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(71) Demandeur/Applicant:
CRUDGINGTON, CLEVELAND, BENEDICT, US

(72) Inventeur/Inventor:
CRUDGINGTON, CLEVELAND, BENEDICT, US

(74) Agent: MACPHERSON LESLIE & TYERMAN LLP

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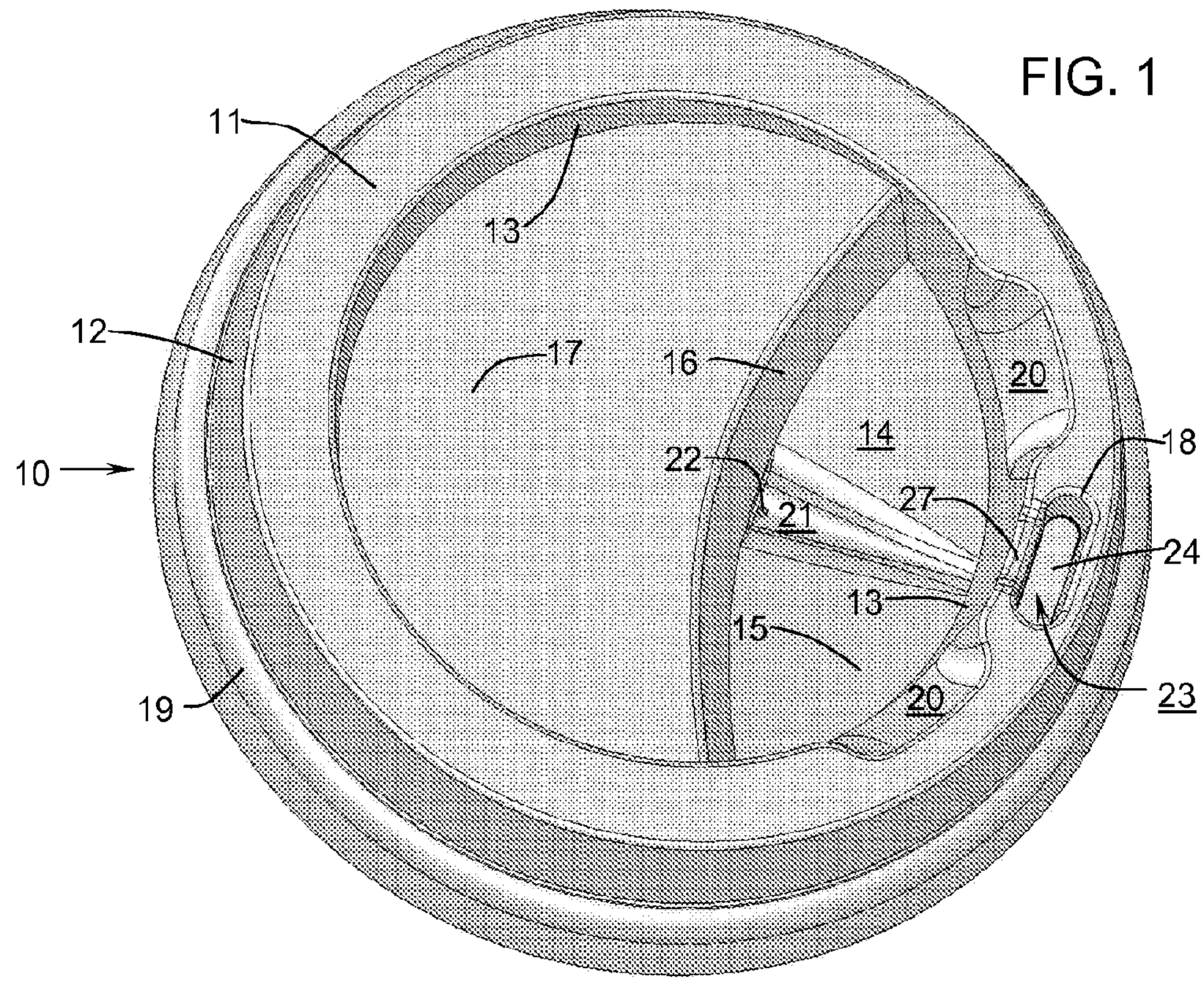


FIG. 1

(57) Abrégé/Abstract:
A disposable drink-through dome lid for disposable drinking cups used in the sale of hot or cold beverages, having an extended volume within the cup, the top surface of the lid elevated above the top surface of the beverage cup when in place and encompassed by an annular ridge that includes a generally oval shaped opening for drinking. Ideally, the generally oval shaped opening includes a chamber that projects downward from the opening's perimeter and contains a flap that closes off the drink-through orifice, thereby providing a shield against accidental spillage due to sloshing of the beverage intended for consumption while on the move.

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(72) Inventor; and
(71) Applicant : **CRUDGINGTON, Cleveland, Benedict** [US/US]; 222 North Myrtle Avenue, Monrovia, California 91016-2243 (US).

(74) Agents: **TARLETON, E., Russell** et al.; Seed Intellectual Property Law Group PLLC, Suite 5400, 701 Fifth Avenue, Seattle, Washington 98104-7064 (US).

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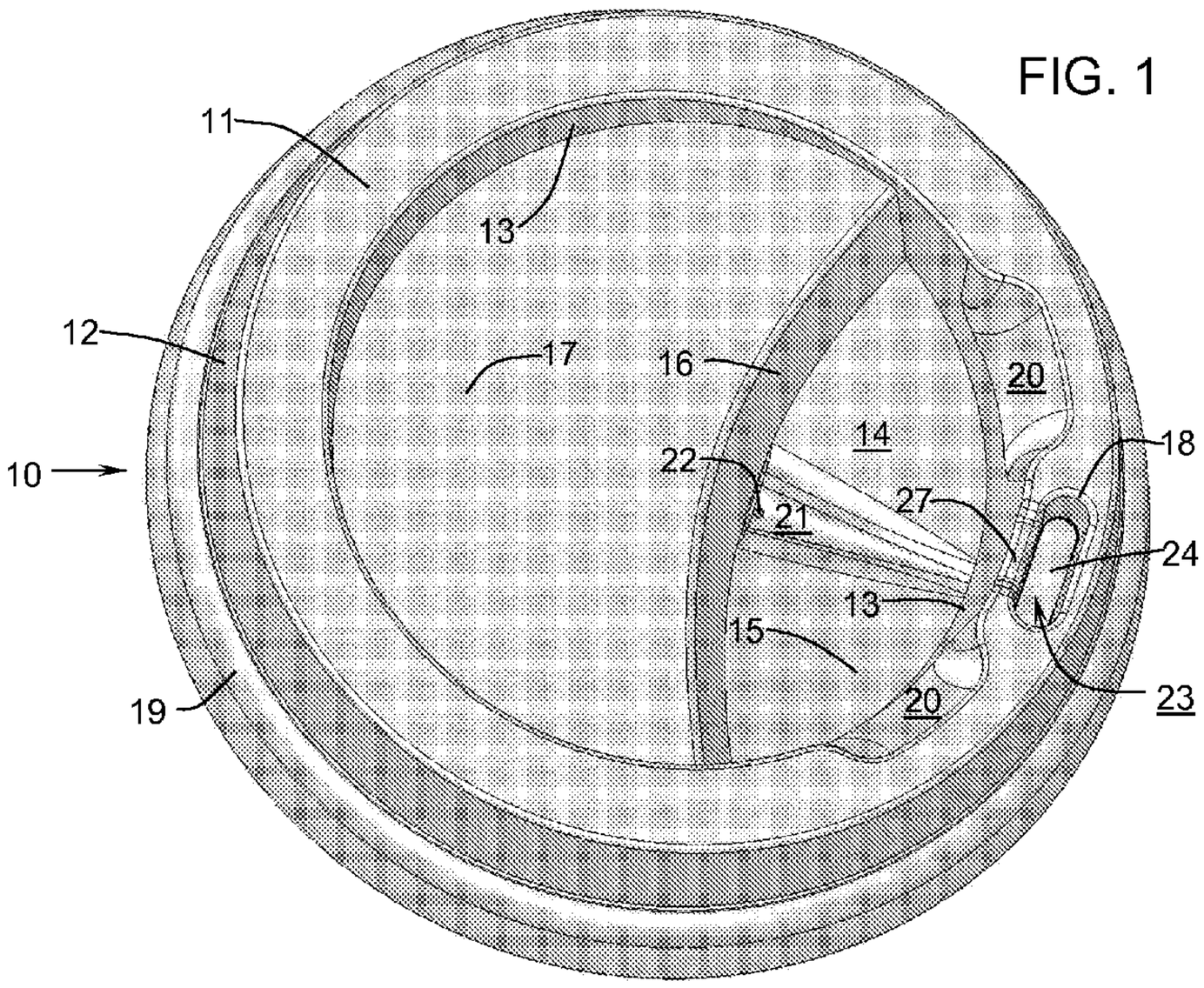


FIG. 1

(57) Abstract: A disposable drink-through dome lid for disposable drinking cups used in the sale of hot or cold beverages, having an extended volume within the cup, the top surface of the lid elevated above the top surface of the beverage cup when in place and encompassed by an annular ridge that includes a generally oval shaped opening for drinking. Ideally, the generally oval shaped opening includes a chamber that projects downward from the opening's perimeter and contains a flap that closes off the drink- through orifice, thereby providing a shield against accidental spillage due to sloshing of the beverage intended for consumption while on the move.

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SPILL RESISTANT DISPOSABLE TRAVEL CUP LID

BACKGROUND

Technical Field

This disclosure relates to disposable lids for travel beverage cups and, more particularly, to disposable dome lids that may be placed over the lip of a beverage cup and that provide a drink-through opening near the perimeter of the lid's top surface so that a seal is formed by the user's mouth for easy drinking access to the beverage, especially while traveling.

Description of the Related Art

With many consumers on the go, carryout beverages are more often than not intended to be consumed in moving vehicles, *i.e.*, automobiles, airplanes, golf carts, boats, etc., or while walking, power walking and even jogging. Disposable lids of the kind that provide a seal between the user's mouth and a small drink-through opening, have proven more suited for prevention of spills during consumption while on the move, than lids with a tear-off flap that exposes a large section for drinking. This observation is based on the widespread acceptance of this type of lid used by take-out food and drink establishments. And with the growing consumption of beverages intended to be consumed while on the move, the need for improvements that reduce spills, has never been greater. Of greatest concern is the safety to the customer behind the steering wheel. Besides the annoyance of soiling one's clothing and vehicle interior, the sudden distraction resulting from a spill could result in an automobile accident and personal injury.

Prior disposable travel lids have an inherent shortcoming. When a relatively full cup is jostled as is often the case while moving about, the sloshing beverage is vulnerable to splashing out through the drink-through opening even when the hole is relatively small. Attempts have been made to address this concern by introducing devices to seal the drink-through opening when the beverage is not being consumed. However, previously presented disposable cup lids offer sealing methods that require manipulation to momentarily remove the sealing device so that the user is able to sip the beverage. While this methodology is practical if simply transporting the unconsumed beverage from one location to another, it is both cumbersome and impractical for occasional consumption while on the go. The present disclosure addresses this shortcoming by setting forth a novel embodiment having a passive

integrated barrier within the disposable cup lid that adequately seals the drink-through opening while the beverage is not being consumed yet permits the consumer to drink from the cup in an enjoyable and satisfying manner.

Prior patents have identified concern for accidental spillage and have suggested means to provide a solution for sealing a disposable dome lid with a small drink-through opening: Clark, U.S. Patent No. 6,644,490; Giraud, U.S. Patent No. 6,886,707; Smith et al, U.S. Patent No. 7,134,566; Zuares et al., U.S. Patent No. 8,235,236 and others describe variations of a flexible arm having a closure member that requires manipulation in order to access and reseal the drink-through opening between sips. Wong, U.S. Patent No. 6,824,003, describes a disposable dome lid having a sliding member that, when engaged by the user, can be slid back and forth to open or close the drink-through orifice between each sip of the beverage. While this concept in theory suggests an effective barrier to selectively seal the orifice, manufacturing costs may well prove the concept to be less desirable. Crudgington, U.S. Patent No. 7,591,393, which is the inventor's prior patent, describes a singular, multi-planar drink-through hole below the drink-through orifice, intended to deflect a sloshing beverage from ejecting up through the opening. However, the passive restriction barrier proves insufficient to prevent a jostled cup from spilling.

BRIEF SUMMARY

This disclosure sets forth a number of novel features for a disposable dome lid, each of which decreases the likelihood of accidental spills as well as increasing the comfort to the user. These features can be implemented alone or in combination to maximize the overall benefits. Of particular importance is the introduction of a drink-through orifice that includes a flap configured to close off the drink-through opening while the user is not consuming the beverage. Thus, when a relatively full cup is jostled, the sloshing beverage is restricted from splashing out. Conversely, while the user takes a sip, the flap yields and permits the beverage to flow through the drink-through orifice with sufficient ease to be a satisfying experience. The user generates the desired flow by gently “pulling” the beverage out from the cup.

The likelihood of accidental spills is further reduced by: 1) recessing the required vent hole within a spill cavity; 2) improving the seal between the lid and the user’s mouth; and 3) modifying the drink hole so froth foaming up through the lid is directed into a spill cavity rather than flowing over the cup’s edge.

In accordance with one aspect of the present disclosure, a lid for a cup is provided that includes: an exterior surface and an interior surface; a mounting portion

that anchors on the cup; an annular outer side wall extending at least partially around a perimeter of the lid and sloping away and radially inwardly from the mounting portion and terminating at a top; a top wall at the top of the annular outer side wall; a drink-through orifice in the top wall that enables drinking from the cup without removal of the lid and permits the lips of a user to encompass the drink-through orifice with the lower lip of the user's lips engaging with the annular outer side wall; and at least one flap in the drink-through orifice having a relaxed position and a non-relaxed position, and when in the relaxed position closing off the drink-through orifice to restrict liquid from passing up through the drink-through orifice, and when in the non-relaxed position providing an opening to permit liquid to pass through the drink-through orifice.

In accordance with a further aspect of the present disclosure, a lid for a cup is provided that includes an exterior surface and an interior surface; a mounting portion that anchors on the cup; an annular outer side wall sloping away and radially inwardly from the mounting portion and terminating at a top; a top wall at the top of the annular outer side wall; an annular inner side wall extending from the top wall and sloping away from the annular outer side wall; the inner and outer side walls and the top wall together forming an annular ridge; a chamber in the annular ridge, the chamber having an open top in the top wall and having a circumscribing wall that encloses an interior of the chamber; the chamber being in fluid communication with the open top to define a drink-through orifice; and the chamber including a flap in the circumscribing wall, the flap capable of opening when a user is drinking through the drink-through orifice to allow liquid to pass through the chamber and the drink-through orifice and to otherwise remain in a closed position to restrict the flow of sloshing liquid from passing up through the chamber and the drink-through orifice.

In accordance with still yet another aspect of the present disclosure, a lid for a cup is provided that includes an exterior surface and an interior surface; a mounting portion that anchors on the cup; an annular outer side wall sloping away upwardly and radially inwardly from the mounting portion and terminating at a top; a top wall at the top of the annular outer side wall that encloses the top of the annular outer side wall; an annular inner side wall extending from the top wall and sloping away from the annular outer wall; the inner and outer side walls and the top wall combining to define an annular ridge; a drink-through opening in the annular ridge that enables drinking from the cup without removal of the lid and that permits a user's lips to encompass the drink-through opening with a lower lip of the user engaging with the annular outer side wall; a drink-through orifice in the top wall that defines the drink-through opening; a downwardly sloping orifice side wall extending from a perimeter of

the drink-through orifice; and an interior ridge defined by the orifice side wall and the annular inner side wall, the interior ridge recessed below the top wall and surrounding drink-through orifice to direct froth bubbling up through the drink-through opening to flow onto the annular inner side wall rather than the annular outer side wall.

In accordance with still yet a further aspect of the present disclosure, a lid for a cup is provided that includes an exterior surface and an interior surface; a mounting portion that anchors on the cup; an annular outer side wall sloping away upwardly and radially inwardly from the mounting portion and terminating at a top; an outer top wall at the top of the annular outer side wall that encloses the top of the annular outer side wall; an annular inner side wall extending downwardly from the outer top wall and sloping away from the annular outer side wall; the inner and outer side walls and the outer top wall combining to define an annular ridge; a drink-through opening in the annular ridge that enables drinking from the cup without removal of the lid and that permits a user's lips to encompass the drink-through opening with a lower lip of the user engaging with the annular outer side wall and an upper lip of the user engaging with the annular inner side wall; a spill cavity bounded by the annular inner side wall and an arcuate interior side wall that provides additional room for the upper lip of the user to engage with the annular inner side wall; and a vent hole at a base of the arcuate interior side wall to vent air into the cup during beverage consumption and possibly to drain liquid back into the cup.

In accordance with a further aspect of the present disclosure, a method of forming and cutting a lid for a cup is provided, the method including providing a support plate that is shaped in the form of a lid that is configured to serve as a mold to vacuum-form thermoplastic material, the support plate further configured to provide multiple planar receiving surfaces for die cutting; providing a mounting plate with cutting tools that includes a block die; forming thermoplastic material onto the support plate vacuum into a lid shape and having a chamber formed thereon; and the method including bringing the block die into contact with the lid-shaped vacuum formed thermoplastic material, with the block die cutting into the wall of the chamber.

In accordance with yet another aspect of the present disclosure, a method of forming and cutting a lid for a cup is provided, the method including providing a support plate that is shaped in the form of a lid and is configured to serve as a mold to vacuum-form thermoplastic material, the support plate further configured to provide multiple planar receiving surfaces for die cutting; providing a mounting plate with cutting tools that includes a block die, the mounting plate further defined by a block die chamber having a laterally and radially positioned mounting slot, the block die further

defined by a laterally and radially positioned flange member and a contoured portion; mounting the block die within the block die chamber such that the flange member is located within the mounting slot, the block die being permitted to slide in a first direction with respect to the mounting plate and prevented from moving in a second direction that is transverse with respect to the first direction; forming a lid with a chamber by vacuum forming the thermoplastic material on the support plate, the lid including a chamber; the chamber having a downwardly and inwardly sloping orifice side wall that terminates at a chamber bottom wall; and the method including guiding the block die into position for cutting into the chamber bottom by the contoured portion of the block die contacting the orifice side wall and moving in the first direction prior to contacting the chamber bottom wall.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features and advantages of the present disclosure will be more readily appreciated as the same become better understood from the following detailed description when taken in conjunction with the accompanying drawings. It should be understood that the preferred embodiments are to be considered in all respects illustrative and not restrictive, wherein:

Figure 1 is an isometric view illustrating the disposable cup lid with all embodiments in the present disclosure including a chamber located below the drink-through orifice and having a singular flap at its base;

Figure 2 is an isometric view illustrating the disposable lid mounted upon a disposable cup with the profile of a user's mouth engaged with the lid in the process of beverage consumption;

Figure 3 is an isometric view illustrating the disposable cup lid with preferred features including a drink-through opening with a recessed interior ridge;

Figure 4 is an isometric view illustrating the disposable cup lid with preferred features including the recessed interior ridge;

Figures 5A and 5B illustrate two preferred flap configurations in a relaxed position and closed position, respectively;

Figure 6 is a fragmentary cross-sectional isometric view of a chamber below the drink-through orifice formed in accordance with the present disclosure illustrating the flap of Figure 5A cut into the base of the chamber;

Figure 7 is a fragmentary isometric view featuring the drink-through orifice with the flap of Figure 5A folded upward in the open and non-relaxed position as would be during consumption of the beverage;

Figure 8 is a fragmentary cross-sectional isometric view of the drink-through orifice of Figure 7 illustrating the flap in an opened position;

Figure 9 is a cross-sectional side view illustrating the disposable dome lid with all of the preferred embodiments of the present invention;

Figure 10 is a top view illustrating the disposable dome lid with all of the preferred embodiments of the present invention;

Figure 11 is a fragmentary cross-sectional isometric view of a drinking straw inserted into the drink-through orifice;

Figure 12 is a cross-sectional isometric view illustrating the profile of a channel within the base of a spill cavity where a vent hole is positioned;

Figure 13 is a cross-sectional side view illustrating the tooling in position for die cutting a flap and vent/drain hole within a thin-walled molded cup lid;

Figure 14 is an enlarged fragmentary cross-sectional elevation view detailing the chamber block die for cutting into the chamber depicted in Figure 13;

Figures 15A-15B illustrate the proposed chamber block die depicted in Figures 13 and 14 for cutting the two flap configurations shown in Figures 5A and 5B;

Figure 16 is an isometric view of the proposed vent block die depicted in Figure 13 for cutting the vent/drain hole shown in Figures 1, 3 and 10;

Figure 17 is a cross-sectional side view illustrating an aligned floating block die prior to engaging with the chamber;

Figure 18 is a cross-sectional side view of the floating block die fully engaged with the chamber and cutting into the chamber;

Figure 19 is the tooling depicted in Figure 17 but where the floating block die is slightly misaligned with the chamber;

Figure 20 is the tooling depicted in Figure 19 showing the floating block die aligning with the chamber upon engaging with and cutting into the chamber;

Figure 21 is an isometric view of the floating block die depicted in Figures 17, 18, 19 and 20;

Figure 22 is a cross-sectional side view illustrating a floating mounting plate with mounted cutting tools in position for die cutting a thin-walled molded cup lid;

Figure 23 is a cross-sectional side view of Figure 22 with the cutting tools engaged in die cutting a thin-walled molded cup lid; and

Figure 24 is a cross-sectional isometric view of the floating mounting plate with mounted cutting tools for die cutting a thin-walled molded cup lid.

DETAILED DESCRIPTION

In the following description, certain specific details are set forth in order to provide a thorough understanding of various disclosed embodiments. However, one skilled in the relevant art will recognize that embodiments may be practiced without one or more of these specific details, or with other methods, components, materials, etc. In other instances, well-known structures or components or both associated with drinking cups, including but not limited to disposable drinking cups formed of paper, plastic, and the like, have not been shown or described in order to avoid unnecessarily obscuring descriptions of the embodiments.

Unless the context requires otherwise, throughout the specification and claims that follow, the word "comprise" and variations thereof, such as "comprises" and "comprising" are to be construed in an open inclusive sense, that is, as "including, but not limited to." The foregoing applies equally to the words "including" and "having."

Reference throughout this description to "one embodiment" or "an embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment is included in at least one embodiment. Thus, the appearance of the phrases "in one embodiment" or "in an embodiment" in various places throughout the specification are not necessarily all referring to the same embodiment. Furthermore, the particular features, structures, or characteristics may be combined in any suitable manner in one or more embodiments.

A disposable dome lid for mounting upon the substantially circular lip or rim of a disposable drinking cup is disclosed. The lid includes a mounting portion that anchors upon the cup lip; an annular outer side wall portion sloping upwardly and radially inwardly from the mounting portion thereby providing a volume extension means within the lid. A top wall portion is formed at the top of the annular outer side wall portion enclosing the top of the annular outer side wall portion. A drink-through orifice is formed within the top wall portion and adjacent to the annular outer side wall portion, enabling drinking from the cup without removal of the lid and permitting the lips of a user drinking from the cup to encompass the drink-through orifice, with the lower lip of the user engaging with the annular outer side wall portion.

In its preferred configuration the drink-through orifice includes a singular flap located within a drink-through chamber below the lid's top wall. When the flap is in its relaxed position it prevents a drink-through opening and restricts sloshed liquid from exiting through the drink-through orifice. And when the flap is in its non-relaxed position it provides the drink-through opening and permits the beverage to flow through the drink-though orifice. The thermo-plastic material used in

production is sufficiently thin and flexible to provide a flap or flaps that can open while the beverage is being consumed yet be sufficiently rigid to resist opening when confronted with a beverage that is sloshing within a generally upright cup. Understandably, other flap configurations may provide the intended result and the illustrated flap configurations should not be construed as the only possible configurations.

The following embodiments further define the preferred flap within a drink-through orifice: (1) A drink-through orifice that closes off a drink-through opening by a restriction barrier in the form of at least one flap; (2) the previously described flap that is integrated within the material comprising the disposable cup lid, thereby eliminating the need for assembly; (3) the previously described flap that in its relaxed or non-deformed state, closes off the drink-through opening; (4) the previously described flap that is concealed by being positioned within a chamber below the drink-through orifice, wherein the flap is hidden from the casual observer and tactually out of reach from the consumer's lips or tongue; (5) the previously described flap within the chamber which, in its non-relaxed and deformed state, momentarily folds into the volume defined by the chamber, thereby exposing the drink-through opening and permitting the flow of beverage; (6) the previously described flap which incorporates a "living hinge" positioned at the bottom of the chamber, where the thermo-formed material is inherently significantly thinner; (7) the previously describe living hinge where its resistance to folding into its non-relaxed state can be modifying by changing the depth or thickness or both depth and thickness of the chamber; (8) the previously described living hinge where its resistance to folding into its non-relaxed state can be modifying by increasing or decreasing the living hinge length; (9) the previously described flap that is created by stamping a cut into the base of the chamber; (10) the previously describe flap that is configured to yield to a drinking straw when pushed down into the drink-through orifice, thereby permitting the straw to become fully inserted into the drinking cup; and (11) the previously described disposable dome lid that is configured to enable a plurality of lids to be stacked in nested relation to each other.

In addition to the novel restriction barrier disclosed herein, other novel embodiments are disclosed for a disposable dome-shaped travel cup lid not because they are required in order for the flap's functionality, but because they further improve the disposable cup lid's resistance to accidental spills and enhance the user's comfort, including: (1) A spill cavity adjacent to the drink-through opening where an interior ridge formed by the boundary between these two features is recessed below the top wall

thereby directing froth bubbling up through the drink-through opening to flow into the spill cavity; (2) a spill cavity including a small hole, for venting and possibly draining purposes, that is located near the lid's center where the level of a sloshing beverage remains relatively stable; (3) the previously described spill cavity further defined by an annular inner wall and an arcuate interior side wall, where the center of the arcuate interior side wall passes near the lid's center, thereby minimizing the size of the spill cavity while retaining its function; (4) the previously described spill cavity having a bottom wall that includes a narrow channel where, at its deepest portion, the previously describe vent hole is located, thereby shielding the hole from being blocked by the user's upper lip while minimizing the volume of the spill cavity; (5) the previously describe spill cavity having a pair of beveled recesses effectively narrowing the top wall surrounding the drink-through orifice thereby improving the comfort and seal between the user's mouth and lid and (6) a substantially planar interior top wall adjacent to a spill cavity, that is downwardly sloping away from a drink-through opening, thereby further improving the adaptability of the lid to the user's anatomy by providing additional room for the user's nose while the upper of the user's lips is positioned within the spill cavity.

Disposable cup lids are typically produced in large quantities by applying heat and pressure to form a thermo-plastic sheet that's placed over an array of singular molds, each of which forms a single lid. As a secondary production process, multiple lids are stamped out from each formed sheet. During this secondary process, desired holes and tear lines are also stamped into the lids. The flap or flaps set forth herein can be created during this stamping process. The present disclosure includes: (1) a process for vertically stamping within cavities formed in the previously describe dome lid with a singular vertical motion similar to that commonly used when stamping thermo-formed disposable cup dome lids, thereby simultaneously stamping flap, vent hole, and lid perimeter; (2) the previously described stamping method that enables a multiple of block dies used in stamping to self-align for simultaneous precision cutting of a multiple of lids from a single thermoplastic sheet.

All of the independent embodiments in this disclosure can be applied individually or in combination to improve any disposable dome having a small drink-through orifice near the lid's perimeter. All disposable dome lids, usually vacuum formed from thin-walled thermoplastic sheets, are designed to grip and seal upon an outwardly projecting ridge formed at the lip of disposable cups usually made from cardboard. Two methods for attaching disposable dome lids to cups have been described or illustrated in the art and are commonly used in practice. An original

method referred to as the "ridge fit" provides an outwardly projecting annular ridge around the lid's apron that snaps into place when pushed over and mating with the cup's lip. The cup's lip has a slightly larger diameter than the lid's mounting ridge. Flexibility of the materials permits the annular apron to slide over the cup's lip and provide a liquid-tight seal. A more recently developed method of attachment utilizes an inverted annular groove surrounding the lid's base, forming what is referred to as a "groove fit." The lid is attached by "plugging" the cup's lip into the annular groove. There are advantages and disadvantages to each method of attachment. And even though only one method of attaching a disposable dome-shaped lid to a travel cup is selected for illustration purposes, all embodiments in this disclosure can be applied to either of these known methods and most likely any other method of attaching a disposable dome-shaped lid to a travel cup.

Figures 1 illustrates all of the preferred embodiments for a spill resistant disposable drink-through dome-shaped thin-walled cup lid 10. The lid 10 includes an outer top wall 11 bounded on its outer perimeter by an annular outer side wall 12 sloping downwardly and outwardly, and on its inner perimeter by an annular inner side wall 13 sloping downwardly and inwardly, with both perimeters being substantially concentric to one another. A spill cavity 14 is bounded by the annular inner side wall 13 and an arcuate interior side wall 16. The spill cavity 14 is further defined by a bottom wall 15, sloping gently upwardly and inwardly and terminating at the arcuate interior side wall 16. The arcuate interior side wall 16, which is laterally bound by the annular inner side wall 13, slopes upwardly and inwardly at a substantially steeper angle than the bottom wall 15 and terminates at an inner top wall 17. The inner top wall 17 is bound by the annular inner side wall 13 and is substantially planar. A drink-through orifice 18 is within the outer top wall 11 and aligns with the spill cavity 14. A mounting portion 19 is formed at or near the base of the annular outer side wall 12 in order to affix the lid 10 to the lip at the rim of a disposable drinking cup 31 shown in Figure 2.

By providing a lid 10 that conforms to the anatomy of the typical user's face, the user not only experiences the lid being more comfortable but the lid 10 is less likely to cause spills while the beverage is being consumed by improving the seal between the user's mouth and the lid 10. Besides collecting spills, the spill cavity 14 accommodates the user's upper lip by deepening the annular inner side wall 13 at the drink-through orifice 18. As more clearly illustrated in Figure 2 and 3, the inner top wall 17, is recessed slightly below the outer top wall 11 at its juncture with the arcuate interior side wall 16, and slopes downwardly and away from the spill cavity 14. The

user's nose is accommodated by deepening the inner top wall 17 where the user's nose is most likely to make contact with lid 10. The user's lower lip is also accommodated by having the annular outer side wall 12 raised sufficiently so the user's lower lip generally clears the mounting portion 19. The user's comfort is further enhanced by providing a pair of beveled recesses 20 that slope downwardly and inwardly within the juncture of the outer top wall 11 and the annular inner side wall 13. The beveled recesses 20 are positioned on each side of the drink-through opening 29, generally at the two locations where the user's upper lip makes contact with the edge otherwise formed by the intersection of the annular inner side wall 13 and the outer top wall 11.

On occasion, froth from the beverage - usually a whipped latte - oozes up through the drink-through orifice 18, thus providing another manner in which spills occur by froth running over the annular outer side wall 12 and down the side of the cup 31. Figure 3 illustrates a 3-dimensional drink-through orifice 18 that defines a drink-through opening 29. By recessing the drink-through opening 29 below the outer top wall 11, an interior ridge 27 is formed on the interior of side of the drink-through orifice 18 that can be recessed below the outer top wall 11, as best seen in Figure 4. Thus, any froth bubbling up through the drink-though opening 29 is directed to flow into the spill cavity 14 instead of flowing down the side of a generally vertically positioned cup 31. Any fluid that happens to flow into the spill cavity 14, if not drained back into the cup through a vent hole 22, is conveniently consumed upon the user tilting the cup 31 to take the next sip of their beverage.

The vent hole 22 is necessary for venting air into the cup 31 as the beverage is removed during consumption. The vent hole 22 is usually positioned on the outer top wall 11 or inner top wall 17 on the side opposite the drink-through orifice 18. By placing the vent hole 22 on either of the top walls 11 or 17, the vent hole 22, even though small, is exposed to potential spills from fluid dribbling out and running down the side of the cup 31. In its preferred configuration, the vent hole 22 is relocated within the spill cavity 14 as shown in Figures 1, 3 and 10. Any beverage that does happen to eject out through the vent hole 22 will be captured within the spill cavity 14. Furthermore, because the surface of a sloshing liquid within a cup remains relatively calm at its center, by repositioning the vent hole 22 near the center of the lid 10, the hole's size can be sufficiently enlarged so that the vent hole 22 also drains liquid captured in the spill cavity 14 back into the cup 31. By positioning the vent hole 22 near the center of lid 10, the likelihood of liquid coming up through even an enlarged vent hole 22 is greatly reduced when the cup 31 is either jostled or tilted for consumption. Besides being visually appealing as Figures 1 and 3 illustrate, the arcuate

interior side wall 16 passes close to the lid's center while only marginally reducing the volume contained within the underside of the dome lid 10.

However, by placing the vent hole 22 anywhere in the bottom wall 15 within the spill cavity 14, the vent hole 22 has the potential of being inadvertently blocked by the user's upper lip thereby preventing air from venting into the cup 31 during consumption of the beverage. Figures 1, 3 and 10 illustrate a channel 21 within the bottom wall 15 of the spill cavity 14. By placing the vent hole 22 within the deepest and narrowest portion of a channel 21, the vent hole 22 is shielded from being blocked by the user's upper lip during consumption. The vent hole 22 is now able to be increased in size to also serve as a drain for the spill cavity 14. In its preferred configuration, the channel 21 is radially aligned with the arcuate interior side wall 16 and centered with the drink-through orifice 18, as shown in Figure 10. Figures 9 and 12 illustrate how the channel 21 can be formed sufficiently deep and narrow at the location of the vent hole 22 to prevent the user's upper lip from contacting the bottom of the channel 21, thereby blocking the vent hole 22.

As illustrated in Figures 5A-5B and 6, an orifice side wall 25 extends downwardly and inwardly from a perimeter of the drink-though orifice 18 and encloses on itself to form a chamber 23. In the preferred configuration, the perimeter of the drink-through orifice 18 is defined by a pair of parallel linear edges connected by a pair of opposing semi-circular edges. Thus, the orifice side wall 25 forms a pair of opposing planar surfaces connected by a pair of opposing arcuate surfaces. The base of the chamber 23 is directly below and aligned with the drink-through orifice 18 as best seen in top views Figures 5A-5B and 10. A flap or flaps 24 is formed by cutting into the base of the chamber 23, which in its preferred configuration is generally planar and horizontal. When the flap 24 is in its relaxed position, as most clearly shown in Figures 5A-5B and 6, the drink-through orifice 18 is closed off thereby restricting sloshed liquid from exiting. When the flap 24 is in its non-relaxed position, as shown in Figures 7 and 8, the resulting drink-through opening 29 permits the beverage to flow through the drink-though orifice 18.

The drink-through orifice 18 remains visually integrated within the dome cup lid 10 by preserving the curvature of the outer and inner side walls 12 and 13, and by preserving the height of the outer top wall 11 surrounding the drink-through orifice 18. By recessing the flap 24 below the drink-through orifice 18 in the chamber 23, the flap 24 along with its functioning, is essentially hidden from view of the casual observer. The flap 24 is created by stamping a cut line into the base of the chamber 23 using die cutting methods adaptable to the industry. The flap 24 preferably follows the

contour of the base of the orifice side wall 25 in order to maximize its size and resulting flow of beverage. The flap 24 is formed by cutting only partially around the perimeter with the uncut portion becoming a hinge portion 26, referred to as a "living hinge", and is preferably along one of the two linear edges within the base of the chamber 23. Figures 5A and 5B illustrate two possible configurations for the living hinge 26. Incidentally, the permanent drink-through opening 29 shown in Figure 3, is created by cutting around the entire perimeter of the orifice side wall 25, thus eliminating the flap 24 embodiment.

The thermo-plastic material commonly used to form disposable cup lids is sufficiently flexible to provide a living hinge that bends, yet is sufficiently rigid to resist bending. Thus a force must be applied to the flap 24 in order for the living hinge 26 to bend thereby exposing the drink-though opening 29 as shown in Figures 7 and 8. When molding thermo-formed plastic sheets, the thickness of the material varies from one segment of the part to the next, tending to thin while forming into the downward extensions. In the present disclosure, one of the thinnest segments of lid 10 is located at the base of the chamber 23. Because the material is inherently more flexible where thinner, by positioning the flap 24 at the base of the chamber 23, the living hinge 26 can be made to fold inward when the user takes a sip of the beverage. The force required for the flap 24 to open can be adjusted by reducing or increasing the depth of the chamber 23, thereby adjusting the thickness of both the flap 24 and the living hinge 26. Additionally, by using a more sophisticated manufacturing technique, the thickness of the flap 24 and the living hinge 26 can be controlled by applying varying pressures to different segments of the material during thermo-forming. Furthermore, the resistance of the living hinge 26 to folding can be adjusted by increasing or decreasing the length of the living hinge 26 as can be visualized in Figures 5A and 5B. It should be noted that the sectional views shown herein fail to accurately reflect the thinning effect of molded thermo-formed plastics.

Figures 7 and 8 show the preferred flap 24 folded into an open position, as it would be if a beverage were flowing through the drink-through opening 29. When flap 24 opens, the flap corners 28 curl against the orifice side wall 25 as shown. With the coupled spring action of the folding living hinge 26 and the curling flap corners 28 exerting force to return to their relaxed state, the flap 24 effectively closes during periods when the beverage is not being consumed. The living hinge 26 is preferably located along one of the two linear edges at the base of the orifice side wall 25. By placing the living hinge 26 at the base of outer planar wall portion of the orifice side wall 25, as shown in Figures 5A and 5B, the flap 24 opens from inward to outward, as

best seen in Figures 7 & 8. Thus, a violently agitated beverage ejecting through the drink-through orifice 18, is redirected by the inwardly angled non-relaxed flap 24 into the spill cavity 14.

Preferably, the flap 24 in the base of the chamber 23 is capable of opening when subjected to a negative air pressure generated by a user through the drink-through orifice 18 to allow liquid to pass through the chamber 23 and the drink-through orifice 18. Otherwise, the flap 24 remains in a closed position to restrict the flow of liquid through the chamber 23 and the drink-through orifice 18.

There are occasions when a user wants to insert a drinking straw 30 through the chamber 23 and into the cup 31, as illustrated in Figure 11. When the straw 30 is inserted into the chamber 23, the flap 24 yields by folding downward as shown, thereby permitting the straw 30 to become fully inserted into the cup 31. Not only does the flap 24 fold out of the way, the orifice side wall 25 provides additional support by enveloping the straw 30 within the chamber 23. The insertion of the drinking straw 30 is likely to distort the living hinge 26 such that the functionality of the flap 24 is destroyed. However, when a user inserts the drinking straw 30, it usually is not removed until the beverage is consumed and the container is discarded.

Stamping of drink-through openings is a common secondary process subsequent to vacuum-formation of the thermoplastic material. As shown in Figure 13, the stamping process typically consists of an array of hardened metallic cutting tools impacting upon a mating metallic receiving surface with the thermoplastic material being supported by the receiving surface during the cutting process. In standard manufacturing of disposable dome lids, all cuts are performed simultaneously even though they are often on different horizontal planes. The cuts typically include the cutting or punching of the drink hole, the punching of vent and drain holes, and the cutting out of the lid itself from the thermoplastic material.

The present disclosure introduces a method for die cutting the flap 24 within the base of chamber 23 that is preferably both primarily horizontal and planar, as most clearly viewed in Figures 6 and 9. Figure 13 not only illustrates a method for die cutting the flap 24, but also illustrates how the vent hole 22, the flap 24, and the lid 10 can all be cut simultaneously with a singular cutting stroke. A support plate 41 is typically shaped similar to the vacuum-formed lid 10. In production, the support plate 41 often serves as the mold used to form the thermoplastic material and a receiving surface to cut the thermoplastic material, thereby combining the vacuum forming process with the cutting operation. This manufacturing technique saves time and cost by eliminating the need for transferring the molded sheets from one station to the next.

A die mounting plate 42 aligns with the support plate 41 and holds all the cutting tools: a vent block die 43 with a needle punch 44 for cutting a small vent hole; a chamber block die 50 with a cutting blade 51 for cutting in the flap 24 or the drink-through opening 29; and a ring die 49 for cutting the lid 10 away from the remainder of the thermoplastic sheet 10a. When the support plate 41 holding the untrimmed cup lid 10 comes into contact with the cutting tools held by the die mounting plate 42, as seen in Figure 13, the vent hole 22 and the flap 24 are cut and the lid 10 is separated from the remainder of the thermoplastic sheet 10a. A receiving socket 46 within the support plate 41 allows the needle punch 44 to penetrate completely through the lid 10 for cutting the vent hole 22.

Figures 14 and 15A-15B illustrate more clearly the die cutting blade 51 of the chamber block die 50 for cutting in the flap 24. Figures 15A and 15B show alternative cutting blades 51 for cutting the two preferred configurations for the living hinge 26, shown in Figures 5A and 5B respectively. Unlike the cutting of drink holes, no waste is generated by cutting in the flap 24, thus eliminating the cost associated with keeping the support plate 41 clear of waste build-up. Of particular interest are Figures 15A-15B and 16, where it can be seen that the block dies 43 and 50 have contoured portions 47 and 52 respectively. The contoured portions 47 and 52 conform to the contours of the lid 10. During the cutting process the chamber block die 50 inserts into the chamber 23 where the contoured portion 52 essentially mates with the contour of chamber 23. Likewise, the vent block die 43 inserts into channel 21 where the contoured portion 47 essentially mates with the contour of the channel 21. The contoured portions 47 and 52 enable the cutting portions, the needle punch 44 and the cutting blade 51, to be relatively short thereby increasing their strength and durability.

The manufacturing of a typical disposable dome lid does not require precision positioning for cutting drink and vent holes, including the cutting out of the lid. Usually, lids are designed to permit a loose tolerance by providing sufficient area surrounding all required cut features. However, the cutting of flap 24 within chamber 23 requires a precise alignment between the chamber block die 50 and the support plate 41, if the flap 24 is to be cut along the base of the orifice side wall 25 as shown in Figures 5 and 6. The likelihood of tooling misalignment becomes an issue when a large number of lids are simultaneously die-cut from a single sheet during production. Figures 17 and 18 illustrate a floating block die 50a similar to the chamber block die 50 except having a flange member 54 that is horizontal and surrounds a block die body 53, best viewed in Figure 21. The mounting plate 42a includes a die chamber 55 for holding the floating block die 50a. The die chamber 55 is further defined by a radial

slot 57 that is also horizontal and surrounds the die chamber 55. The floating block die 50a is supported within the die chamber 55 by the flange member 54 which inserts into the radial slot 57. The floating block die 50a is capable of lateral movement 56 because of space provided between vertical surfaces within the die chamber 55. The floating block die 50a is restricted from vertical movement within die chamber 55 because of the restricted clearance between horizontal contacting surfaces within radial slot 57. If the floating block die 50a is aligned with the chamber 23, as shown in Figure 17, there will be no lateral movement 56 during the cutting process as shown in Figure 18. However, if a minor misalignment exists between the floating block die 50a and the chamber 23, the contoured portion 52 of the floating block die 50a contacts the orifice side wall 25 prior to die cutting, as shown in Figure 19. As the floating block die 50a continues its insertion into the chamber 23, the downwardly and inwardly sloping orifice side wall 25 exerts a lateral force to the floating block die 50a thereby causing the floating block die 50a to move laterally into the proper alignment for cutting, as shown in Figure 20.

Another method for self-aligning cutting dies with the thermo-formed disposable dome cup lid 10, introduces a separate floating mounting plate 42a for each cup lid 10, as shown in Figures 22 and 23. A mounting plate base 58 holds an array of similar floating mounting plates 42a that align with the support plate 41. The floating mounting plate 42a includes a mounting plate flange 48 that is horizontal and surrounds the mounting plate side wall 45, best viewed in Figure 24. A contoured ring die 49a is mounted to the floating mounting plate 42a for separating the lid 10 from the remainder of the thermoplastic material 10a. In a preferred configuration the floating mounting plate 42a also contains all cutting tools for cutting each cup lid 10 including the chamber block die 50 and the vent block die 43. An annular contoured portion 61 of the contoured ring die 49a aligns with the annular outer side wall 12 of the just-formed cup lid 10. The floating mounting plate 42a is mounted within a mounting plate chamber 59 in the mounting plate base 58. The mounting plate chamber 59 is further defined by a radial chamber slot 60. The floating mounting plate 42a is supported within the mounting plate chamber 59 by the mounting plate flange 48 which inserts into the radial chamber slot 60. The floating mounting plate 42a is capable of lateral movement 56 because of space provided between vertical surfaces within the mounting plate chamber 59. The floating mounting plate 42a is restricted from vertical movement

within mounting plate chamber 59 because of the restricted clearance between horizontal contacting surfaces within the radial chamber slot 60. The floating mounting plate 42a is restricted from rotational movement within the mounting plate base 58 by one or more flange tabs 40 shown in Figure 24. Rotational alignment is required if the floating mounting plate 42a includes cutting tools within the interior of the contoured ring die 49a. If the floating mounting plate 42a is aligned with the lid 10, as shown in Figure 22, there will be no lateral movement 56 during the cutting process as shown in Figure 22. However, if a minor misalignment exists between the floating mounting plate 42a and the cup lid 10, the annular contoured portion 61 of the floating mounting plate 42a contacts the annular outer side wall 12 of the formed cup lid 10 prior to die cutting. As the cup lid 10 inserts into the misaligned contoured ring die 49a, the mating of the annular outer side wall 12 with the annular contoured portion 61 results a lateral force being applied to the floating mounting block 42a thereby causing the floating mounting plate 42a to move laterally 56 into the proper alignment for all cuts including separating the cup lid 10 from the remainder of the thermoplastic sheet 10a, as shown in Figure 23.

These described methods are particularly useful for making cuts within deeper cavities that require a precision tolerance. By implementing one or more of the described methods, the precise alignment for cutting into the contours of the formed thermoplastic sheet can be achieved by the self-guided motion of the cutting tools. When deviations measured tenths of a millimeter are a concern, maintaining proper alignment becomes an issue in production where a large array of cutting tools are simultaneously cutting a multitude of disposable cup lids.

The various embodiments described above can be combined to provide further embodiments. Aspects of the embodiments can be modified, if necessary to employ concepts of the various patents, applications and publications to provide yet further embodiments.

The disclosures of U.S. provisional patent application Serial No. 61/672,514, filed July 17, 2013, and U.S. provisional patent application Serial No. 61/774,471, filed March 7, 2013, are incorporated herein in their entirety.

These and other changes can be made to the embodiments in light of the above-detailed description. In general, in the following claims, the terms used should not be construed to limit the claims to the specific embodiments disclosed in the specification and the claims, but should be construed to include all possible embodiments along with the full scope of equivalents to which such claims are entitled. Accordingly, the claims are not limited by the disclosure.

AMENDED CLAIMS
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1. A lid for a cup, the lid comprising:

a mounting portion capable of anchoring on the cup;

an annular outer side wall extending at least partially around a perimeter of the lid and sloping away and radially inwardly from the mounting portion and terminating at a top;

a top wall at the top of the annular outer side wall;

a drink-through orifice in the top wall that enables drinking from the cup without removal of the lid and permits the lips of a user to encompass the drink-through orifice with the lower lip of the user's lips engaging with the annular outer side wall; and

a chamber having a side wall and a bottom wall that cooperate to form an interior of the chamber that is in fluid communication with the drink-through orifice, the chamber including at least one flap in the bottom wall having a relaxed position capable of closing off the bottom wall to restrict liquid from passing through the interior of the chamber and the drink-through orifice, and a non-relaxed position capable of permitting liquid to pass through the interior of the chamber and the drink-through orifice.

2. The lid of claim 1 further comprising:

an inner top wall formed below and within the top wall, the inner top wall bounded by an annular inner side wall extending upward to meet the top wall; and

a spill cavity bounded by the annular inner side wall and an arcuate interior side wall and configured to enable the upper lip of the user to engage with the annular inner side wall within the spill cavity.

3. The lid of claim 2 further defined by a bottom wall bounded by the annular inner side wall and the arcuate interior side wall, the bottom wall sloping upwardly and inwardly, the bottom wall including a channel radially aligned with the annular inner side wall and the arcuate interior side wall;

a vent hole at a base of the arcuate interior side wall and configured to vent air into the cup and to drain liquid back into the cup by

increasing the vent hole diameter, the channel configured to prevent the upper lip of the user from blocking the vent hole.

4. The lid portion of claim 2 comprising a pair of beveled recesses in the top wall and within a portion of the annular inner side wall occupied by the spill cavity, each beveled recess positioned on a respective side of the drink-through orifice, each of the beveled recesses configured to engage with the upper lip of the user lip.

5. The lid of claim 3 comprising a pair of beveled recesses in the top wall within a portion of the annular inner side wall occupied by the spill cavity, and each beveled recess positioned on a respective side of the drink-through orifice, each of the beveled recesses configured to engage with the user's upper lip.

6. The lid of claim 2, wherein the inner top wall includes a planar wall that slopes downwardly away from the drink-through orifice to define a lower area of the inner top wall that is configured to provide additional room for the user's nose.

7. The lid of claim 6, wherein the spill cavity includes a pair of beveled recesses in the top wall and within a portion of the annular inner side wall occupied by the spill cavity, the recesses positioned on each respective side of the drink-through orifice, each of the beveled recesses configured to engage with the user's upper lip.

8. The lid of claim 7, wherein the spill cavity includes:

a bottom wall bounded by the annular inner side wall and the arcuate interior side wall, the bottom wall sloping upwardly and inwardly and including a channel radially aligned with the annular inner side wall and the arcuate interior side wall; and

a vent hole at a base of the arcuate interior side wall and configured to vent air into the cup and possibly drain liquid back into the cup, and the channel configured to prevent the upper lip of the user from blocking the vent hole.

9. A lid for a cup, comprising:

a mounting portion that anchors on the cup;

an annular outer side wall sloping away and radially inwardly from the mounting portion and terminating at a top;

a top wall at the top of the annular outer side wall and having an exterior surface and an interior surface;

an annular inner side wall extending from the top wall and sloping away from the annular outer side wall, the inner and outer side walls and the top wall together form an annular ridge; and

a chamber in the annular ridge, the chamber having an open top in the top wall and having a circumscribing wall that encloses an interior of the chamber, the chamber is in fluid communication with the open top to define a drink-through orifice and further comprising a flap in the circumscribing wall, the flap capable of opening when a user is drinking through the drink-through orifice to allow liquid to pass through the chamber and the drink-through orifice and to otherwise remain in a closed position to restrict the flow of sloshing liquid from passing up through the chamber and the drink-through orifice.

10. The lid of claim 9 comprising:

an inner top wall formed below and within the top wall, the inner top wall bounded by the annular inner side wall;

an arcuate interior side wall; and

a spill cavity bounded by the annular inner side wall and the arcuate interior side wall and configured to enable the upper lip of the user to engage with the inner side wall within the spill cavity.

11. The lid of claim 10, wherein the spill cavity includes:

a bottom wall bounded by the annular inner side wall and the arcuate interior side wall, the bottom wall including a channel radially aligning with the annular inner side wall and the arcuate interior side wall; and

a vent hole at a base of the arcuate interior side wall and configured to vent air into the cup and to drain liquid into the cup by increasing the vent hole diameter; and the bottom wall configured to prevent the upper lip of the user from blocking the vent hole.

12. The lid of claim 10, wherein the spill cavity comprises a pair of beveled recesses in the top wall and within a portion of the annular inner side wall occupied by the spill cavity, each beveled recesses formed on a respective side of the drink-through orifice, and configured to engage with the user's upper lip.

13. The lid of claim 9, wherein the spill cavity includes a pair of beveled recesses in the top wall and within a portion of the annular inner side wall occupied by the spill cavity, each beveled recess formed on a respective side of the drink-through orifice and configured to engage with the user's upper lip.

14. The lid of claim 10, wherein the inner top wall includes a planar wall that slopes downwardly away from the drink-through orifice to define a lower area of the inner top wall that is configured to provide additional room for the user's nose.

15. The lid of claim 14, wherein the spill cavity further comprises a pair of beveled recesses in the top wall and within a portion of the annular inner side wall occupied by the spill cavity, each beveled recess positioned on each side of the drink-through orifice and configured to engage with the user's upper lip.

16. The lid of claim 15, wherein the spill cavity further comprises:

a bottom wall bounded by the annular inner side wall and the arcuate interior side wall, the bottom wall including a channel radially aligned with the annular inner side wall and the arcuate interior side wall; and

a vent hole at a base of the arcuate interior side wall configured to vent air into the cup and to drain liquid into the cup by increasing the vent hole diameter, and the channel configured to prevent a user's upper lip from blocking the vent hole.

17. A lid for a cup, the lid comprising:

a mounting portion that anchors on the cup;

an annular outer side wall sloping away and radially inwardly from the mounting portion and terminating at a top;

a top wall at the top of the annular outer side wall that encloses the top of the annular outer side wall, the outer top wall having an exterior surface and an interior surface;

an annular inner side wall extending from the top wall and sloping away from the annular outer wall, the inner and outer side walls and the top wall combining to define an annular ridge;

a drink-through orifice in the annular ridge that enables drinking from the cup without removal of the lid and that permits a user's lips to encompass the drink-through opening with a lower lip of the user engaging with the annular outer side wall; and

a recessed interior ridge formed in the annular inner sidewall and the top wall configured to define a drink-through opening in fluid communication with the drink-through orifice that is capable of directing froth bubbling up from the cup to flow through the drink-through opening and onto the annular inner side wall of the annular ridge.

18. The lid of claim 17, further comprising:

an inner top wall formed below and within the top wall, the inner top wall bounded by an annular inner side wall extending upward to meet the top wall; and

a spill cavity bounded by the annular inner side wall and an arcuate interior side wall and configured to enable the upper lip of the user to engage with the inner side wall within the spill cavity.

19. The lid of claim 18, wherein the spill cavity comprises:

a bottom wall bounded by the annular inner side wall and the arcuate interior side wall, the bottom wall including a channel radially aligned with the annular inner side wall and the arcuate interior side wall; and

a vent hole at a base of the interior arcuate side wall configured to vent air into the cup and to drain liquid into the cup by increasing the vent hole diameter; and the bottom wall configured to prevent a user's upper lip from blocking the vent hole.

20. The lid of claim 18, wherein the spill cavity comprises a pair of beveled recesses in the top wall and within a portion of the annular inner side wall occupied by the spill cavity, each beveled recess positioned on a respective

side of the drink-through opening, each of the beveled recesses configured to engage with the upper lip of the user lip.

21. The lid of claim 19, wherein the spill cavity comprises a pair of beveled recesses in the top wall and within a portion of the annular inner side wall occupied by the spill cavity, each beveled recess positioned on a respective side of the drink-through opening, each of the beveled recesses configured to engage with the upper lip of the user lip.

22. The lid of claim 18, wherein the inner top wall comprises a planar wall that slopes downwardly away from the drink-through opening to define a lower area of the inner top wall that is configured to provide additional room for the user's nose during consumption of the beverage.

23. The lid of claim 22, wherein the spill cavity further comprises a pair of beveled recesses in the top wall and within a portion of the annular inner side wall occupied by the spill cavity, each beveled recess positioned on each side of the drink-through opening and configured to engage with the user's upper lip.

24. The lid of claim 23, wherein the spill cavity further comprises:

a bottom wall bounded by the annular inner side wall and the arcuate interior side wall, the bottom wall including a channel radially aligned with the annular inner side wall and the arcuate interior side wall; and

a vent hole at a base of the arcuate interior side wall configured to vent air into the cup and to drain liquid into the cup by increasing the vent hole diameter; and the bottom wall configured to prevent a user's upper lip from blocking the vent hole.

25. A lid for a cup, the lid comprising:

a mounting portion that anchors on the cup;

an annular outer side wall that slopes away upwardly and radially inwardly from the mounting portion and terminates at a top;

an outer top wall at the top of the annular outer side wall that encloses the top of the annular outer side wall, the outer top wall having an exterior surface and an interior surface;

an annular inner side wall extending from the annular outer top wall and sloping away from the annular outer side wall;

the inner and outer side walls and the outer top wall combining to define an annular ridge;

a drink-through opening in the annular ridge that enables drinking from the cup without removal of the lid and that permits a user's lips to encompass the drink-through opening with a lower lip of the user engaging with the annular outer side wall and an upper lip of the user engaging with the annular inner side wall; and

a spill cavity portion bounded by the annular inner side wall and an arcuate interior side wall to enable the upper lip of the user to engage with the annular inner side wall within the spill cavity, the spill cavity including:

a bottom wall bounded by the annular inner side wall and the arcuate interior side wall, the bottom wall including a channel radially aligning with the annular inner side wall and the arcuate interior side wall; and

a vent hole in the channel at a base of the arcuate interior side wall and configured to vent air into the cup and to drain liquid into the cup, the channel configured to prevent the upper lip of the user from blocking the vent hole.

26. Cancelled

27. The lid of claim 25, wherein the spill cavity includes a pair of beveled recesses in the top wall and within a portion of the annular inner side wall occupied by the spill cavity, each beveled recess positioned on each side of the drink-through opening and configured to engage with the user's upper lip.

28. The lid of claim 25, wherein the spill cavity includes a pair of beveled recesses in the top wall and within a portion of the annular inner side wall occupied by the spill cavity, each beveled recess positioned on each side of the drink-through opening and configured to engage with the user's upper lip.

29. A lid for a cup, the lid comprising:

a mounting portion that anchors on the cup;

an annular outer side wall sloping away and radially inwardly from the mounting portion and terminating at a top of the annular outer side wall;

an outer top wall at the top of the annular outer side wall that encloses the top of the annular outer side wall;

an annular inner side wall extending from the outer top wall and sloping away from the annular outer side wall, the inner and outer side walls and the adjoining outer top wall combining to define an annular ridge;

an inner top wall formed within and below the outer top wall;

a drink-through opening in the annular ridge that enables drinking from the cup without removal of the lid and that permits a user's lips to encompass the drink-through opening with a lower lip of the user's lips engaging with the annular outer side wall and an upper lip of the user's lips engaging with the annular inner side wall; and

the inner top wall having a planar portion that slopes downwardly away from the drink-through opening to define a lower area of the inner top wall that provides additional room for the user's nose during consumption of the beverage.

30. The lid of claim 29 further comprising a spill cavity that comprises the annular inner side wall and an arcuate interior side wall that is configured to enable a user's upper lip to engage with the annular inner side wall within the spill cavity.

31. The lid of claim 29 further comprising:

a spill cavity that comprises the annular inner side wall and an arcuate interior side wall that is configured to enable a user's upper lip to engage with the annular inner side wall within the spill cavity, and a bottom wall that comprises a channel radially aligned with the annular inner side wall and the arcuate interior side wall; and

a vent hole at a base of the arcuate interior side wall that is configured to at least one from among vent air into the cup and drain liquid into the cup, the vent hole positioned in the channel, and the channel configured to prevent the upper lip of the user from blocking the vent hole.

32. The lid of claim 30, wherein the spill cavity includes a pair of beveled recesses in the top wall and within a portion of the annular inner side wall occupied by the spill cavity, each beveled recess formed on each side of the drink-through opening and configured to engage with the user's upper lip.

33. The lid of claim 32, wherein the spill cavity includes a pair of beveled recesses in the top wall and within a portion of the annular inner side wall occupied by the spill cavity, each beveled recess formed on each side of the drink-through opening and configured to engage with the user's upper lip.

34. A lid for a cup, comprising:

a primary wall having first and second opposing surfaces, the first surface comprising an exposed top surface and the second surface defining an interior surface when the lid is attached to the cup;

an edge structured to extend entirely around a perimeter of the primary wall and capable of removably attaching the primary wall to the cup and preventing liquid from passing between the edge and the cup;

an annular ridge extending away from the first surface of the primary wall in a direction opposite the second surface of the primary wall, the annular ridge having a top wall, an outer side wall extending from the top wall to the edge, and an inner side wall extending from the top wall to the first surface of the primary wall, the annular ridge at least partially circumscribing the perimeter of the primary wall; and

a chamber in the annular ridge, the chamber having an open top in the top wall of the annular ridge and a circumscribing wall that encloses an interior of the chamber that is in fluid communication with the open top to define a drink-through orifice, the chamber further comprising a flap in the circumscribing wall capable of opening when subjected to a negative air pressure generated by a user through the drink-through orifice to allow liquid to pass through the chamber and the drink-through orifice and to otherwise remain in a closed position to restrict the flow of liquid through the chamber and the drink-through orifice.

35. The lid of claim 34 including an interior ridge defined by the interior side wall and the chamber, the interior ridge recessed below the top wall to direct froth bubbling up through the drink-through orifice to flow onto the inner side wall of the annular ridge.

36. The lid of claim 35 further comprising a spill cavity bounded by the inner side wall and an arcuate interior side wall and configured to enable a user's upper lip to engage with the inner side wall within the spill cavity.

37. The lid of claim 36, wherein the spill cavity comprises:

a bottom wall adjacent the inner side wall and the arcuate interior side wall, the bottom wall comprising a channel radially aligned with the annular ridge and arcuate interior side wall;

a vent hole at a base of the arcuate interior side wall that is configured to at least one from among vent air into the cup and drain liquid into the cup, and the bottom wall configured to prevent a user's upper lip from blocking the vent hole.

38. The lid of claim 36 wherein the spill cavity further comprises a pair of beveled recesses in the top wall and within a portion of inner side wall occupied by the spill cavity, each beveled recess formed on each side of the chamber and configured to engage with the user's upper lip.

39. The lid of claim 36 comprising an inner top wall formed below and within the top wall, the inner top wall having a planar wall that slopes downwardly away from the drink-through orifice to define a lower area of the inner top wall that is configured to provide room for the user's nose.

40. The lid of claim 38 comprising an inner top wall formed below and within the top wall , the inner top wall having a planar wall that slopes downwardly away from the drink-through orifice to define a lower area of the inner top wall that is configures to provide room for the user's nose.

41. A method of forming a lid for a cup, comprising:

providing a support plate that is shaped in the form of a lid and is configured to serve as a mold to vacuum-form thermoplastic material, the support plate further configured to provide multiple planar receiving surfaces for die cutting;

providing a mounting plate that includes a block die;

vacuum forming thermoplastic material on to the support plate into a lid shape having a chamber formed thereon; and

bringing the block die into contact with the lid-shaped vacuum formed thermoplastic material, with the block die cutting into the wall of the chamber.

42. The method of claim 41 wherein bringing the block die into contact with the lid-shaped vacuum formed thermoplastic material comprises cutting into the wall of the chamber to form a flap.

43. The method of claim 41, wherein the mounting plate includes a needle punch, an annular die and the block die, and the method further comprise:

cutting a vent hole in the lid-shaped thermoplastic material at a separate location from the chamber; and

cutting the lid-shaped thermoplastic material from surrounding thermoplastic material with the annular die.

44. The method of claim 42, wherein the mounting plate includes a needle punch, an annular die and the block die, and the method further comprises:

cutting a vent hole in the lid-shaped thermoplastic material at a separate location from the chamber; and

cutting the lid-shaped thermoplastic material from surrounding thermoplastic material with the annular die.

45. A method of forming a lid for a cup, comprising:

providing a support plate that is shaped in the form of a lid and is configured to serve as a mold to vacuum-form thermoplastic material, the support plate further configured to provide multiple planar receiving surfaces for die cutting;

providing a mounting plate that includes a block die chamber having a laterally and radially positioned mounting slot; and

providing a floating block die that includes a laterally and radially positioned flange member and a contoured portion, and mounting the floating block die within the block die chamber such that the flange member permits the floating block die to slide in a first direction with respect to the mounting plate and prevents the floating block die from moving in a second direction that is transverse with respect to the first direction;

forming a lid with a chamber by vacuum forming the thermoplastic material into the lid shape on the support plate, the chamber having a downwardly and inwardly sloping side wall that forms a bottom wall; and

cutting into the chamber by guiding the floating block die into position in the chamber by the contoured portion of the block die contacting the side wall and moving in the first direction prior to contacting the bottom wall.

46. The method of claim 45 wherein cutting into the chamber comprises cutting into the wall of the chamber to form a flap.

47. The method of claim 45, wherein the mounting plate includes a needle punch, an annular die and the block die, and the method further comprises:

cutting a vent hole in the lid at a separate location from the chamber; and

cutting the lid from the surrounding thermoplastic material with the annular die.

48. The method of claim 46, wherein the mounting plate includes a needle punch, an annular die and the block die, and the method further comprises:

cutting a vent hole in the lid at a separate location from the chamber; and

cutting the lid from the surrounding thermoplastic material with the annular die.

49. A method of forming a lid for a cup, comprising:

providing a support plate that is shaped in the form of a lid and is configured to serve as a mold to vacuum-form thermoplastic material, the support plate further configured to provide multiple planar receiving surfaces for die cutting;

providing a mounting plate base that includes a mounting plate chamber having a laterally and radially positioned mounting slot; and

providing a floating mounting plate that includes a laterally and radially positioned flange member, the mounting plate also including a contoured ring die with an annular contoured portion, and the floating mounting plate positioned within the mounting plate chamber such that the flange member permits the floating mounting plate to slide in a first direction with respect to the

mounting plate base and prevents the floating mounting plate from moving in a second direction that is transverse with respect to the first direction;

forming a lid with an annular outer side wall by vacuum forming the thermoplastic material into the lid on the support plate, the lid having a downwardly and outwardly sloping annular side wall; and

cutting into the thermoplastic material by guiding the floating mounting plate into position with the support plate and by the annular contoured portion of the floating mounting plate contacting the annular outer side wall of the lid and moving in the first direction prior to the contoured ring die cutting the lid from the surrounding thermoplastic material.

50. The method of claim 49, wherein the floating mounting plate is restricted from rotational movement within the mounting plate base by one or more flange tabs included within the flange member; the floating mounting plate includes a needle punch, a block die and the contoured ring die, and the method further comprises:

cutting a vent hole in the lid; and

cutting a drink-though opening into the lid.

51. The method of claim 49, wherein the floating mounting plate is restricted from rotational movement within the mounting plate base by one or more flange tabs included within the flange member; the floating mounting plate includes a needle punch, a block die and the contoured ring die, and the method further comprises:

cutting a vent hole in the lid; and

cutting a flap into the lid.

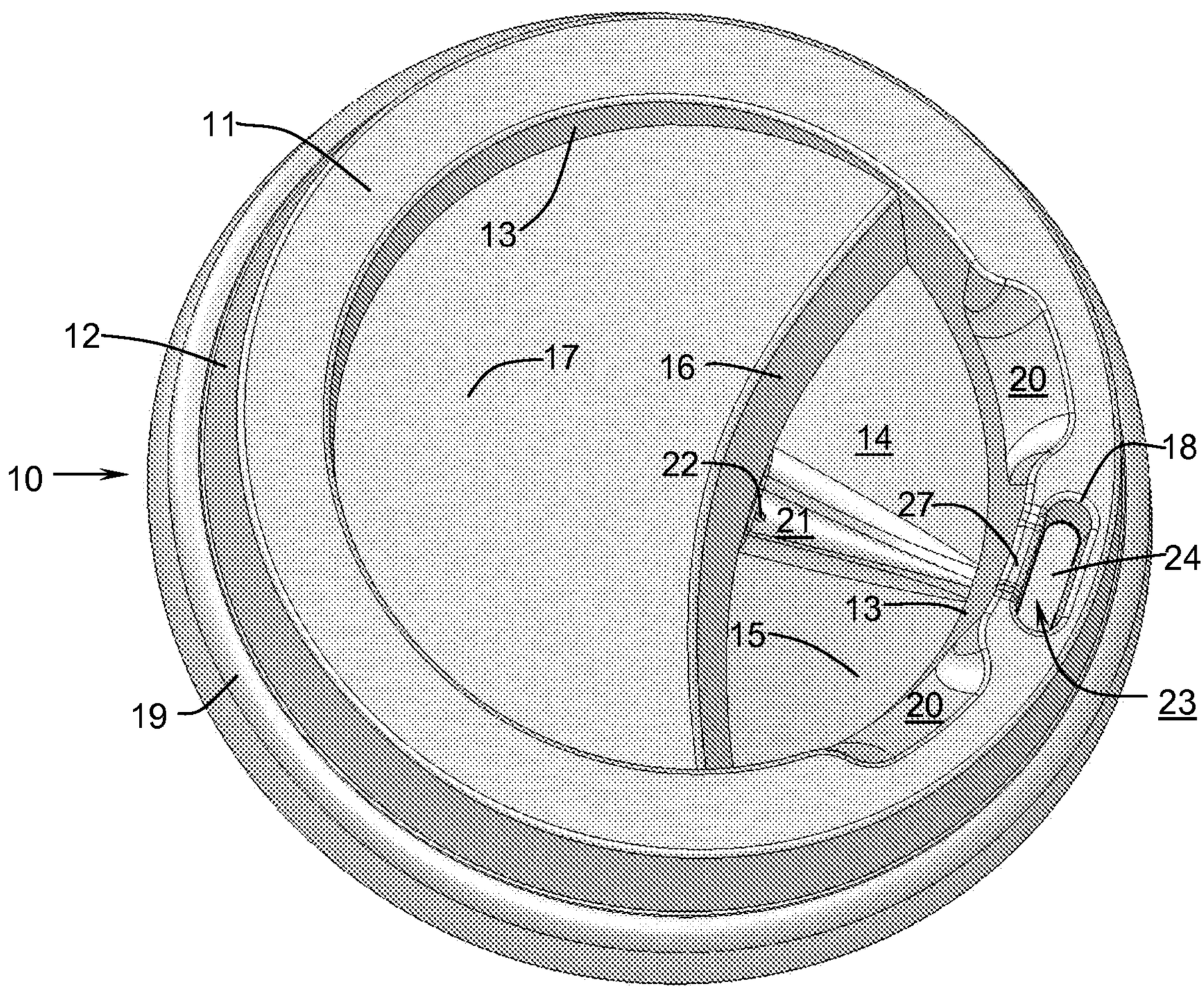


FIG. 1

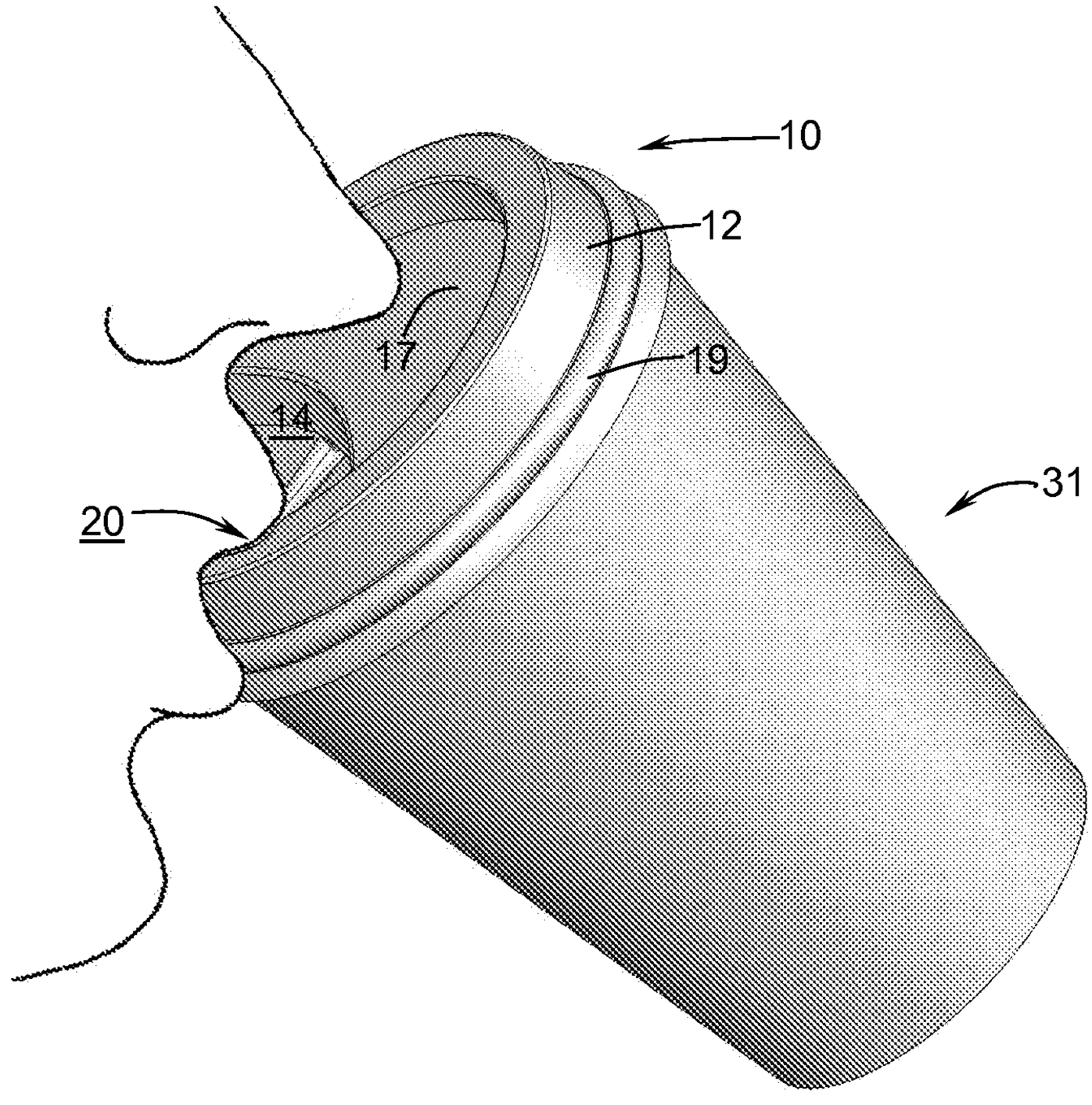


FIG. 2

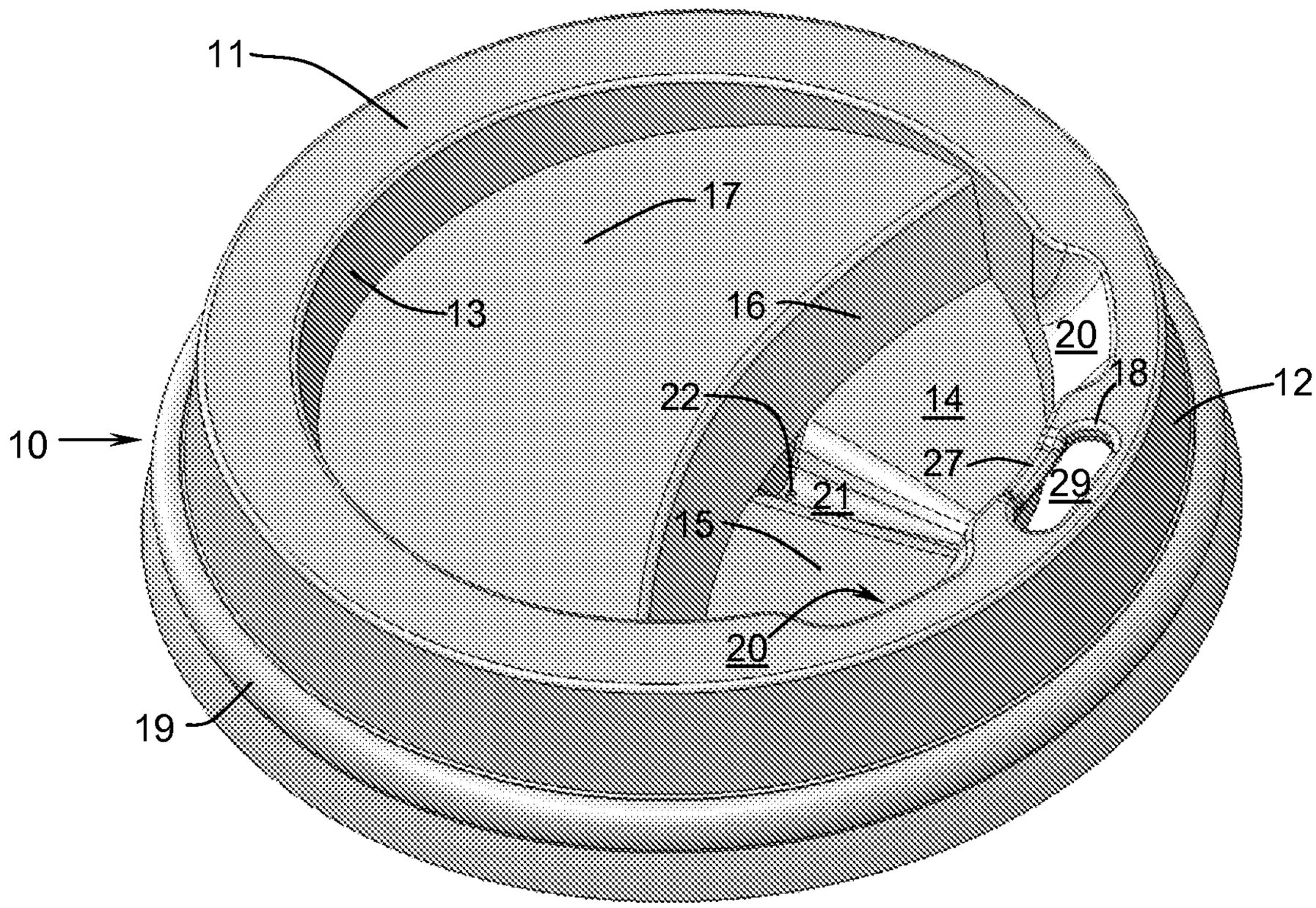

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FIG. 3

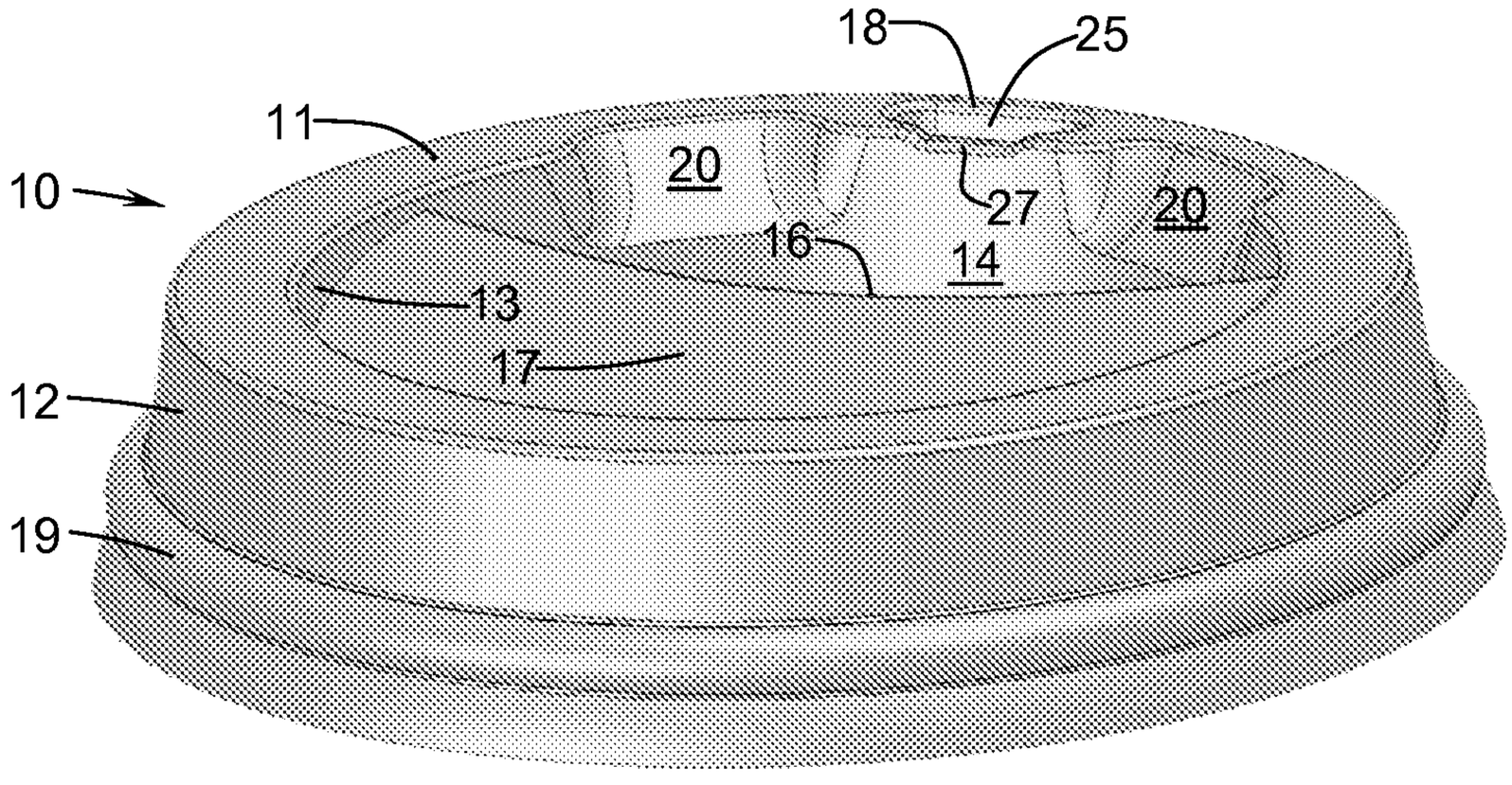

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FIG. 4

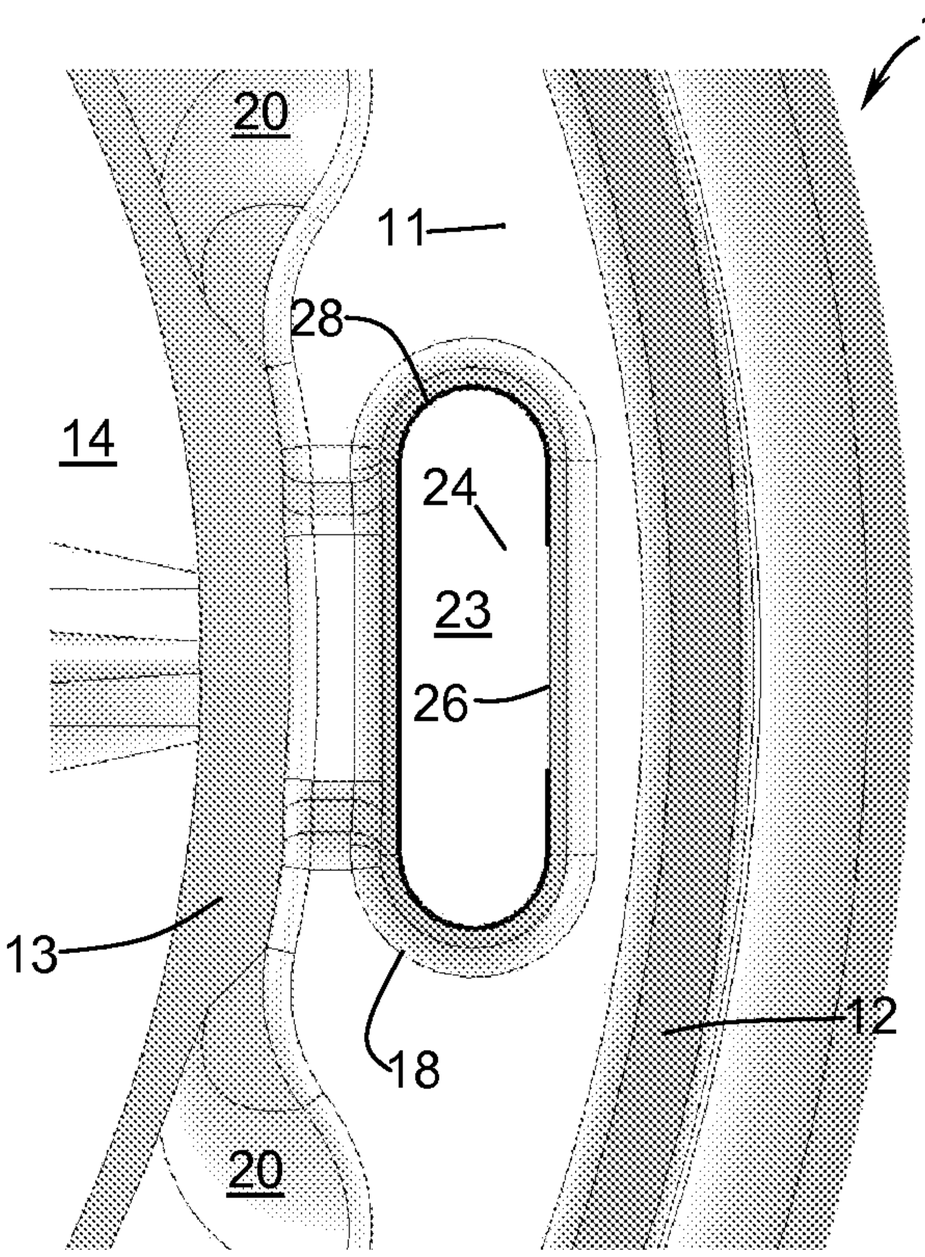


FIG. 5A

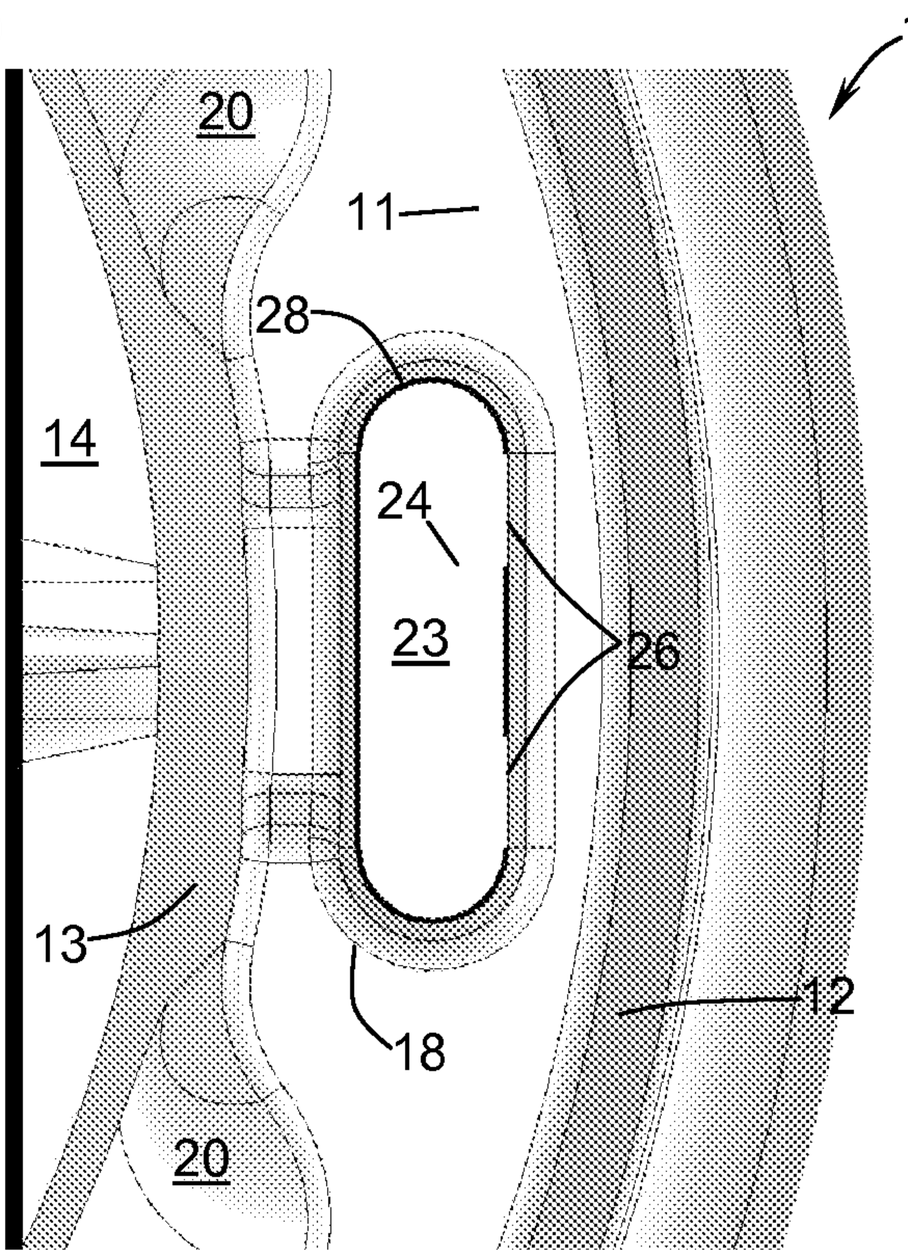


FIG. 5B

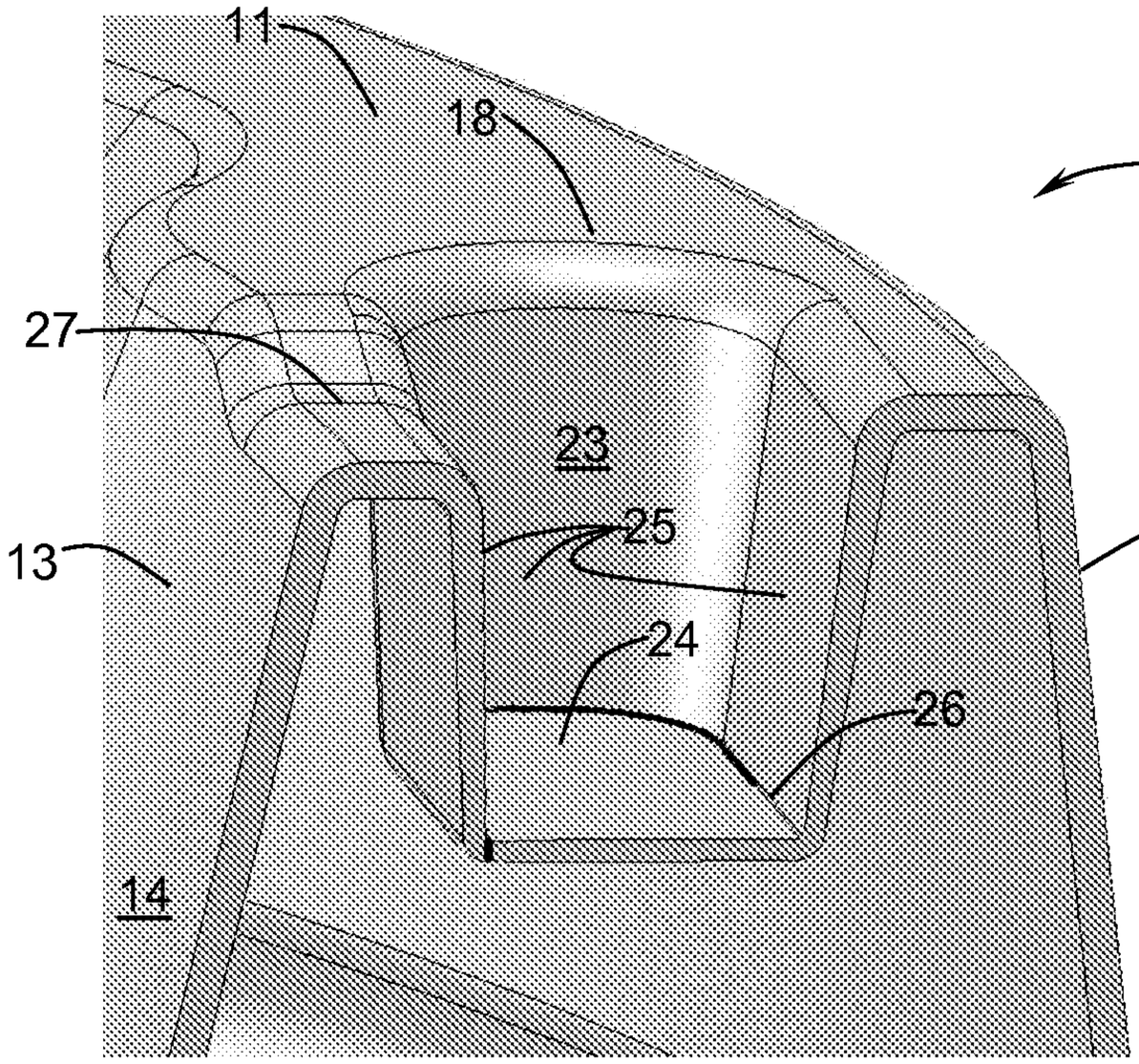


FIG. 6

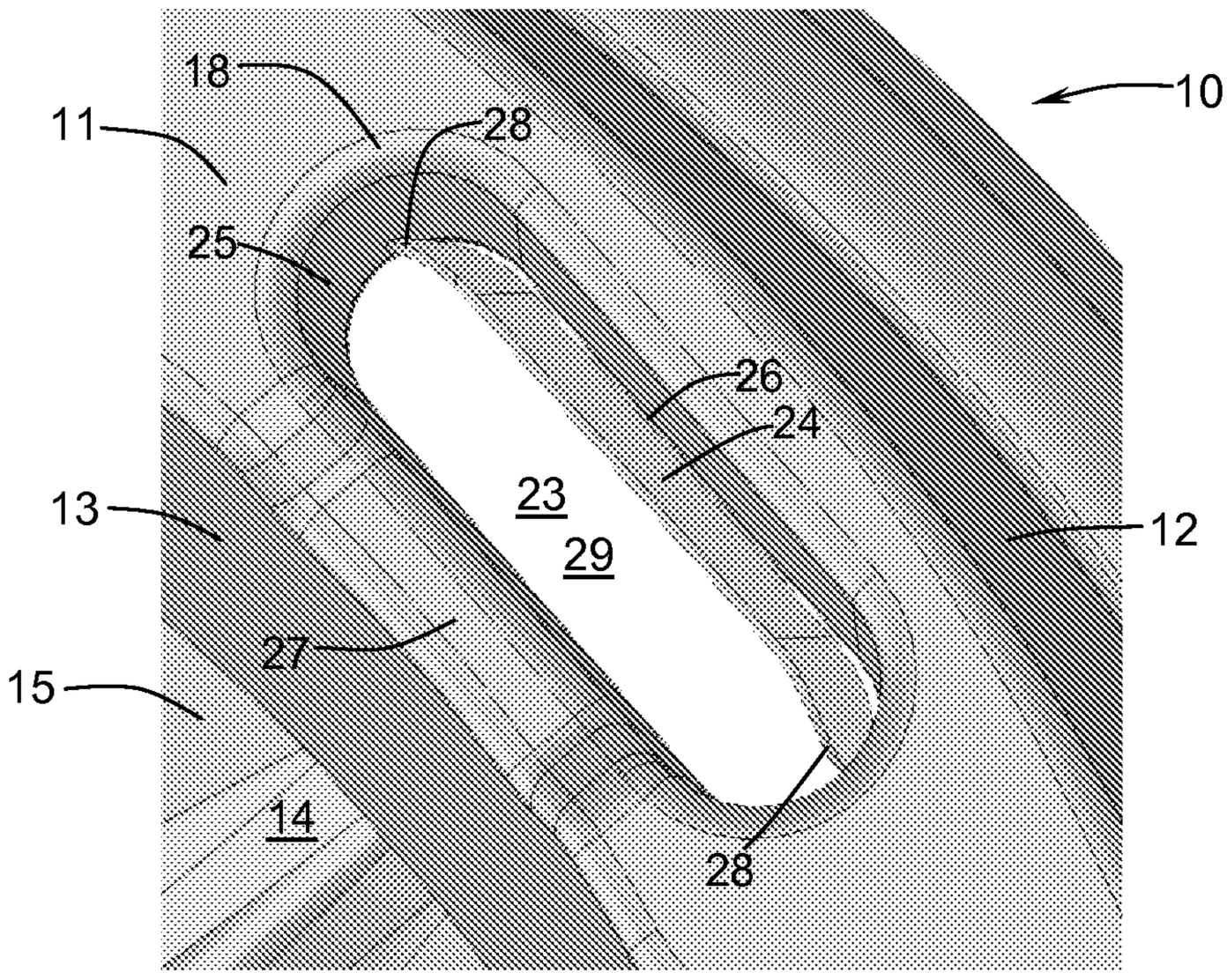

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FIG. 7

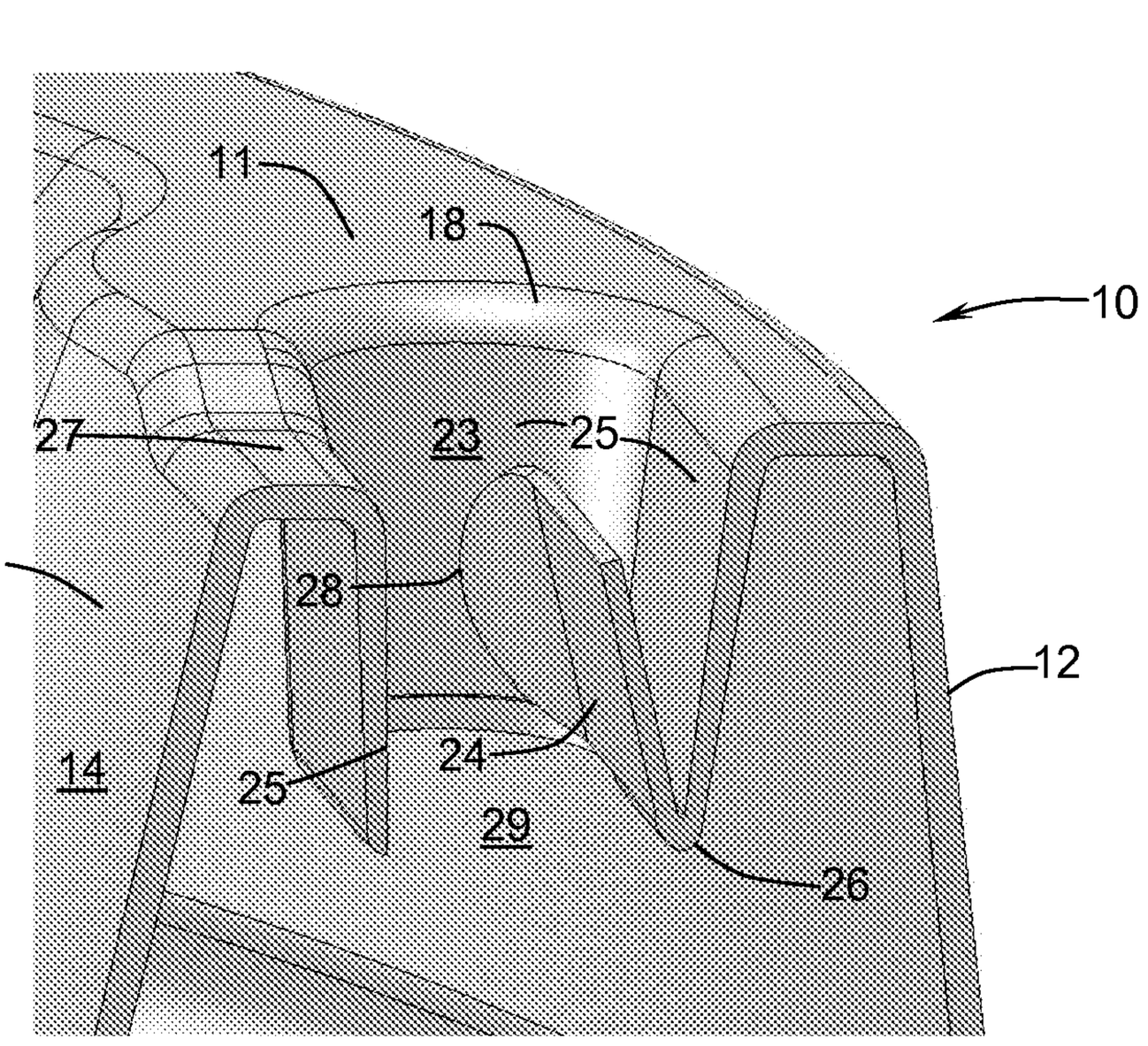

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FIG. 8

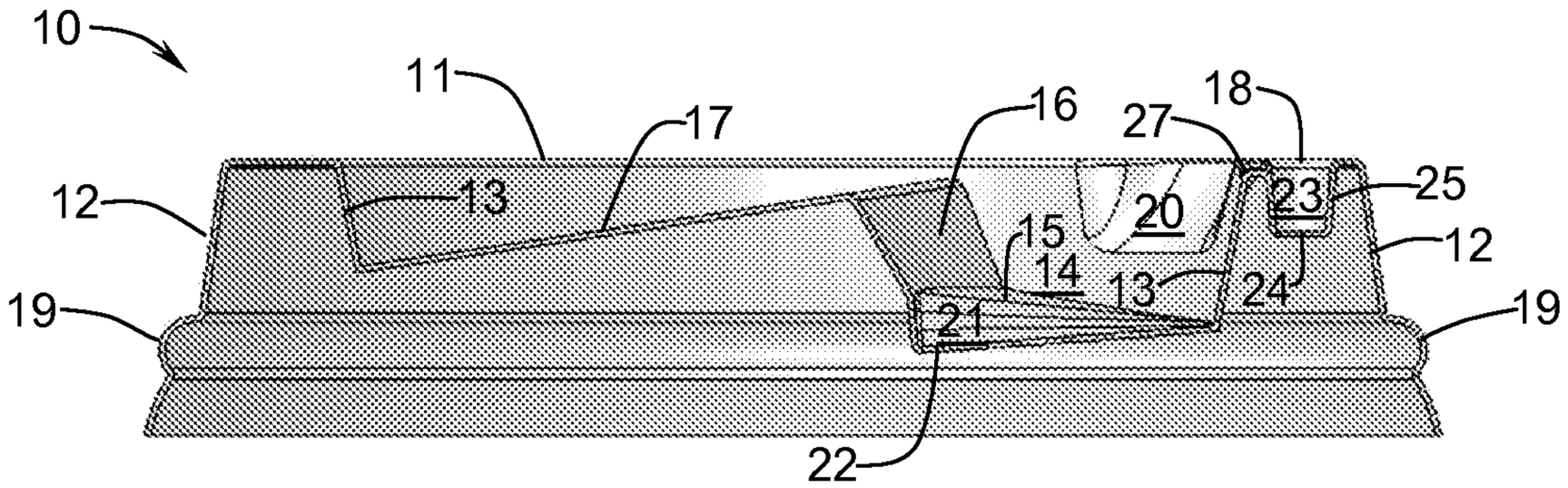

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FIG. 9

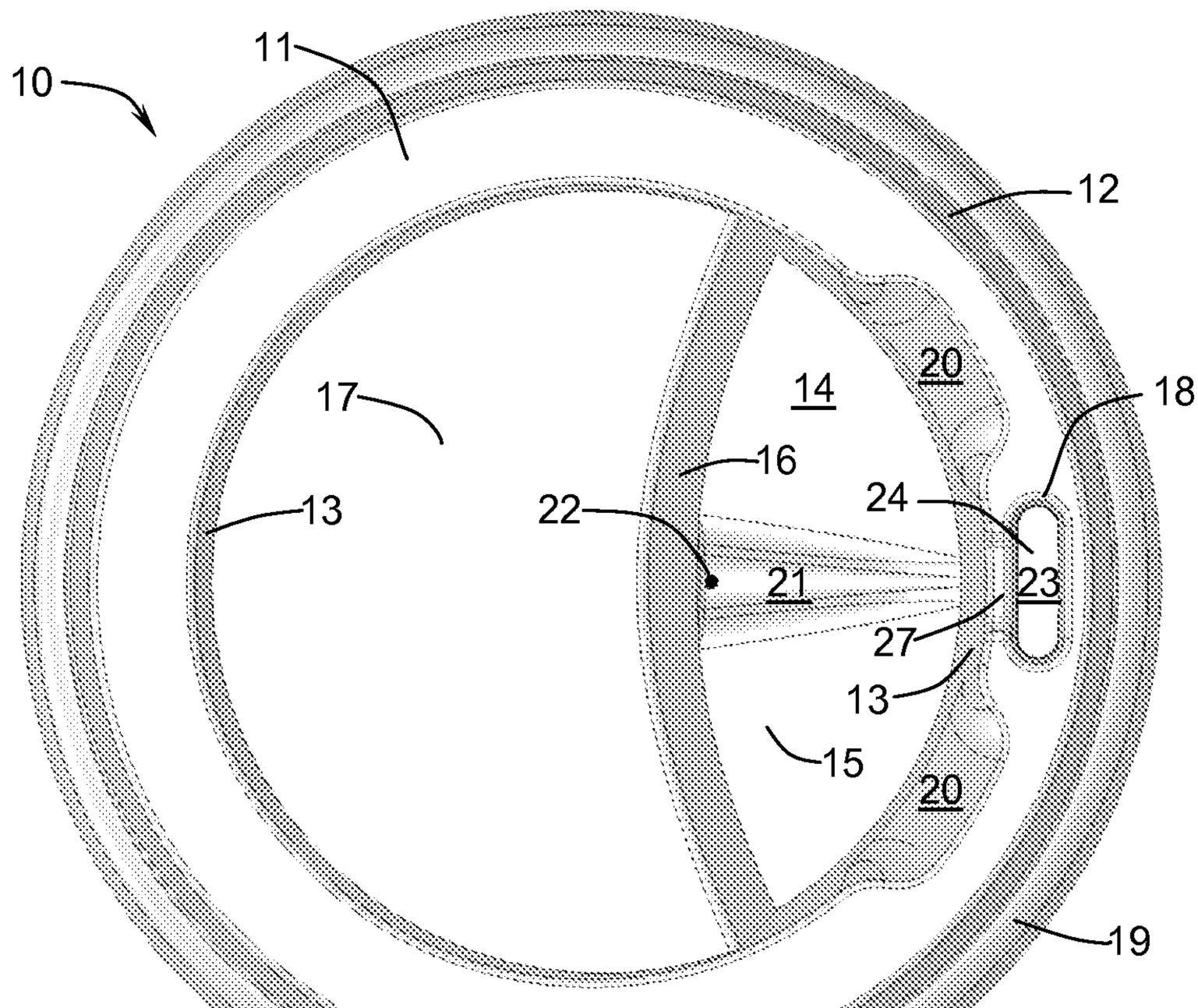

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FIG. 10

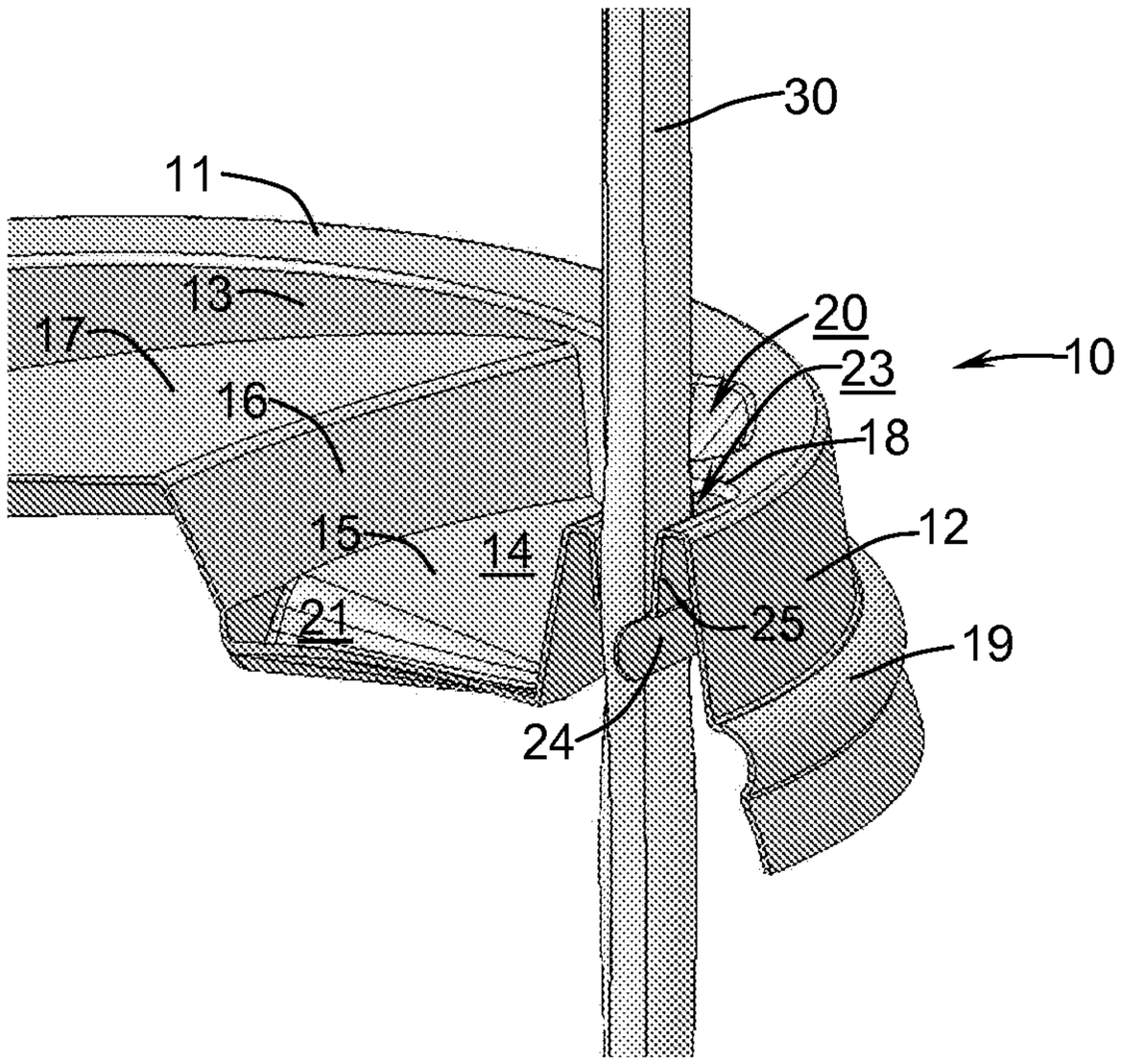

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FIG. 11

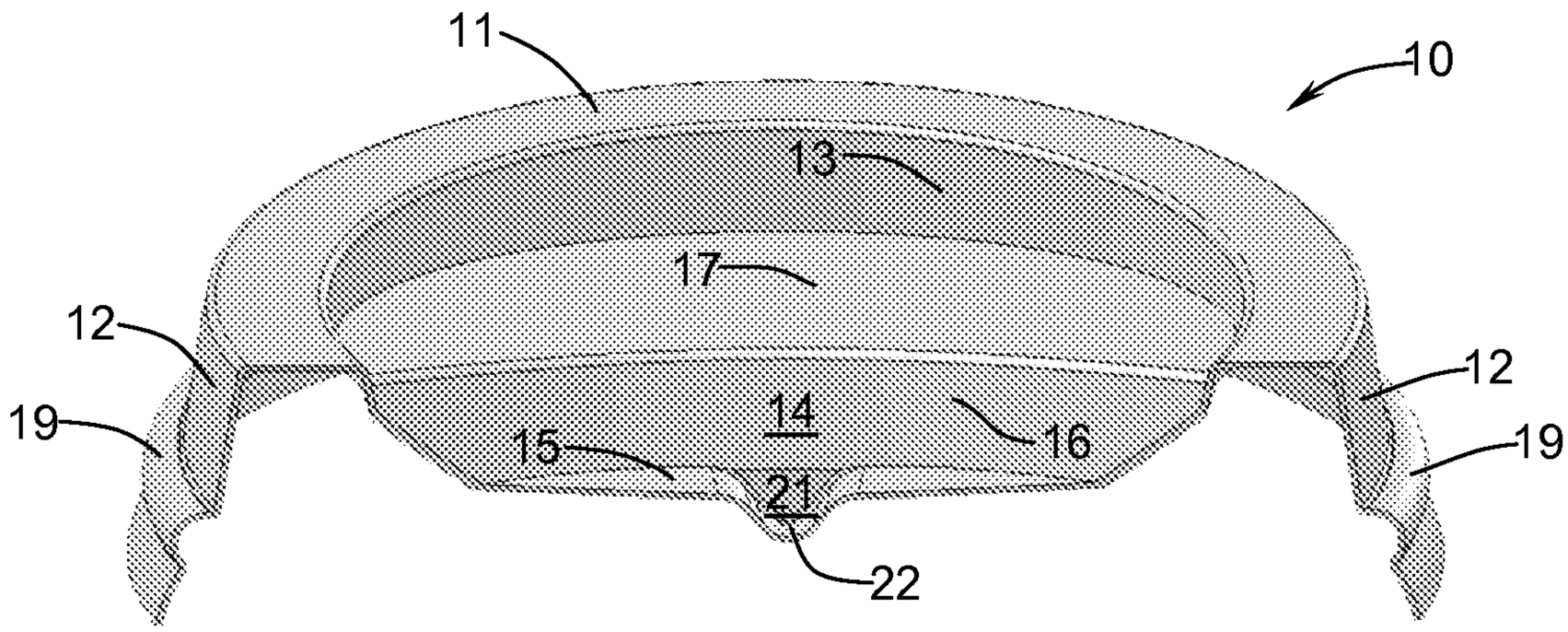

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FIG. 12

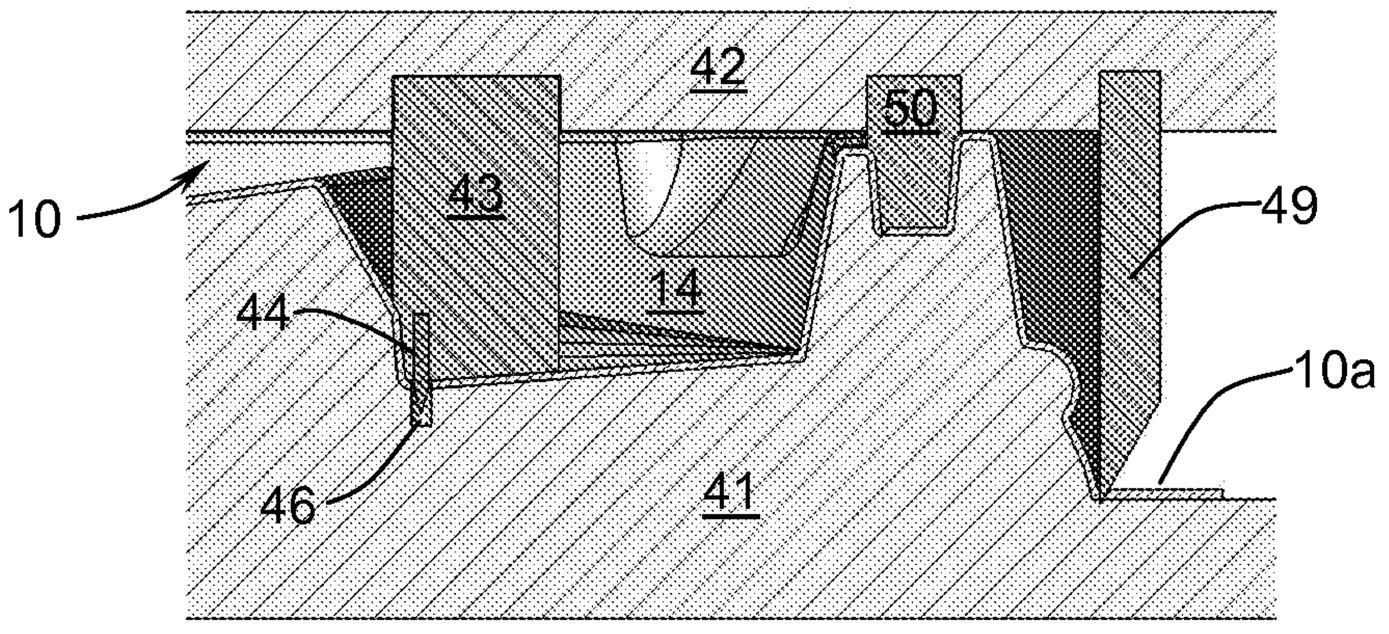


FIG. 13

FIG. 14

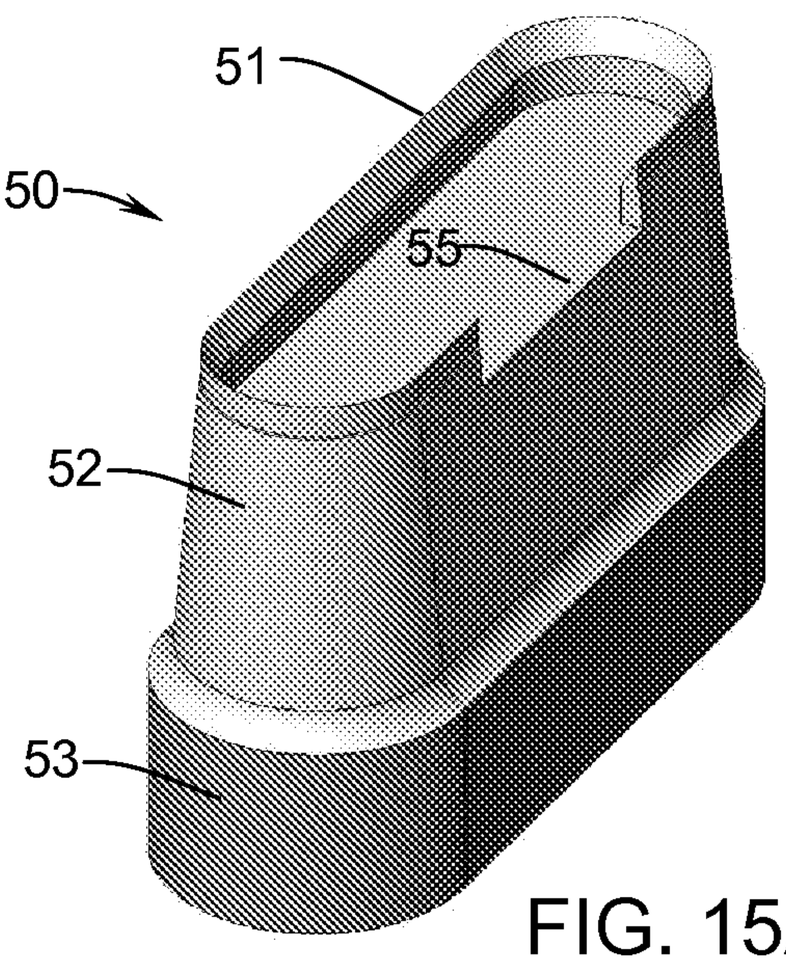


FIG. 15A

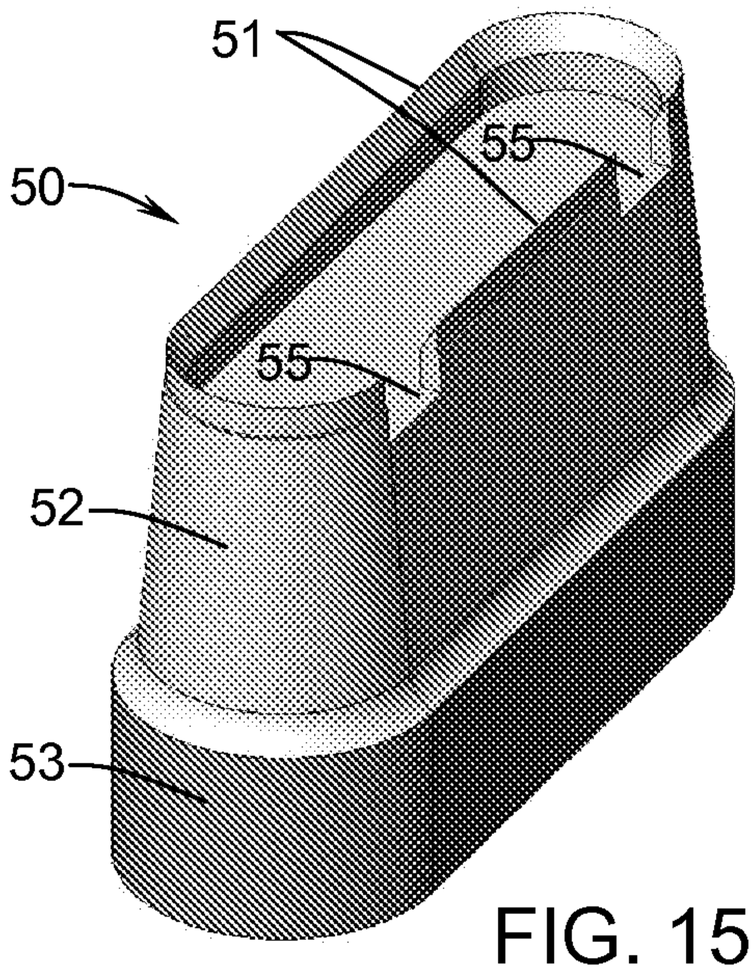


FIG. 15B

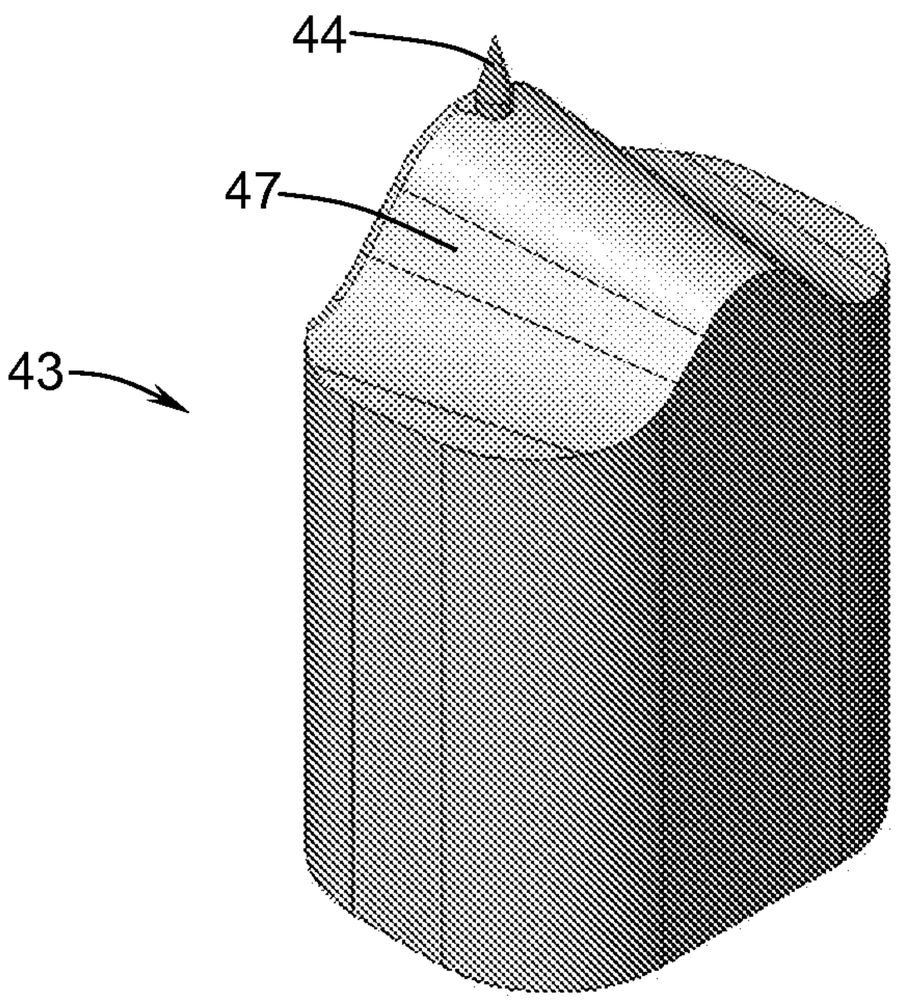


FIG. 16

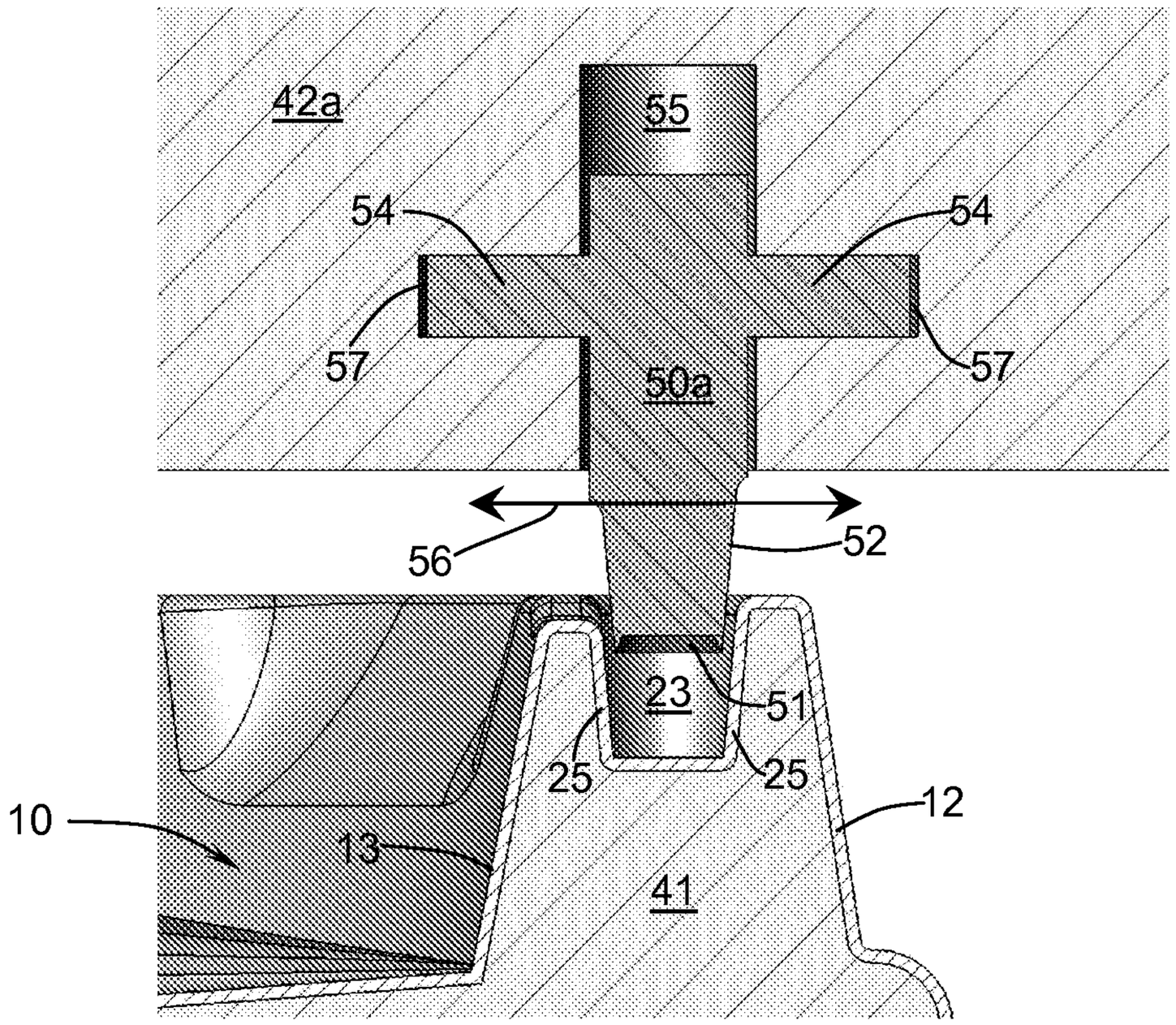

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FIG. 17

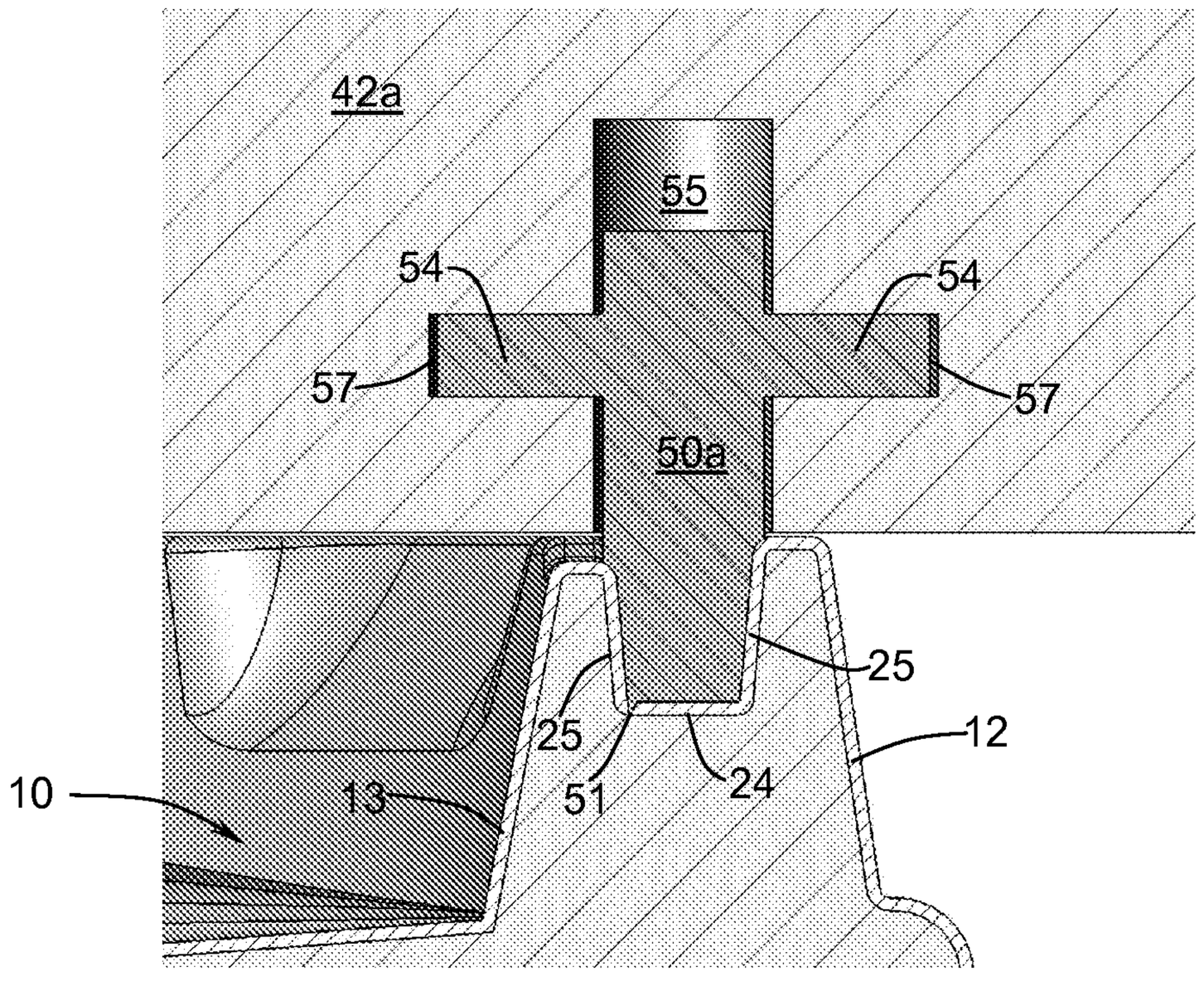

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FIG. 18

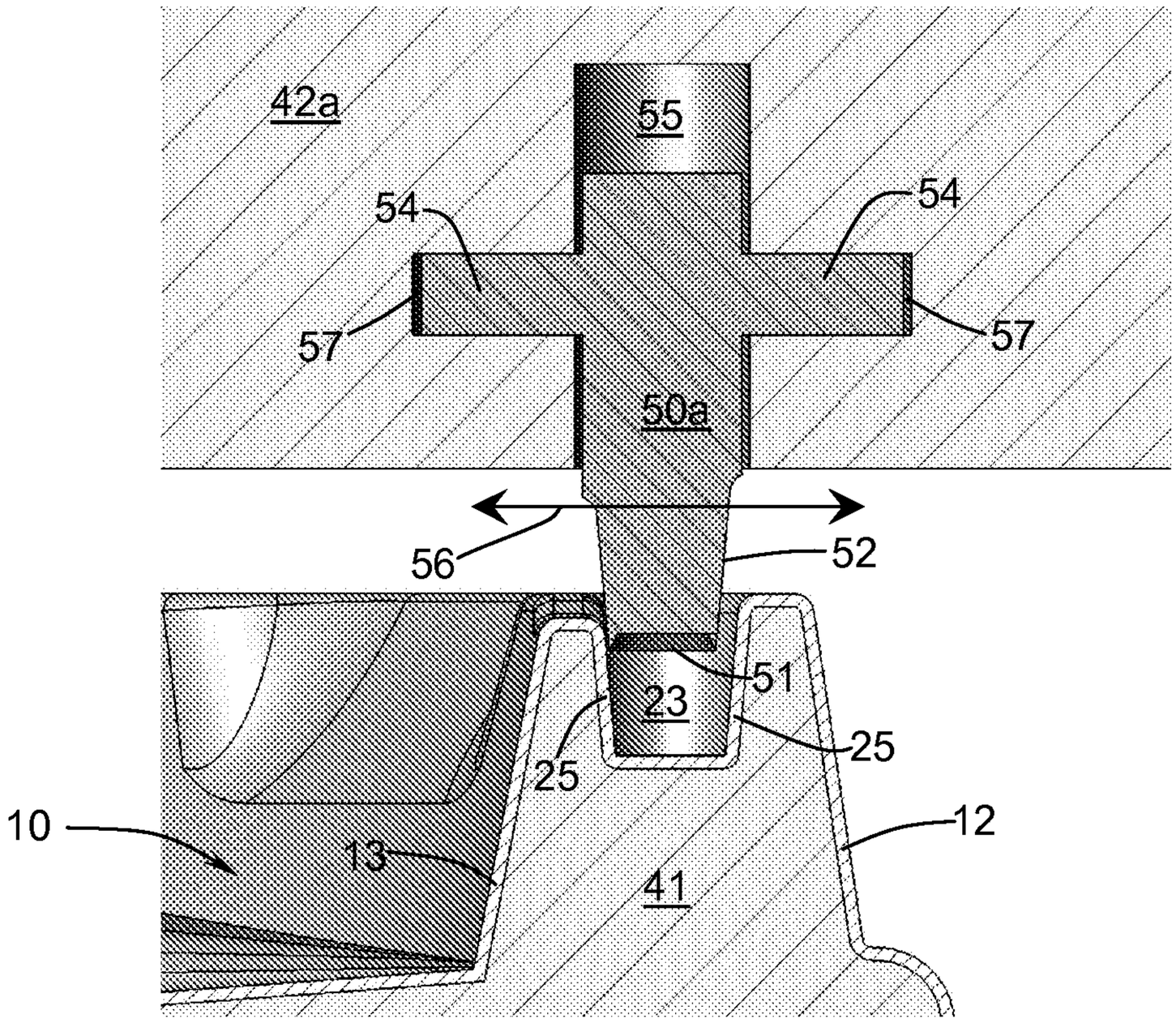

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FIG. 19

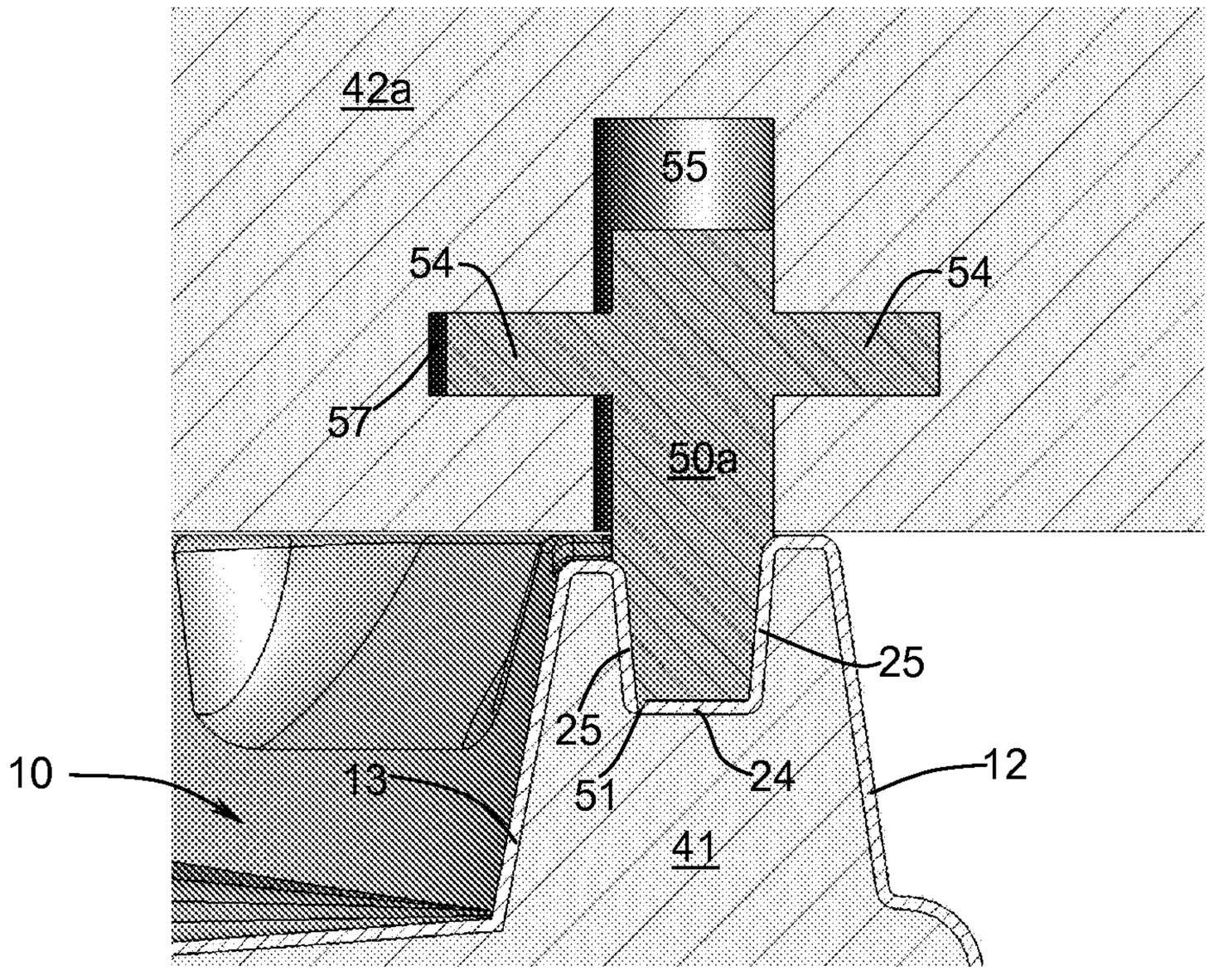

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FIG. 20

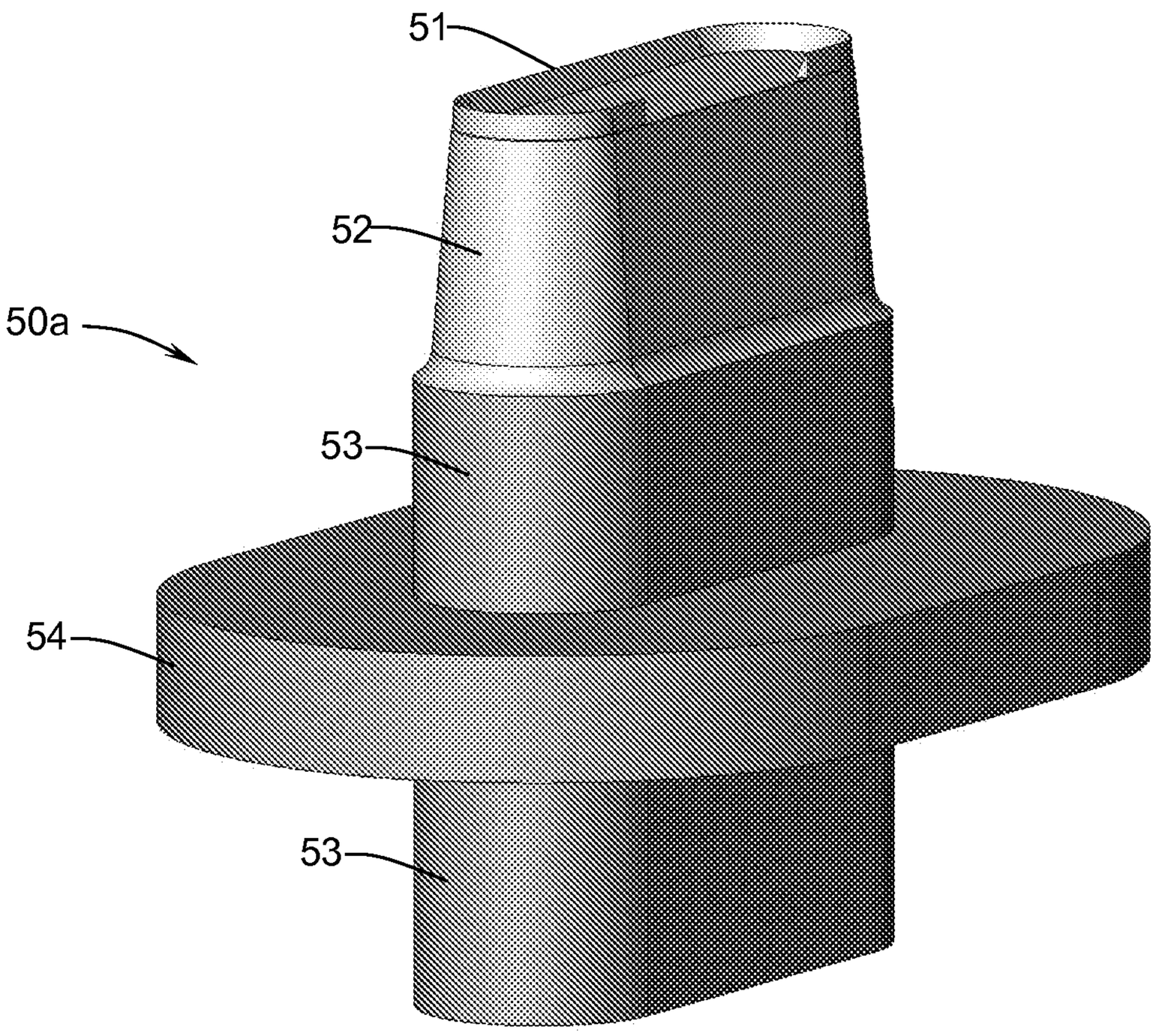


FIG. 21

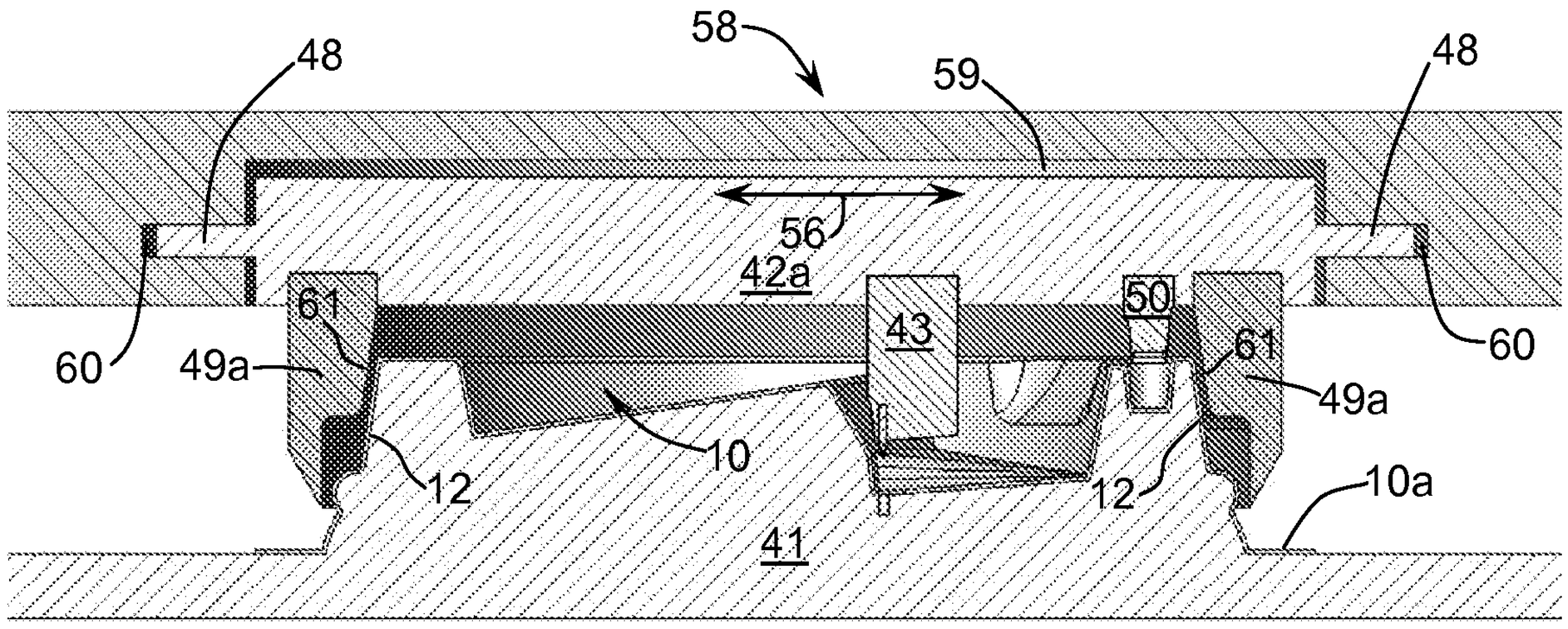

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FIG. 22

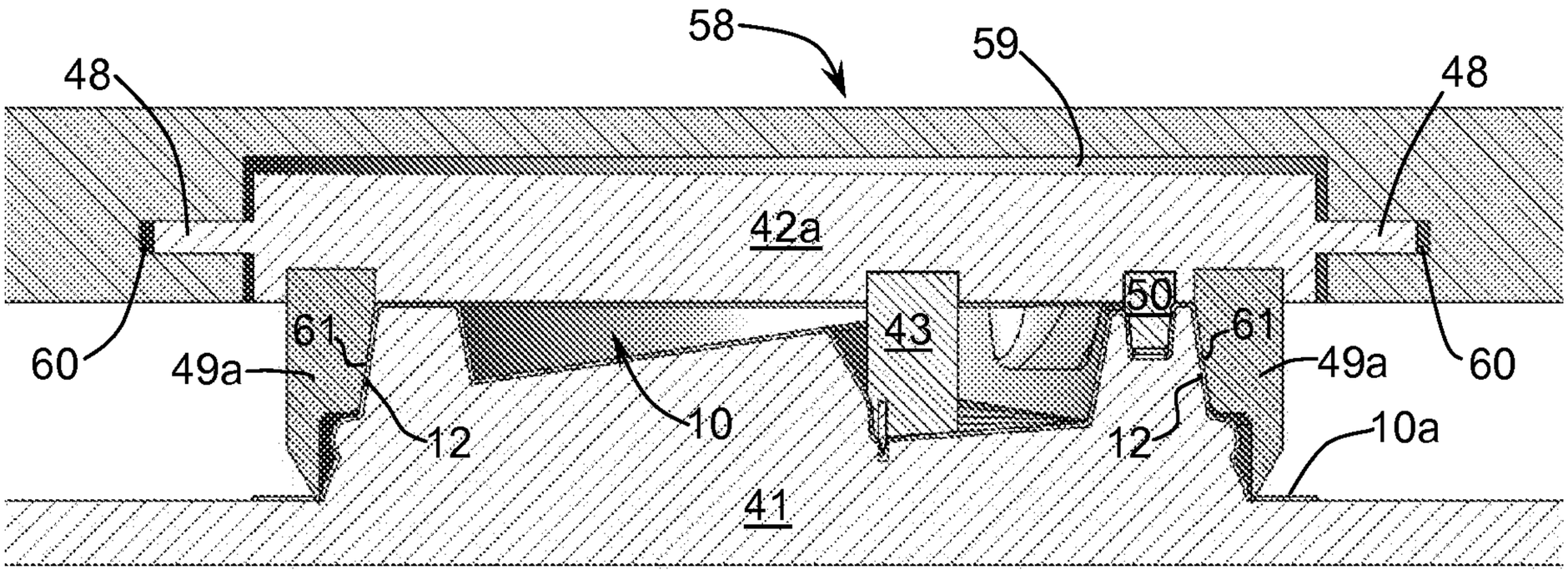

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FIG. 23

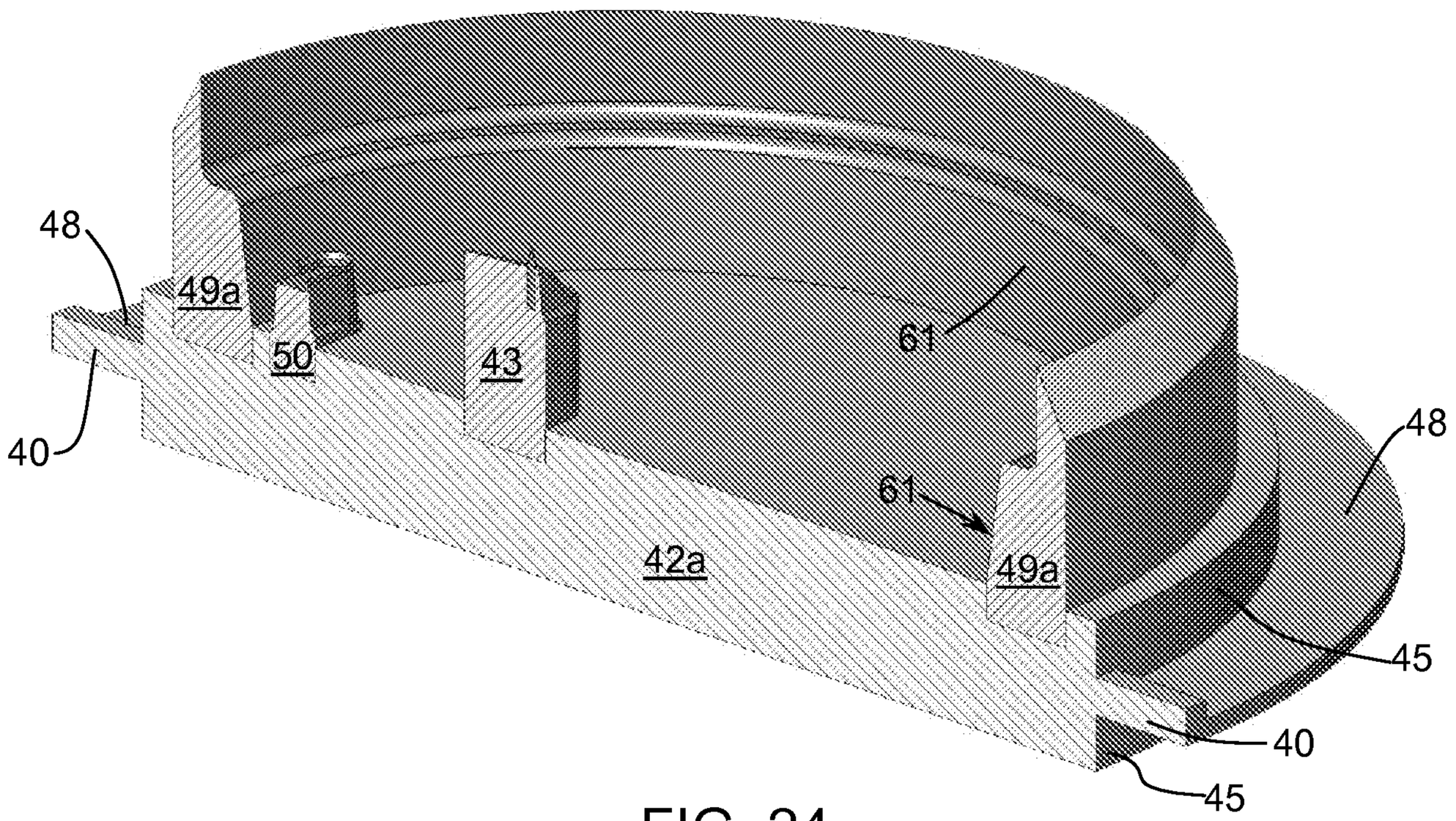


FIG. 24

FIG. 1

