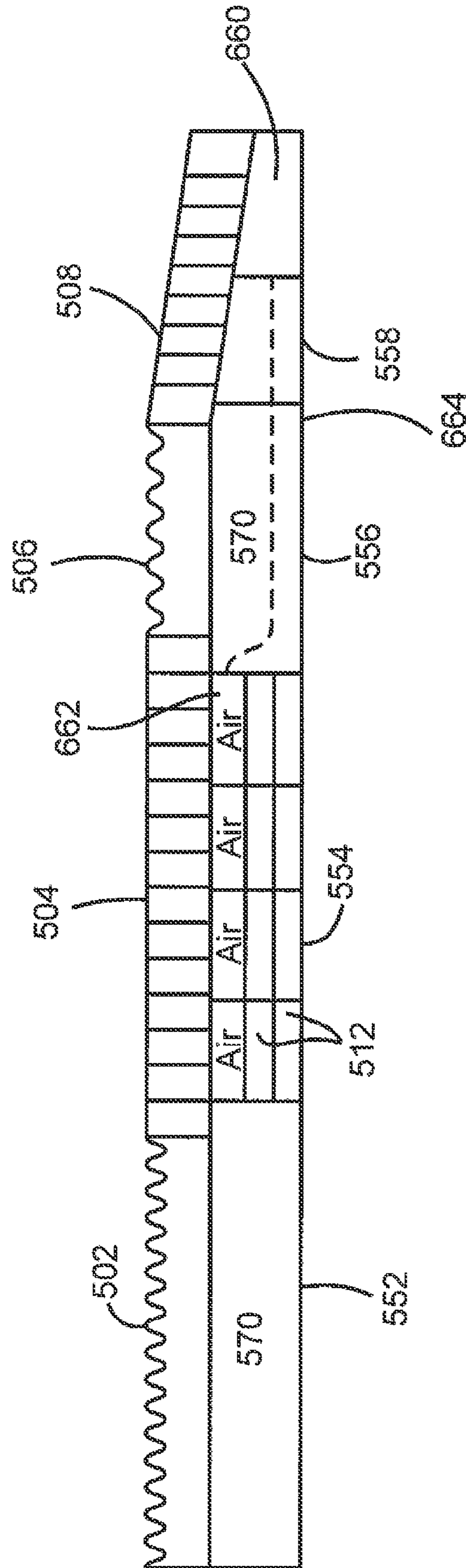


FIG. 36

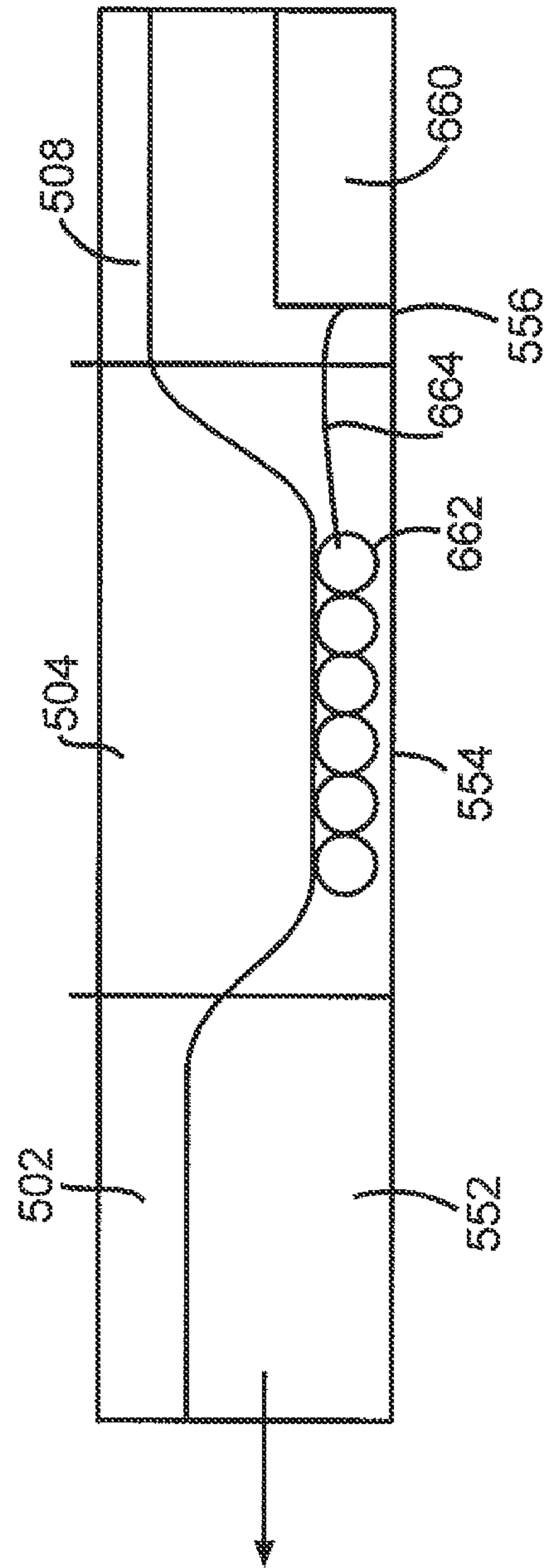


FIG. 37

