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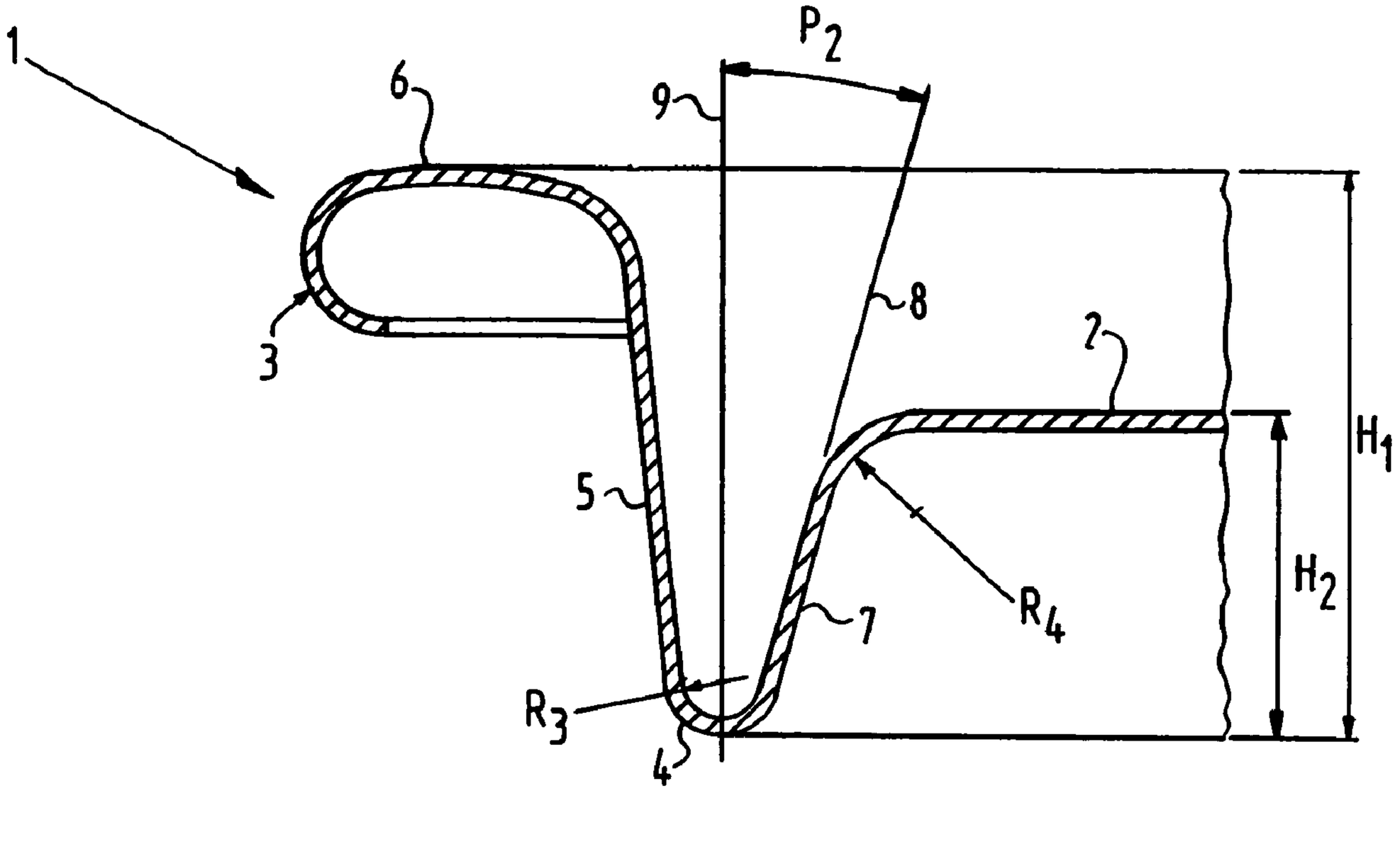

(57) Abrégé/Abstract:
The invention relates to a can end for a can, such as an easy opening can, comprising: a central panel; a can end radius for connection to a body of the can; and a countersink connected via a transition wall to the can end radius and via a panel wall to the panel; wherein a panel wall angle (A_2, P_2) is 2° - 45°; a panel radius (R_4) is larger than 0.5 mm; a panel depth (H_2) is 1 mm - 7 mm; and a counter sink radius (R_3) is less than 5 mm; and to cans provided with at least one such a can end.

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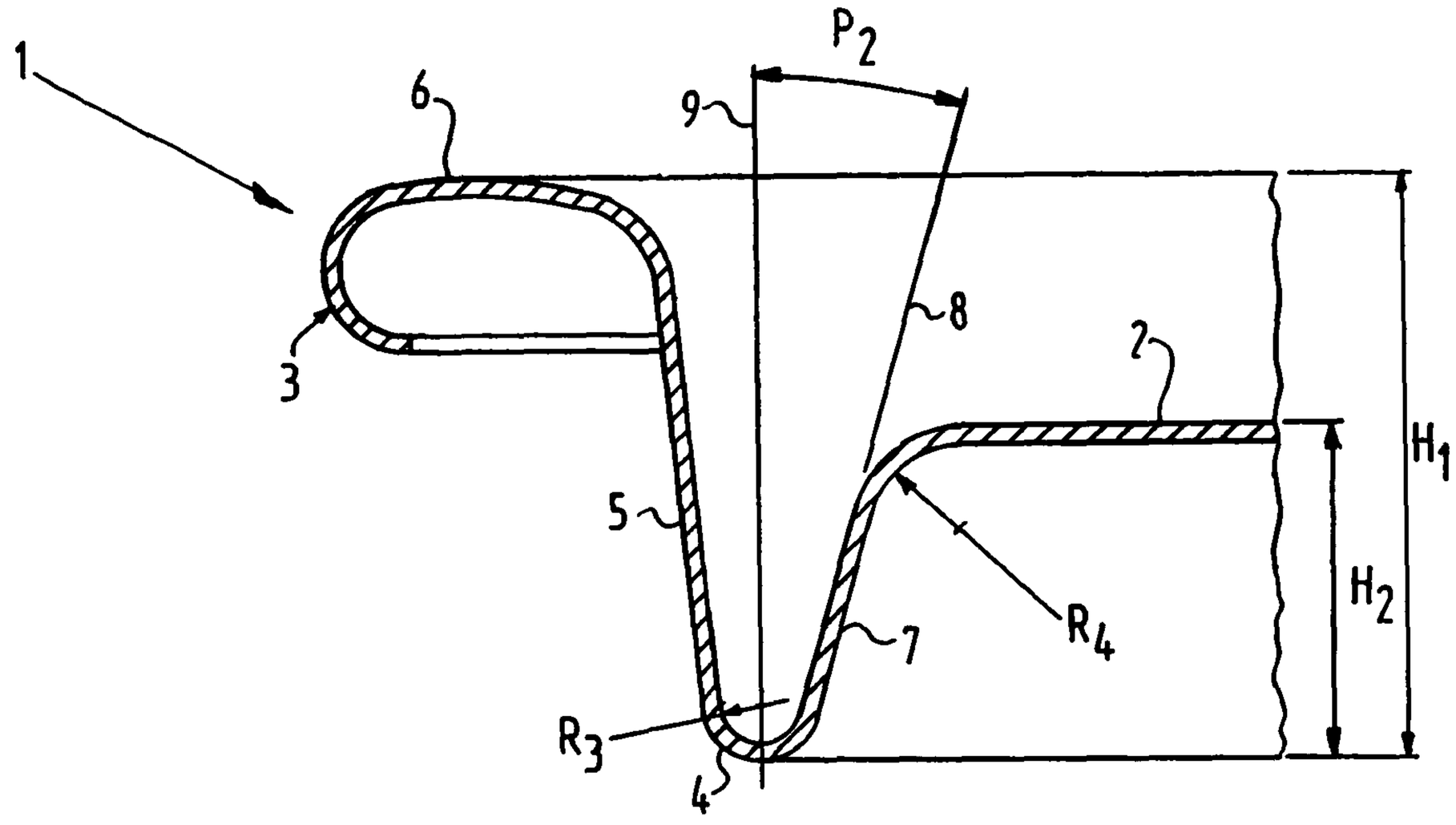
(54) **Title:** CAN END FOR A CAN AND SUCH CAN



(57) **Abstract:** The invention relates to a can end for a can, such as an easy opening can, comprising: a central panel; a can end radius for connection to a body of the can; and a countersink connected via a transition wall to the can end radius and via a panel wall to the panel; wherein a panel wall angle (A_2, P_2) is 2° - 45°; a panel radius (R_4) is larger than 0.5 mm; a panel depth (H_2) is 1 mm - 7 mm; and a counter sink radius (R_3) is less than 5 mm; and to cans provided with at least one such a can end.

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CAN END FOR A CAN AND SUCH CAN

The present invention relates to a can end for a can, such as an easy opening can, and to such a can provided with at least one such a can end.

Such cans are intended for use as a beverage can and as a food can.

Generally, beverage cans are thin walled (0.04 - 0.15 mm). Such a beverage can obtains its strength (after filling and closure) by an internally build up pressure. To that extent the can is filled and provided with gas generating material. After closure, gas formation results in the internal build up of pressure.

Generally, food cans are provided with food which may have to be subjected to a pasteurization or sterilization procedure. Accordingly, pressure build up may be temporary during such procedure. However, due to undesired circumstances bacterial growth might result in internal pressure build up after the food can was filled and closed.

In relation to both food cans and beverage cans improper processing filling and handling of such cans may result in temporary or continuous pressure build up which may result in a deformation of in particular the can closure at the top end and/or the bottom end. Accordingly, overfilling the can with the content material, too high processing temperatures, unsatisfactory cooling operations, insufficient vacuum drawing in the can, pre-process spoilage of content, gas formation due to an undesired reaction between can metal and the content resulting in gas formation such as hydrogen gas, and incorrect handling resulting in impacting on the can

may result in continuous or temporary pressure build up. These pressure build ups may result in a deformation of the can ends to an extent dependent on the pressure build up.

One form of localized distortion of the can end is buckling or pleating resulting in a local distortion which could extent into the counter sink and seaming region. The bulked portion may even locally extent beyond the perimeter of the can. Higher pressure build up may result in bulging or even the formation of a so called springer. Such bulges may be forced back into the normal can end position. A hard blow will result in a severe and permanent outbulging of one or both ends of the can.

In this respect it is noted that can ends may be designed such that due to pressure build up the concave can end flips out into a convex form (see for instance EP 0 906 222).

The present invention has for its object to provide a can end for a can, such as an easy opening can, which sustains higher internal pressures than a conventional can end while managing volume expansion. The can end of the invention has a form such that the resistance of the can end to distortion due to pressure build up is improved. For instance, a can provided with a can end according to the invention having a diameter ranging from 45 - 260 mm may resist pressures built up to more than 2 bar preferably up to more than 3 - 4 bar or even up to more than 5 bar. But, if a pre-designed pressure build up is surpassed, then the can end will distort but such that its form will not transform from a concave form into a convex form but will be provided with irregular distortions. Accordingly, the consumer could appreciate that due to the irregular buckled or pleated can end the content may be spoilt and should not be consumed.

The form and shape of the can end according to the

invention is having a form and shape designed such that high pressure resistance and/or expansion is obtained preferably at minimum thickness of closure and/or body of the can. The pressure resistance is such that the can end and/or can may undergo a temporary deformation due to the pressure built up. Such a deformation allows temporary increase of internal volume of the can thus minimizing the actual pressure. It also allows inspection of the cans according to the invention at different stages during filling, closing, processing and storing using classical detector systems monitoring the outer shape properties. Accordingly, the opportunity is provided to inspect the cans for too low or too high internal pressure. This will provide relevant information in relation to the closing of the cans in pressurization processes and could detect undesired pressure loss due to leakages or pressure raises due to spoilage.

The present invention is the result of insights based on experimental research so that by particular shaping and dimensioning the can end the above objectives are fulfilled and the above mentioned drawbacks substantially overcome.

Accordingly, the present invention provides a can end for a can, such as an easy opening can, comprising

- a central panel,
- a can end radius for connection to a body of the can; and
- a countersink connected via a transition wall to the can end radius and via a panel wall to the panel,

wherein

- a panel wall angle (A_2,P_2) is 2° - 45°,
- a panel radius (R_4) is larger than 0.5 mm
- a panel depth (H_2) is 1 mm - 7 mm, and
- a counter sink radius (R_3) is less than 5 mm.

The panel wall angle A_2, P_2 is selected within the range of 2° - 45°. At a lower angle connecting, such that seaming the can end onto the body may be difficult or problematic. An angle beyond 45° will have an adverse effect on the pressure performance.

The panel radius R_4 is larger than 0.5 mm. Below 0.5 mm lacquer applied on the metal may be damaged during the forming of the metal, whereas the resistance to small pleats in the adjacent region towards the panel is insufficient. The panel radius R_4 is preferably selected within the range of 1.0 - 1.5 mm. A panel radius R_4 larger than 2 mm may result in a reduction of strength and thereby the occurrence of pleating and buckling in the region towards the counter sink.

The panel depth H_2 is within the range of 1 mm - 7 mm. Below 1 mm panel depth H_2 the panel wall angle A_2, P_2 will become too large. This will have a negative impact on the pressure resistance. Beyond a panel depth H_2 of 7 mm the panel wall angle P_2 will become too small whereby the pressure resistance will not be affected anymore.

For a can end intended as a can bottom the optimum panel depth H_2 is between 2 - 5 mm and for a top closure is H_2 optimal 2.0 - 2.5 mm.

The counter sink radius R_3 should be less than 5 mm. Otherwise, the strength would be insufficient. A counter sink radius R_3 lower than 0.5 mm could result in lacquer cracking during the forming of the metal.

For a can bottom is the counter sink radius R_3 preferably within the range of 0.5 - 1.5 mm. For a can lid is the optimum counter sink radius R_3 from 0.5 - 0.7 mm.

A can end according to the invention having the indicated dimensions and structure will be improved in sustaining higher internal pressures in combination with (temporary) elastic deformation. Pleats and buckles will

appear at higher internal pressures and in localized predetermined locations. Furthermore, early buckling or bursting in the case of an easy open end is avoided and still (due to high internal pressures) total can volume expansions up to 30 cm^3 (at a can diameter of 73 mm) allowed before failure. Generally the internal pressure resistence ranges to at least 2 bar or more, frequently to more than 3 - 4 bar and even to more than 5 bar. This applies to cans having a diameter of generally 45 - 260 mm, preferably in the range of 52 - 153 mm, such as a practical diameter of 73 mm, 83 mm and/or 99 mm.

For a optimal pressure performance it is preferred that the panel wall angle A_2, P_2 is 5° - 35°.

Smaller pleats and less buckles are formed when the panel radius R_4 is selected in the preferred range of 1.0 - 1.5 mm, or even at 1.25 - 1.5 mm.

Optimally, the panel depth H_2 is selected between 2.0 - 2.5 mm.

According to one general embodiment the can end according to the invention is a can bottom for a can. In such can bottom the can end radius is connected to the body of the can and forms a foot of the ultimate can. According to an embodiment of the can bottom according to the invention the foot has an end foot radius R_2 which is less than 5 mm, preferably 0.5 - 1.5 mm. The upper limit for the end foot radius R_2 is such that an axial load does not generate a rolling in of the profile. Thus this can bottom provides less deformability against axial load. Furthermore, when the can end is used for a can which is subjected to thermal processing of the filled can, the closure according to the invention allows the use in continuous cookers, preferably with a can of which its body wall is provided with a rolling bead. For these applications and handling conditions it is

preferred that the end foot radius R_2 is within the range of 0.5 - 1.5 mm.

According to a preferred embodiment of the can bottom according to the invention, the foot has a foot radius R_{13} of less than 5 mm, preferably of 0.5 - 1.5 mm. Preferably in combination with a food height H_{11} in the range of 1-7 mm, preferably 2-5 mm, the can bottom provides a improved or even perfect stackability of the filled can, in particular those provided with an easy opening top closure. Specially when the load of the upper can is on the top of the seam connecting the can lid to the can body and prevents excess wear on the tab of the can lid and thereby prevention of undesired opening of the can lid.

It is noted that the foot of the can bottom may have an outer foot radius R_{14}. The dimensions of the outer foot radius R_{14} depends on the distance between the foot radius R_{13} and the end foot radius R_2.

In addition, the properties and resistance to internal pressure and/or allowance of expansion at various can diameters and wall thicknesses, may be further improved when the unit depth (H_1) is 2 - 10 mm, preferably is 5 - 7 mm.

It is preferred that the can end is provided with a panel outer ring. Such panel outer ring will decrease the sensitivity to pleat formation.

For a can bottom it is preferred that in the can bottom a panel outer ring slope (A_3) is 0° - 35° and a panel outer ring width (L_1) is 0 - 15 mm. The panel outer ring slope A_3 may be up to 35°. A minimum A_3 is about 1°. Preferably the panel outer ring slope A_3 ranges from 2° - 20°. The panel outer ring width L_1 is up to 15 mm. A minimum panel outer ring width for improved properties starts from

about 0.5 mm or from 1 mm. Preferably L_1 is within the range of 1 - 5 mm.

According to another general embodiment according to the present invention the can end according to the invention is a can lid. It could be an easy opening can lid or any other type of can lid which may require an opener for opening the can.

For optimal properties the can lid according to the invention has the unit depth (H_1) is 5 - 7 mm.

When the can lid is provided with a panel outer ring then it is preferred that in the can lid the panel outer ring slope (P_3) is 0° - 35° and the panel outer ring width (L_1) is 0 - 15 mm, preferably 1 - 3 mm, more preferably 1 - 2 mm. The panel outer ring width L_1 for the can lid is less than 15 mm and a minimum width is about 0.5 mm. A preferred range for the outer ring width L_1 for the can lid is 1 - 3 mm, more preferably 1 - 2 mm.

The panel outer ring slope P_3 of the can lid according to the invention is preferably up to 35°. A minimum slope P_3 is as from 0.5° more preferably as from 1° or 2°. The general range is therefore from 0.5° - 35° preferably 2° - 20°.

In both can lid and can bottom there may be an angle with the transition wall. This foot wall angle A_1 ranges from 0° - 45°, preferably from 2° - 35°.

When present the panel outer ring L_1 has a width of more than about 0.1 to 0.2 mm. When present the panel outer ring may be provided with the score line. Preferably, the score line is located closer to the panel center than to the counter sink which is optimal for the burst resistance.

Preferably, the panel ring has a slope A_3, P_3 such that higher internal pressures will less distort the form and structure of the can end. The panel ring slope A_3, P_3 may be up

to 35° which results in a reduction of the formation of pleats. Preferably, the panel ring slope A_3, P_3 is within the range of 2° - 20° whereby the panel is provided with a well rounded shape which is least distorted due to internal pressure build up.

The can end according to the invention may be an easy opening can end for an easy opening can. Thus, for opening the can via a preformed opening defined by a score line in the can end it is preferred that the can end is provided with an opening tab.

According to another aspect of the invention is provided a can which comprises a body and at least one can end according to the invention as described above. In one embodiment of the can according to the invention, the body may be provided at both ends with a can end according to the invention. In another embodiment only the can lid is a can end according to the invention. The can bottom or can lid may be integral with the body of the can and formed by any conventional process such as DWI, DRD and (deep) drawing. In another embodiment the can may be provided with a body and a can lid and with a can bottom which is a can end according to the invention.

Another preferred can according to the invention is a can which is composed of a can lid as described above (preferably with an opening tab and cooperating score line) and with another can lid as described above (not provided with opening means) but functioning as a can bottom. Accordingly, the advantage is obtained that the can lid functioning as a can bottom due to its design has a larger radius and therefore better in internal pressure resistance and allowing more expansion within elastic limits. According to another embodiment the can is provided with a can lid and with a can bottom as described above in relation to the

present invention. Either of the can ends may be integral with the body of the can. The other can end is connected to the body of the can by traditional techniques such as seaming.

According to one aspect of the present invention, there is provided metallic can end for a can, such as an easy opening can, comprising: a flat or concave central panel (2), a can end radius for connection to a body of the can; and a counter sink connected via a transition wall to the can end radius and via a straight panel wall (4) to the central panel (2), wherein a panel wall angle (A_2,P_2) is 2° - 45°, a panel radius (R_4) is larger than 0.5 mm, a panel depth (H_2) is 1 mm – 7 mm, and a single counter sink radius (R_3) in the range of 0.5 mm to 5 mm, wherein the counter sink radius determines the internal curvature of the section between the panel wall (7) and the transition wall.

Mentioned and other features and characteristics of the can end and can according to the present invention will be further illustrated by means of several embodiments which are given for illustrative purposes and are not intended to limit the present invention to any extend. In particular, cans are illustrated with an easy open end, but of course, such cans could also be realized with one or more sanitary end or more generally a non-easy open end. These embodiments will be described with reference to the annexed drawings in which:

figures 1, 2 and 3 partial cross-sections of can lid according to the invention;

figure 4 at a smaller scale a can provided with a can lid according to the invention;

figure 5 at a larger scale the can lid of a can having a localized pleated or buckled region due to internal pressure build up;

figure 6 shows in cross section a can bottom according to the invention;

figures 7-8 are details VII and VIII of figure 6;

figure 9 is an alternative embodiment of the can bottom of figure 7,-

figures 10 and 11 are an alternative embodiment of the can bottom of figure 8;

figure 12 is an alternative embodiment of the can bottom of figure 6;

figure 13 is in cross section a can according to the invention provided with a can lid of figure 3 and as a can bottom the can lid of figure 1

bottom the can lid of figure 1 (integrally formed with the can body);

figure 14 is a can according to the invention as an alternative to the can of figure 4 having as a can bottom the can bottom of figure 6;

figure 15 is a can according to the invention provided with a can lid according to figure 3 and a can bottom according to figure 12; and

figure 16 is a can according to the invention with two can ends seamed to the can body.

Figure 1 shows a can lid or can bottom 1 according to the invention. The can end has a central panel 2 and a can end radius or curl 3 for attachment, for instance by seaming, to a body of a can. The can end 1 further comprises a counter sink 4 which is connected via a transition wall 5 to a seaming panel 6 of the curl 3. The counter sink 4 is also connected via a panel wall 7 to the panel 2.

The panel wall angle P_2 is determined by the slope 8 of the panel wall 7 relative to the vertical line 9. The panel radius R_4 determines the curvature of the connection between the panel wall 7 and the panel 2. The counter sink radius R_3 determines the internal curvature of the section between the panel wall 7 and the chuck wall 5. Finally, the panel depth H_2 is the distance between the underside of the counter sink and the panel 2 and unit depth H_1 the distance between seaming panel 6 and the counter sink underside.

In the can end 1 is the panel wall angle P_2 15°, the panel radius R_4 1.30 mm, the panel depth H_2 2.3 mm and the counter sink radius R_3 0.6 mm.

Figure 2 shows another can end 10 according to the invention.

In comparison to the can end 1 of figure 1 is the panel wall angle P_2 increased. The panel radius R_4 is also

increased as well as the counter sink radius R_3. The panel depth is also reduced.

As shown in figure 2 is the can end 10 further provided with a panel outer ring 11 at the circumference of the panel 2 and connected via the panel wall 7 to the counter sink 4. The outer ring 11 has a width L_1 of 1 mm and is provided with a score line 12. The panel outer ring 11 has a slope with the horizontal 13. This panel outer ring slope P_3 is 20°.

The dimensions of the can end 10 are panel wall angle P_2 = 30°, panel radius R_4 = 0.8 mm, panel depth H_2 = 1.2 mm, counter sink radius R_3 0.9 mm and panel outer ring width L_1 1.5 mm.

Figure 3 shows a can end 14 according to the invention. In comparison to the can end 10 illustrated in figure 2, the panel wall angle P_2 is 10°, the panel radius R_4 is 1.8 mm, the panel depth H_2 is 2.4 mm and the counter sink radius R_3 is 0.6 mm. Furthermore, the outer ring width L_1 is 1.5 mm and the outer ring panel slope P_3 is 10°.

The following table shows buckle resistance of the can ends 1, 10 and 14 (made of steel) dependent on metal range and metal temper.

case identification	metal gauge	metal temper	burst pressure
closure 1 of figure 1	0.23 mm	TH 580	4.9 bar
closure 10 of figure 2	0.23 mm	TH 580	4.0 bar
closure 14 of figure 3	0.23 mm	TH 580	5.1 bar
closure 1 of figure 1	0.24 mm	TH 435	4.1 bar
closure 10 of figure 2	0.24 mm	TH 435	3.2 bar
closure 14 of figure 3	0.24 mm	TH 435	4.4 bar

Figure 4 shows a can according to the invention. The can 15 is provided with a body 16 and an integral concave can bottom 16 of greater wall thickness and a seamed can end 18 according to figure 1 (although can ends 10 or 14 of respectively figures 2 and 3 could also have been applied). The panel 19 of the can end 18 is provided with an opening tab 20 connected via a rivet 21 to the panel 19. The panel 19 is further provided with a circular score line 22. Accordingly, the can 15 is an easy opening can for beverage and/or food content.

Figure 5 shows at a larger scale the can of figure 4. Due to undesired pressure development in the closed container 15 a buckle 23 formed locally (over a part of the circumference) in the region between the counter sink and the panel. As illustrated the other regions of the can end 18 are not distorted.

Figure 6 shows a can bottom 24 of the invention which is integrally connected to a body of the can. The can bottom 24 comprises a central panel 25 which is provided with a outer panel ring 26 which is connected via a panel radius 27 to a panel wall 28 which via a counter sink radius 29 is connected to a transition wall 30. The transition wall 30 is connected via an end/foot radius 31 to the body wall 32. The details of the can bottom 24 are shown in figures 7 and 8.

The minimal value of the outer radius R_{14} is dependent on the distance between the food radius R_{13} and the end food radius R_2.

The following table shows the buckle (pressure) resistance of the can end 24 of figures 6-8 at a wall thickness of 0.22 mm and dependent on the unit depth H_1 and the panel depth H_2.

Thickness	H1 (mm)	H2 (mm)	Buckle pressure (bar)
0.22	5.6	3	52
0.22	6	3	53
0.22	6.4	3	54
0.22	6.8	3	55

Thickness	H1 (mm)	H2 (mm)	Buckle pressure (bar)
0.22	6	2.6	52
0.22	6	2.8	52
0.22	6	3	53
0.22	6	3.2	54

Figure 9 shows an alternative can bottom 33 according to the invention. This can bottom 33 comprises a panel 34

which is directly connected to a panel radius 35. Accordingly, this panel 34 does not comprise a panel ring.

Figure 10 shows still another embodiment of a can bottom 36 according to the invention. In this embodiment the can end/foot radius 31 is directly connected to the body wall 32 of the can. Accordingly, this can bottom 36 does not comprise the foot radius R_{13} and the outer foot radius R_{14} (see figure 7).

Figure 11 shows still another alternative embodiment in the form of a can bottom 37 in comparison to the can bottom 24 of figure 8, the can bottom 37 comprises in the body wall 32 a rolling bead 38 for guiding the closed can provided with the can bottom 37 during processing in a continues cooker.

Figure 12 shows another embodiment of a can bottom 39 of the invention. This can bottom 39 comprises a body wall 32 and a can end/foot radius 31 connected via a transition or chuck wall 30 and a counter sink radius 29 to a panel wall 28. The panel wall 28 is connected via a panel radius 27 to a central panel 40. In comparison to the can bottom 24 of figure 6 this panel has a convex shape as the integral can bottom 17 (not according to the invention) as illustrated for the can 15 of figure 4.

Figure 13 shows a can 41 comprising a body wall 42 provided with a can lid 43 and an integral can bottom 44. The can lid 43 is a can lid 14 as shown in figure 3. The can lid 14 is connected by a seam 45 to the body wall 42. The can lid 14 is provided with an opening tab 46 for opening the can 41 via an opening determined by a score line 12 formed in panel outer ring 11. The can bottom 44 is a can end 1 as presented in figure 1 as a can lid but integrally formed with the body wall 42. The can end 1 comprises the panel 2 connected via the panel wall 7 and the counter sink 4 and the transition

wall 5 to the curl or can end radius 3 which integrally is connected to the body wall 42.

Figure 14 shows another can 47 according to the invention. It is an alternative to the can 15 shown in figure 4. In this alternative the can bottom 48 is formed by the can bottom 24 as shown in figure 6.

Figure 15 shows another can 49 according to the invention which is an alternative to the can 44 of figure 13. In this case the can bottom 50 has the form of the can bottom 39 as illustrated in figure 12.

Finally, figure 16 shows a can 51 according to the invention in which a can lid 54 and a can bottom 52 are both seamed to a can body 53.

It is noted that the various can lids and can bottoms could be manufactured by standard technologies by drawing from a disc shape metal part using various dies for forming the various can end structures. Each can end may be used as can lid and/or can bottom as is desired.

The metal used may be of any suitable metal such as aluminum, steel, plated steel. The metal may be provided with a coating in the form of a lacquer or plastic layer as is traditionally used for food and beverage cans.

CLAIMS:

1. Metallic can end for a can, such as an easy opening can, comprising:

a flat or concave central panel (2),

a can end radius for connection to a body of the can; and

a counter sink connected via a transition wall to the can end radius and via a straight panel wall (4) to the central panel (2), wherein

a panel wall angle (A_2,P_2) is 2° - 45°,

a panel radius (R_4) is larger than 0.5 mm,

a panel depth (H_2) is 1 mm – 7 mm, and

a single counter sink radius (R_3) in the range of 0.5 mm to 5 mm, wherein the counter sink radius determines the internal curvature of the section between the panel wall (7) and the transition wall.

2. Can end as claimed in claim 1, wherein the panel wall angle (A_2,P_2) is 5° - 35°, and the panel radius (R_4) is 1.0 – 1.5 mm.

3. Can end as claimed in claim 1, wherein and panel radius (R_4) is 1.0 – 1.5 mm.

4. Can end as claimed in claim 1, wherein the panel wall angle (A_2,P_2) is 5° - 35°.

5. Can end as claimed in claim 1 or 2, wherein the can end is a can bottom, and the can end radius forms a foot and the foot has an end foot radius R_2 which is less than 5 mm.

6. Can end as claimed in claim 5 wherein R_2 is between 0.5 – 1.5 mm.

7. Can end as claimed in claim 5, wherein the counter sink radius (R_3) is 0.5 – 1.5 mm, and the panel depth (H_2) is 2 – 5 mm.

8. Can end as claimed in claim 5, wherein the panel depth (H_2) is 2 – 5 mm.

9. Can end as claimed in claim 5, wherein the countersink radius (R_3) is 0.5 – 1.5 mm.

10. Can end as claimed in any one of claims 5 to 9, wherein a foot radius (R_{13}) is less than 5 mm.

11. Can end as claimed in claim 10, wherein the foot radius (R_{13}) is between 0.5 – 1.5 mm.

12. Can end as claimed in any one of claims 5 to 11, wherein the foot height (H_{11}) is 1 – 7 mm.

13. Can end as claimed in claim 12, wherein the foot height (H_{11}) is between 2 – 5 mm.

14. Can end as claimed in any one of claims 5 to 13, wherein the unit depth (H_1) is 2 – 10 mm.

15. Can end as claimed in claims 3-6, wherein the unit depth (H_1) is 5 – 7 mm.

16. Can end as claimed in claim 14, wherein a panel outer ring slope (A_3) is 0° - 35° and a panel outer ring width (L_1) is 0 – 15 mm.

17. Can end as claimed in claim 16, wherein the panel outer ring slope (A_3) is 2° - 20°.

18. Can end as claimed in claim 16, wherein the panel outer ring width (L_1) is 1 – 5 mm.

19. Can end as claimed in claim 16, wherein the panel outer ring slope (A_3) is 2° - 20° and the panel outer ring width (L_1) is 1 – 5 mm.

20. Can end as claimed in claim 1 or 2, wherein the can end is a can lid.

21. Can end as claimed in claim 20, wherein the panel depth (H_2) is 2.0 – 2.5 mm.

22. Can end as claimed in claim 20, wherein the counter sink radius (R_3) is 0.5 – 0.7 mm.

23. Can end as claimed in claim 20, wherein the panel depth (H_2) is 2.0 – 2.5 mm and the counter sink radius (R_3) is 0.5 – 0.7 mm.

24. Can end as claimed in claim 20, wherein the unit depth (H_1) is 5 – 7 mm.

25. Can end as claimed in any one of claims 20 to 24, wherein the panel outer ring slope (P_3) is 0° - 35° and the panel outer ring width (L_1) is 0 – 15 mm.

26. Can end as claimed in claim 25, wherein the panel outer ring width (L_1) is 1 - 3 mm.

27. Can end as claimed in claim 25, wherein the panel outer ring width (L_1) is 1 – 2 mm.

28. Can end as claimed in any one of claims 25, 26, 27 wherein the panel outer ring slope (P_3) is 2° - 20°.

29. Can comprising a body and at least one can end according to any one of claims 1-25.

30. Can comprising a body and at least one can lid that is a can end according to any one of claims 20 to 28.

31. Can comprising a body and at least one can bottom that is a can end according to any one of claims 5 to 19.

32. Can as claimed in any one of claims 29 to 31, wherein the can comprises a can lid and as a can bottom another can lid.

33. Can as claimed in any one of claims 29 to 31, wherein the can comprises a can lid and a can bottom.

34. Can as claimed in claim 30, wherein the can lid is integral with the body of the can.

35. Can as claimed in claim 31, wherein the can bottom is integral with the body of the can.

36. Can as claimed in claim 33, wherein the can lid or the can bottom is integral with the body of the can.

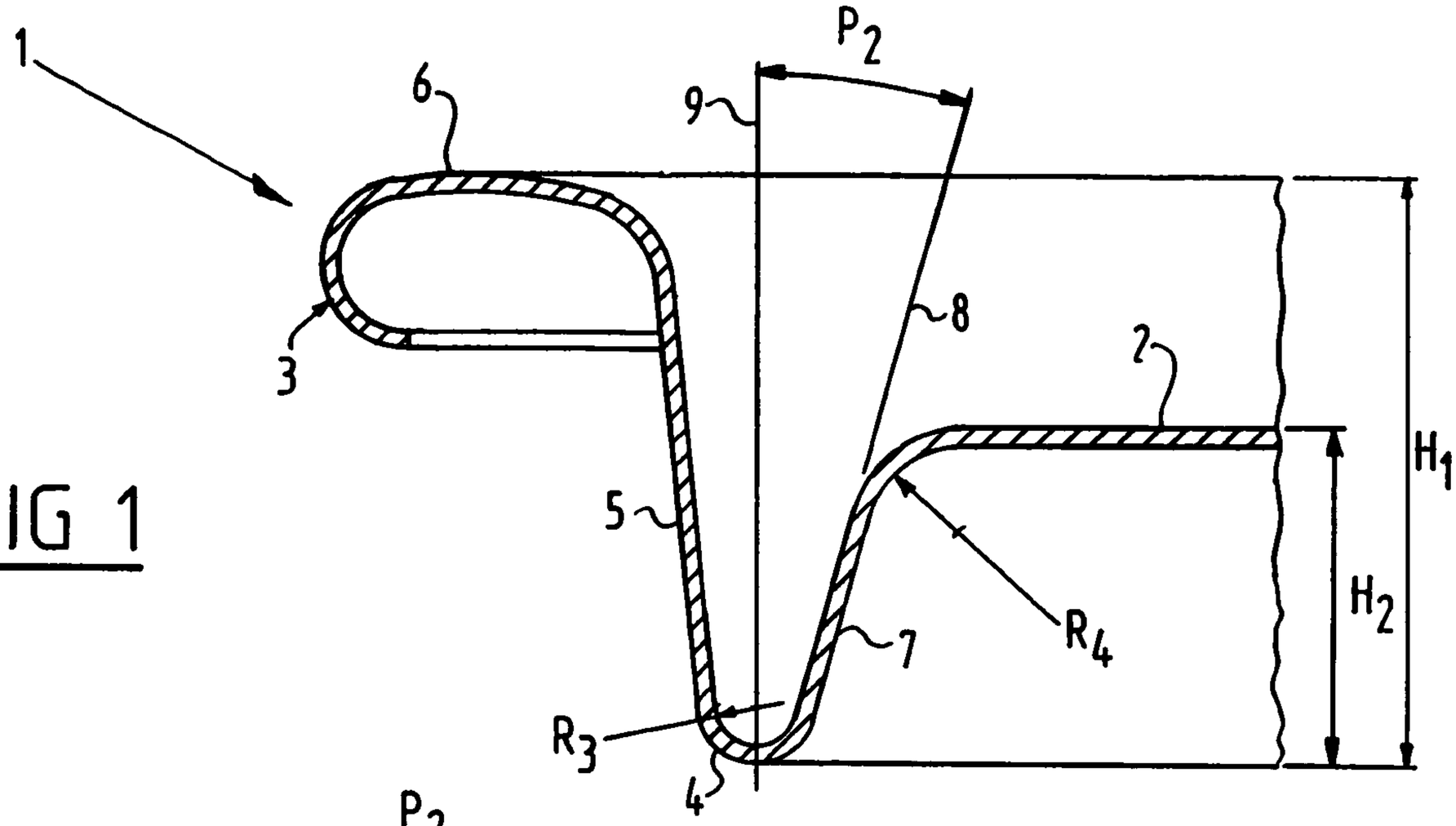


FIG 1

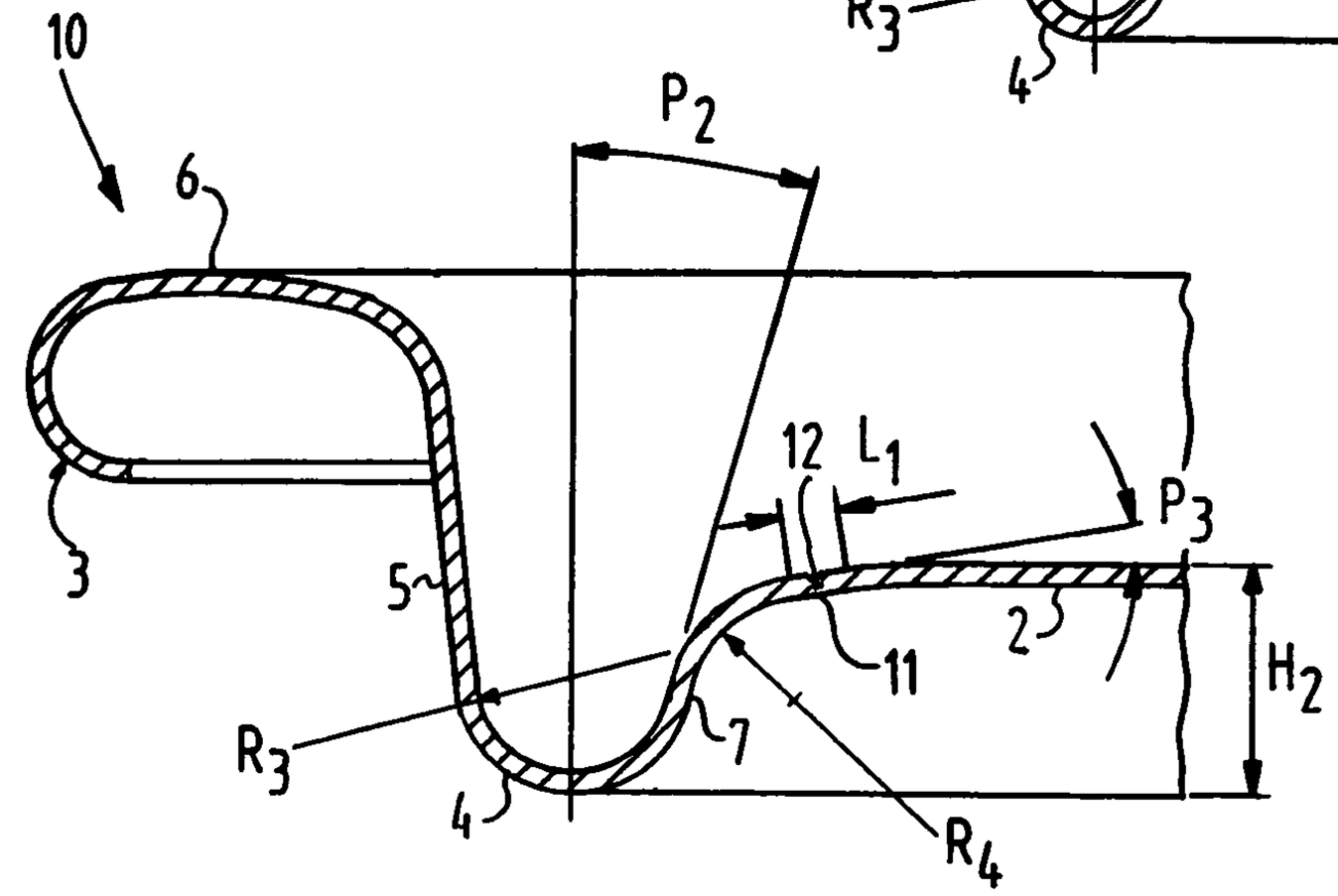


FIG 2

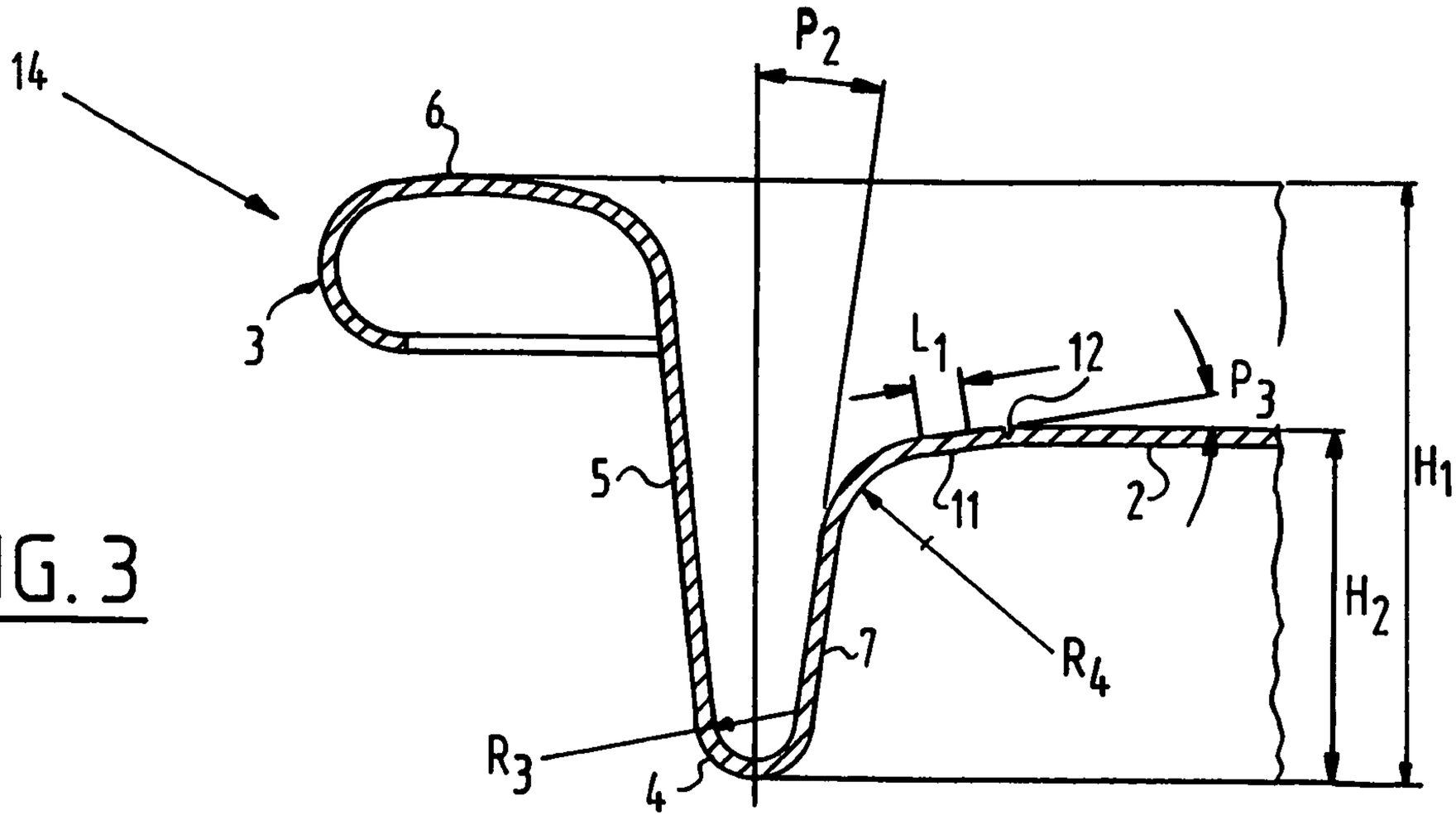


FIG. 3

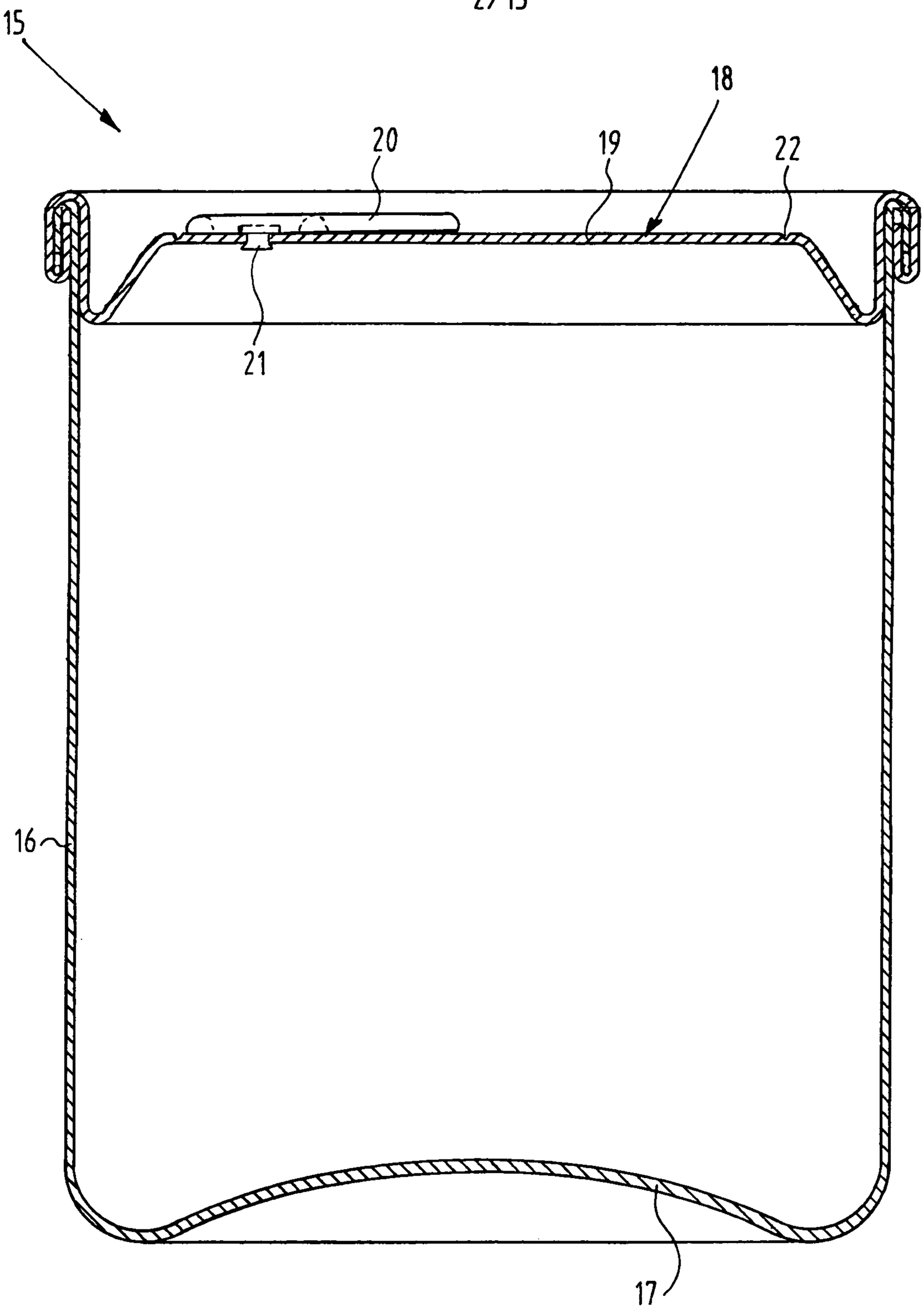


FIG. 4

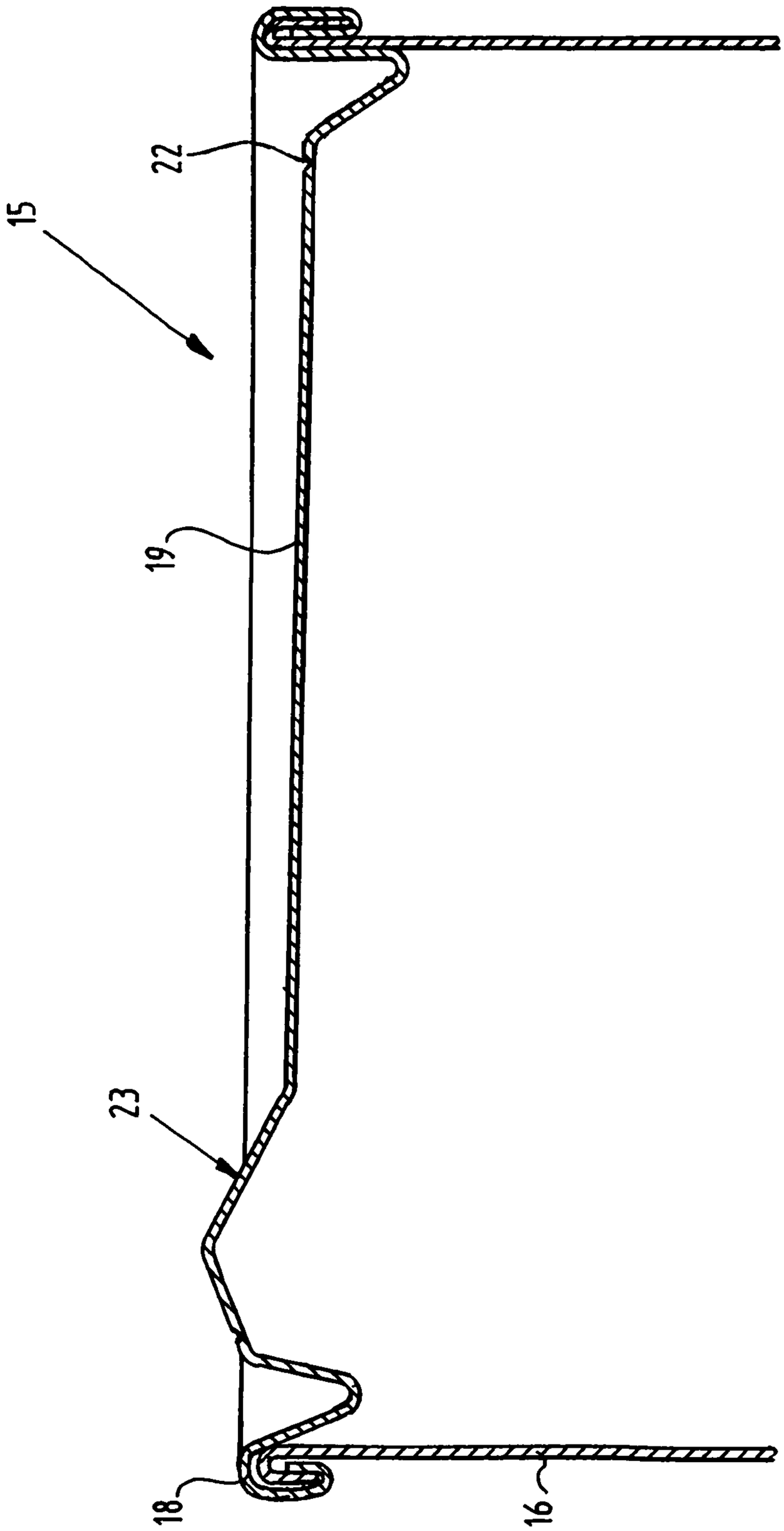


FIG. 5

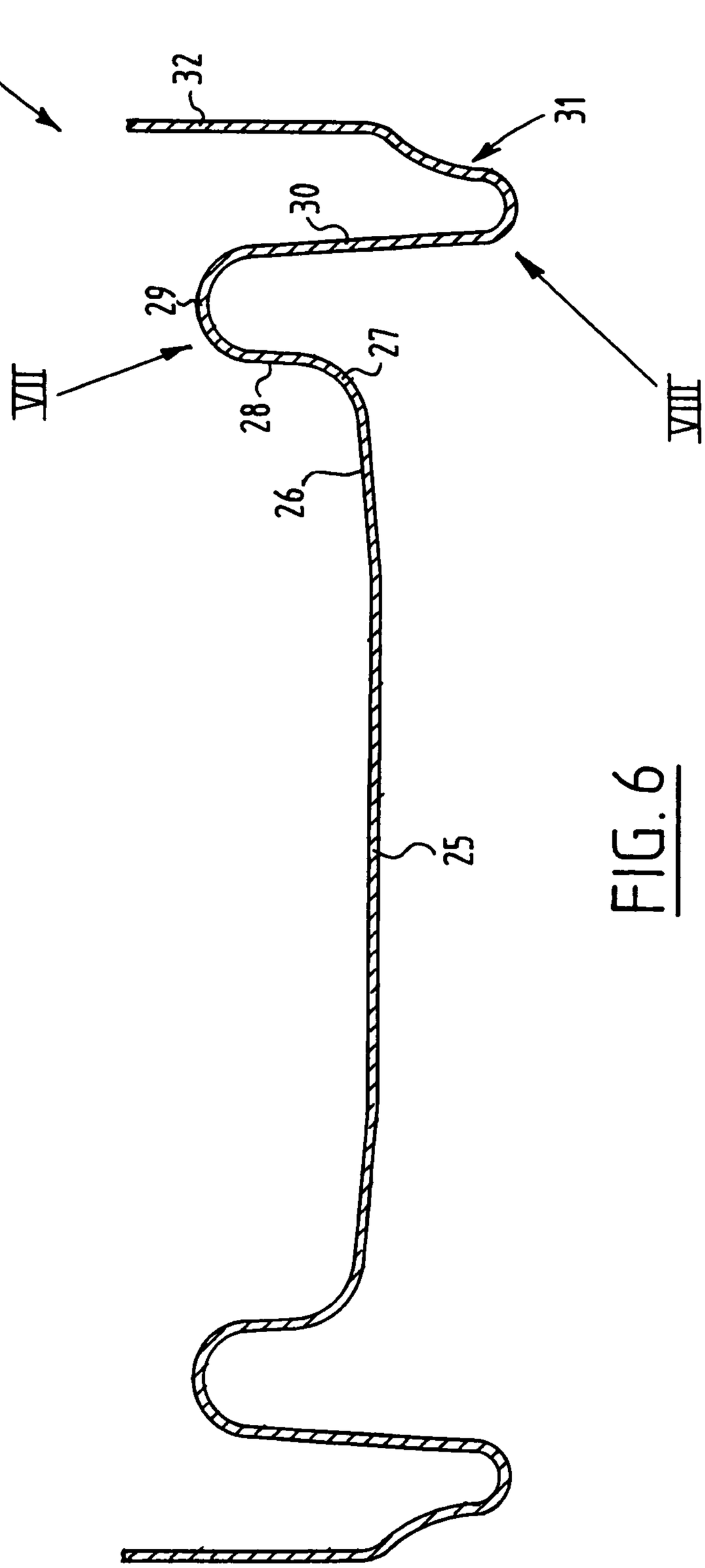


FIG. 6

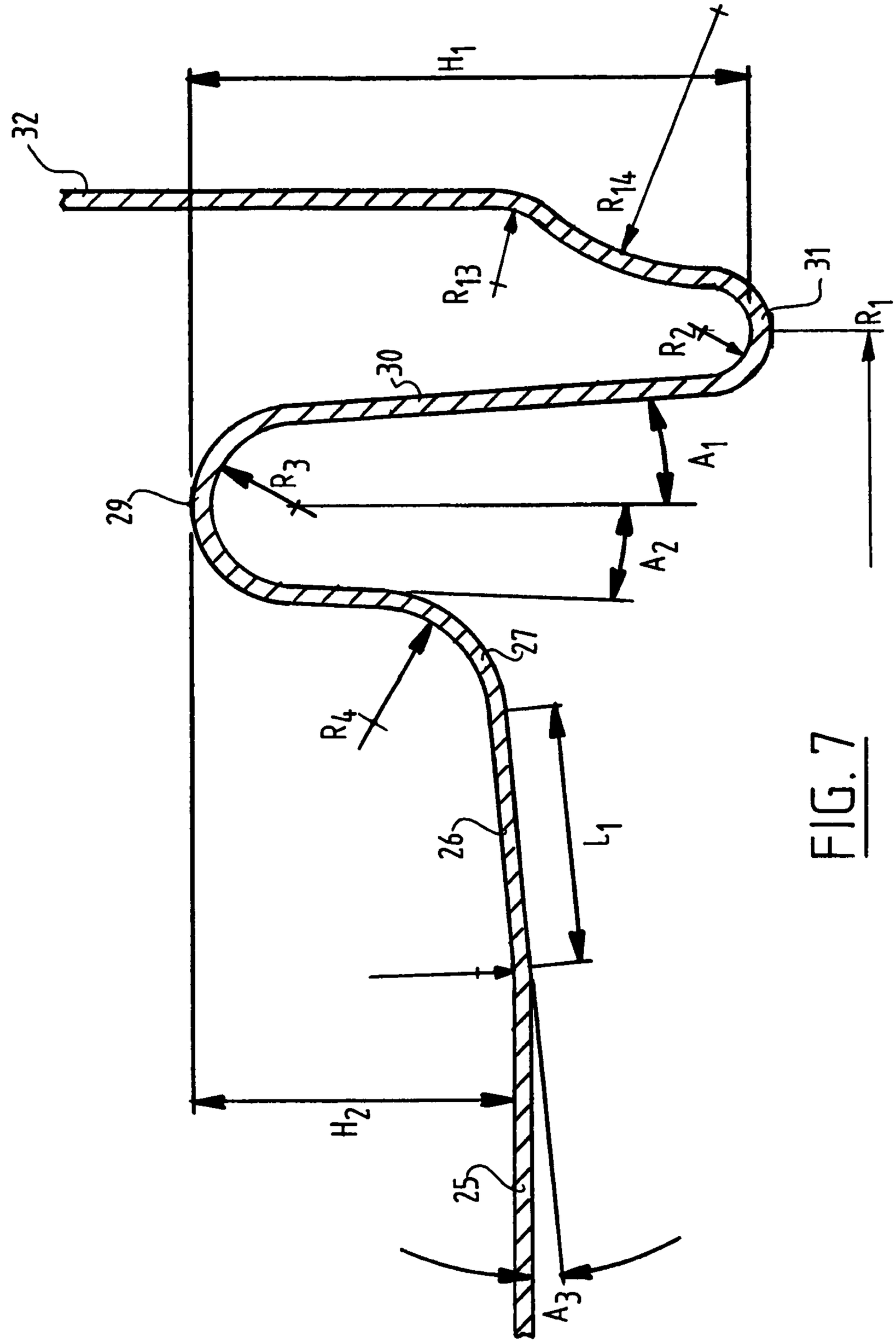


FIG. 7

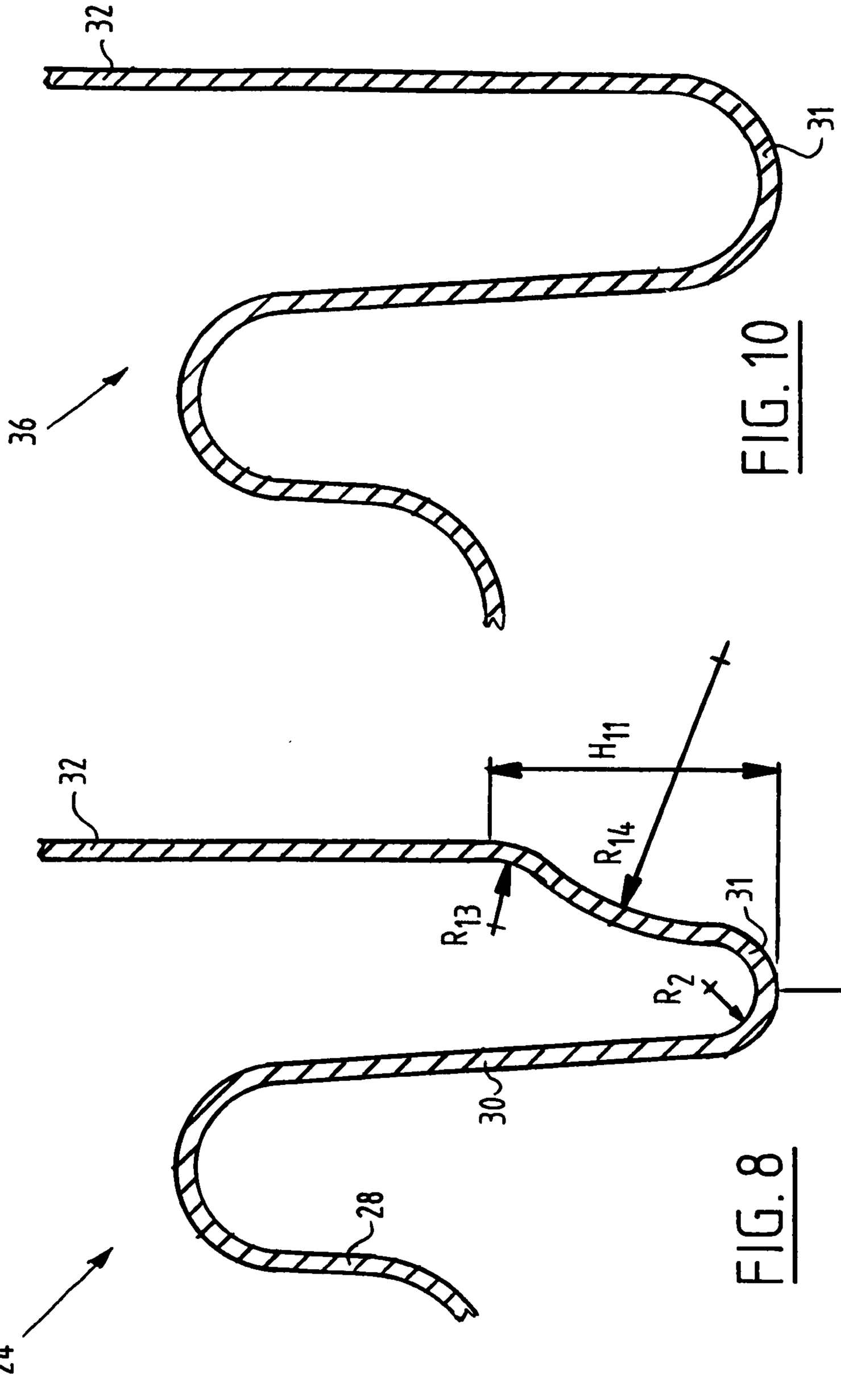


FIG. 10

FIG. 8

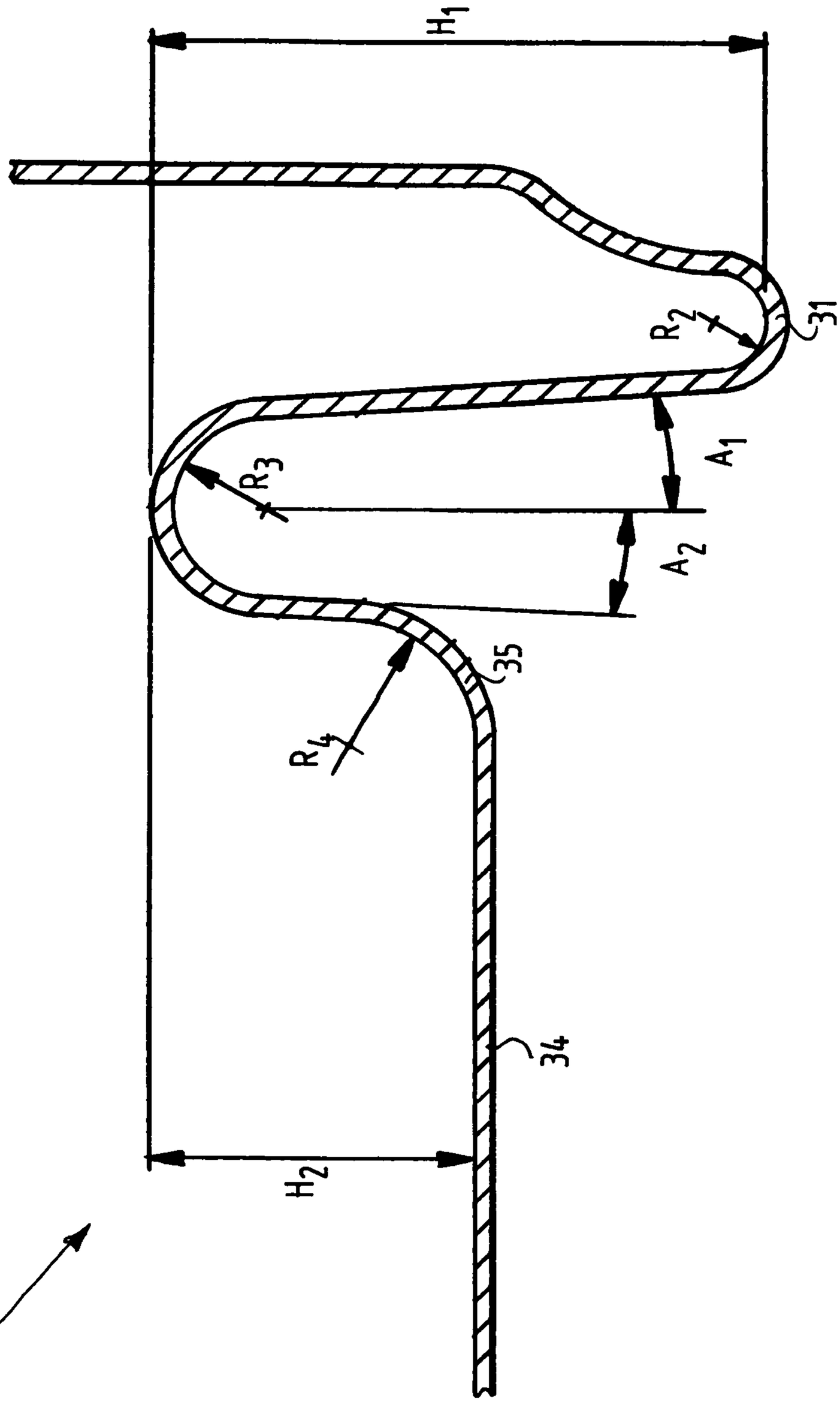


FIG. 9

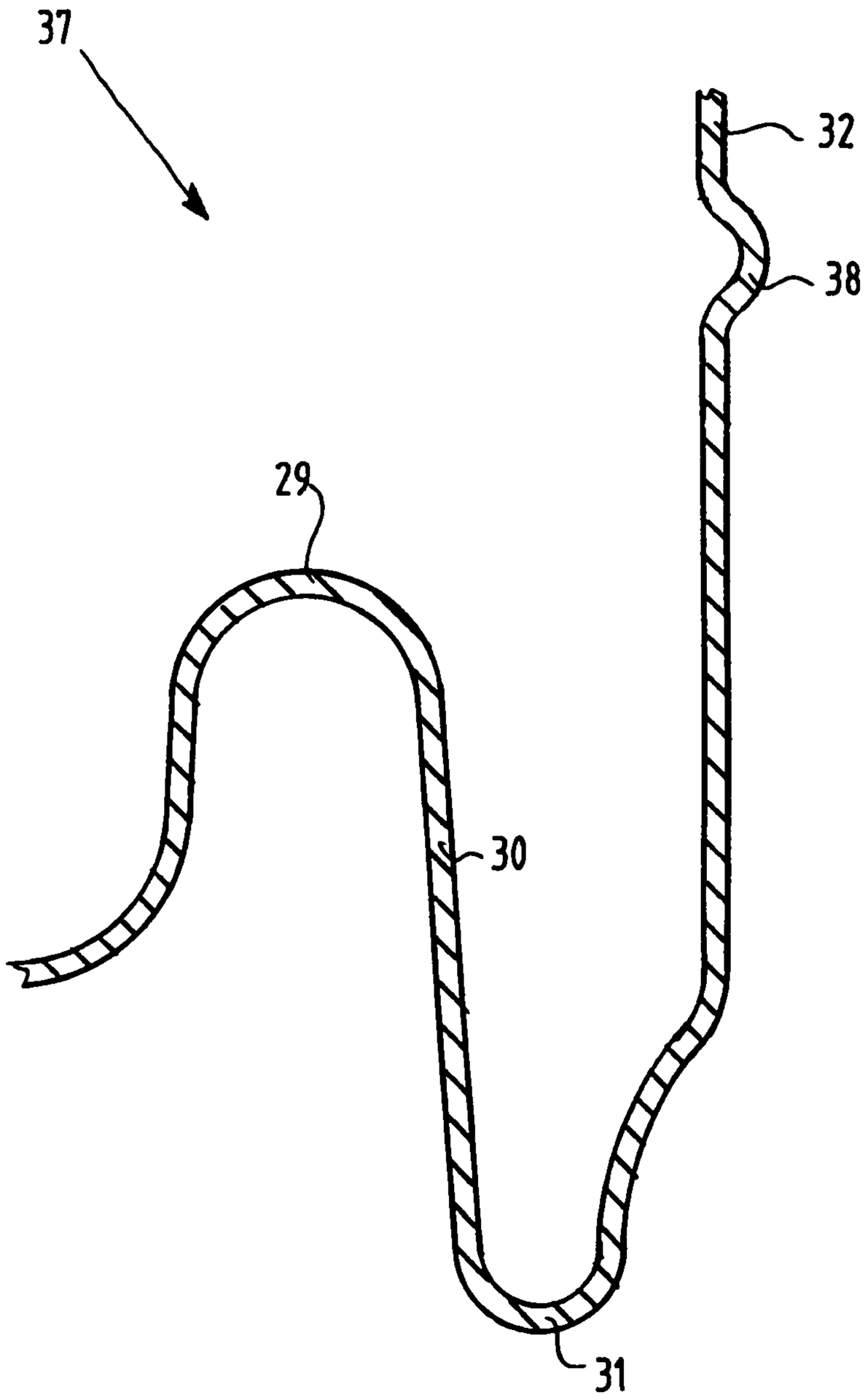


FIG. 11

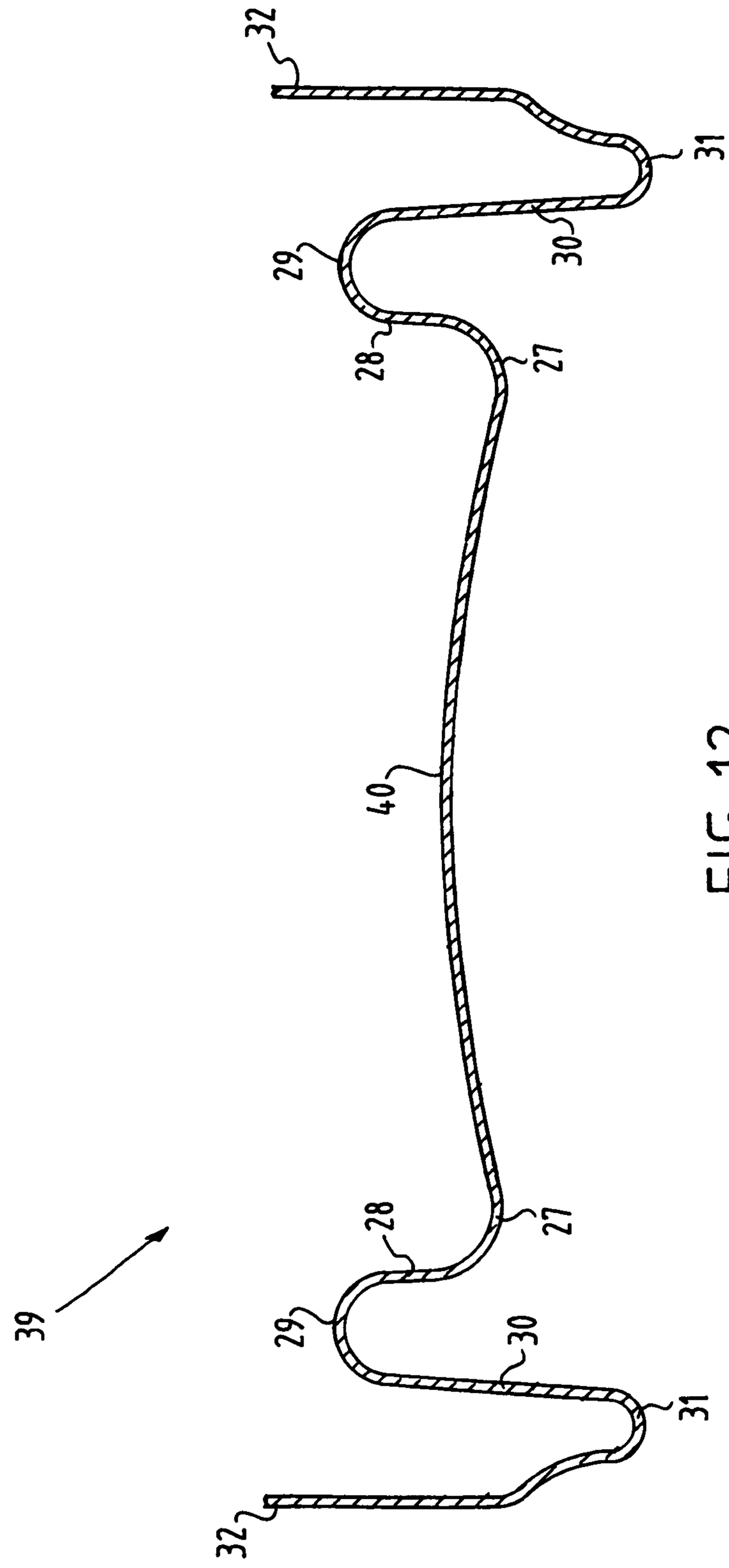


FIG. 12

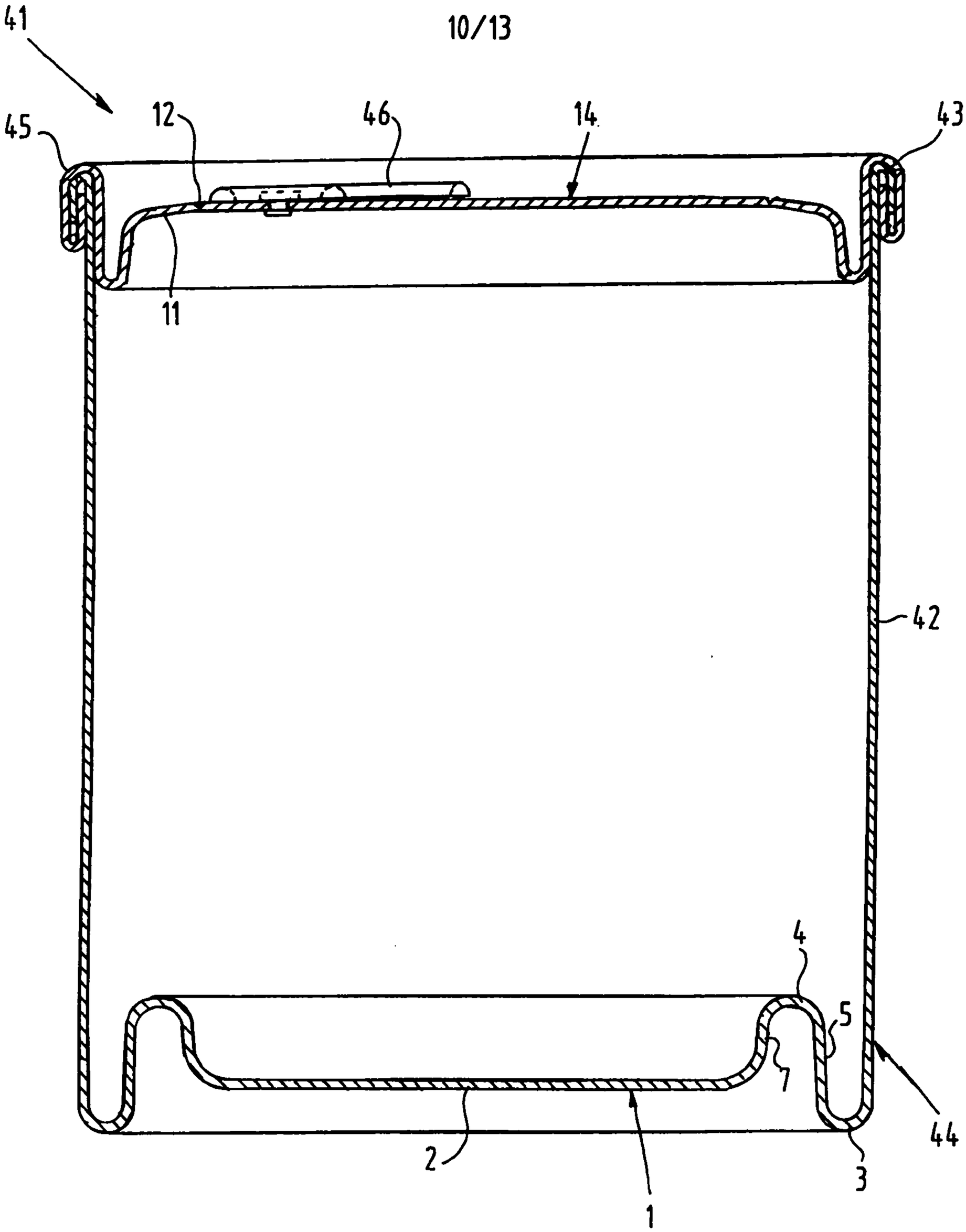


FIG. 13

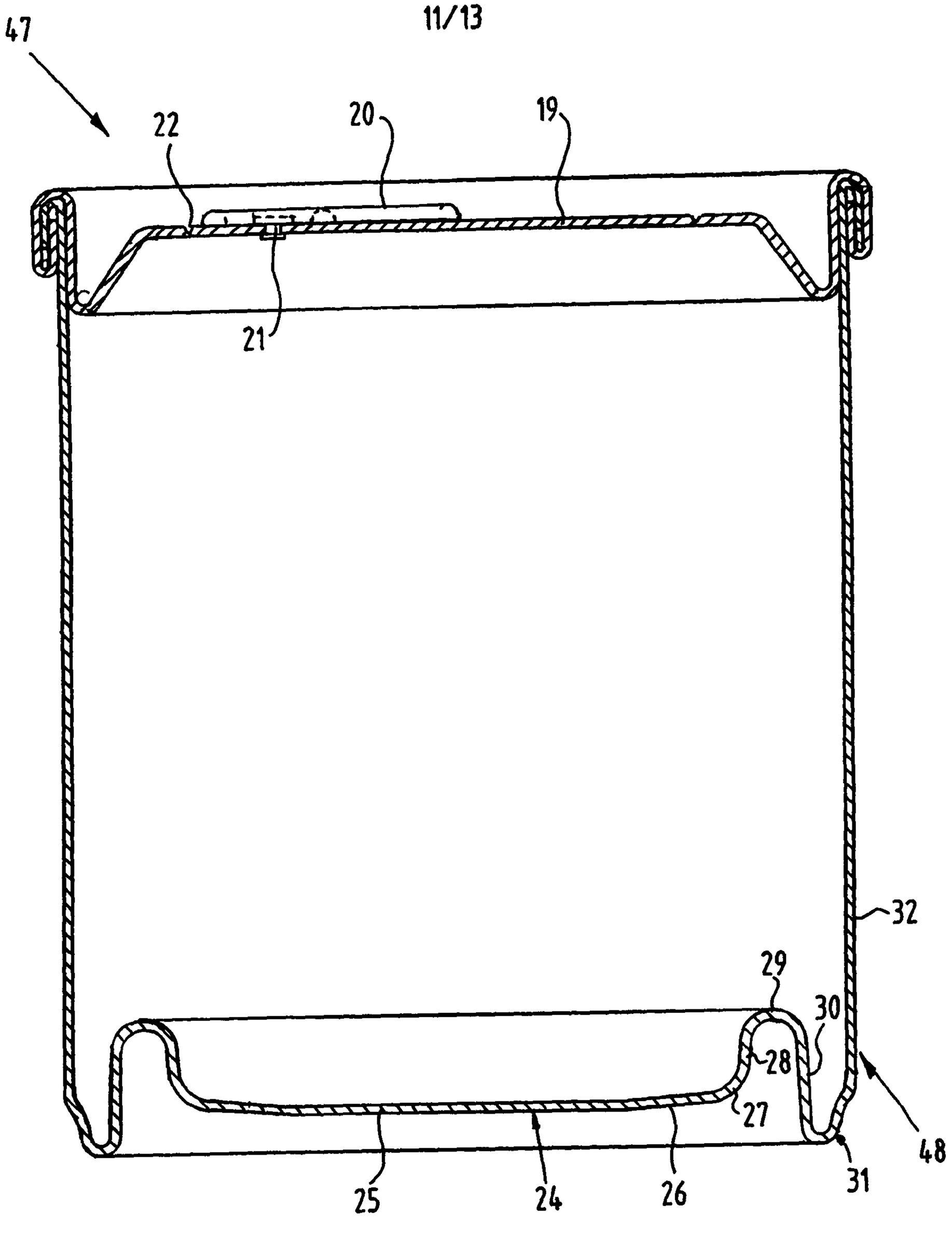


FIG. 14

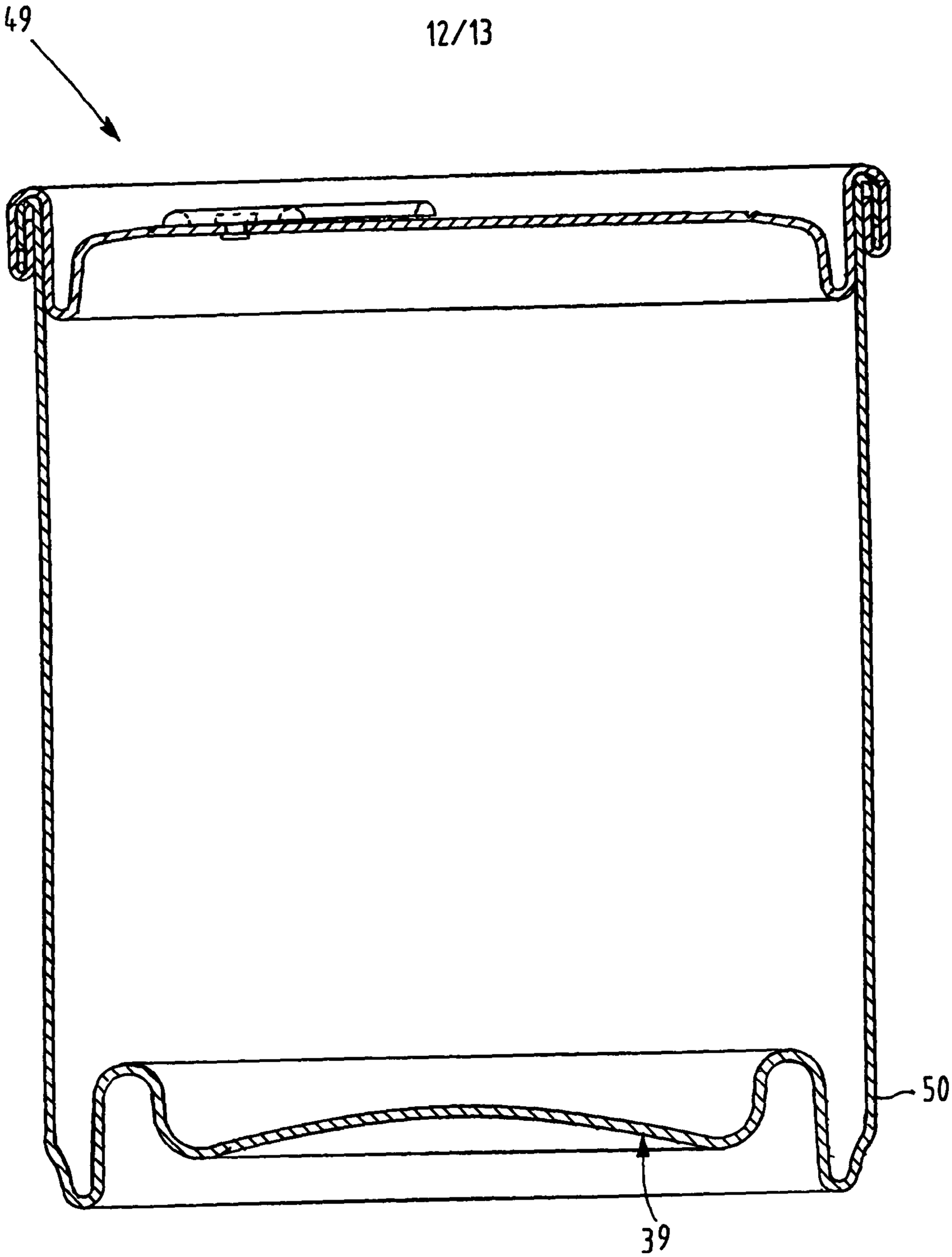


FIG. 15

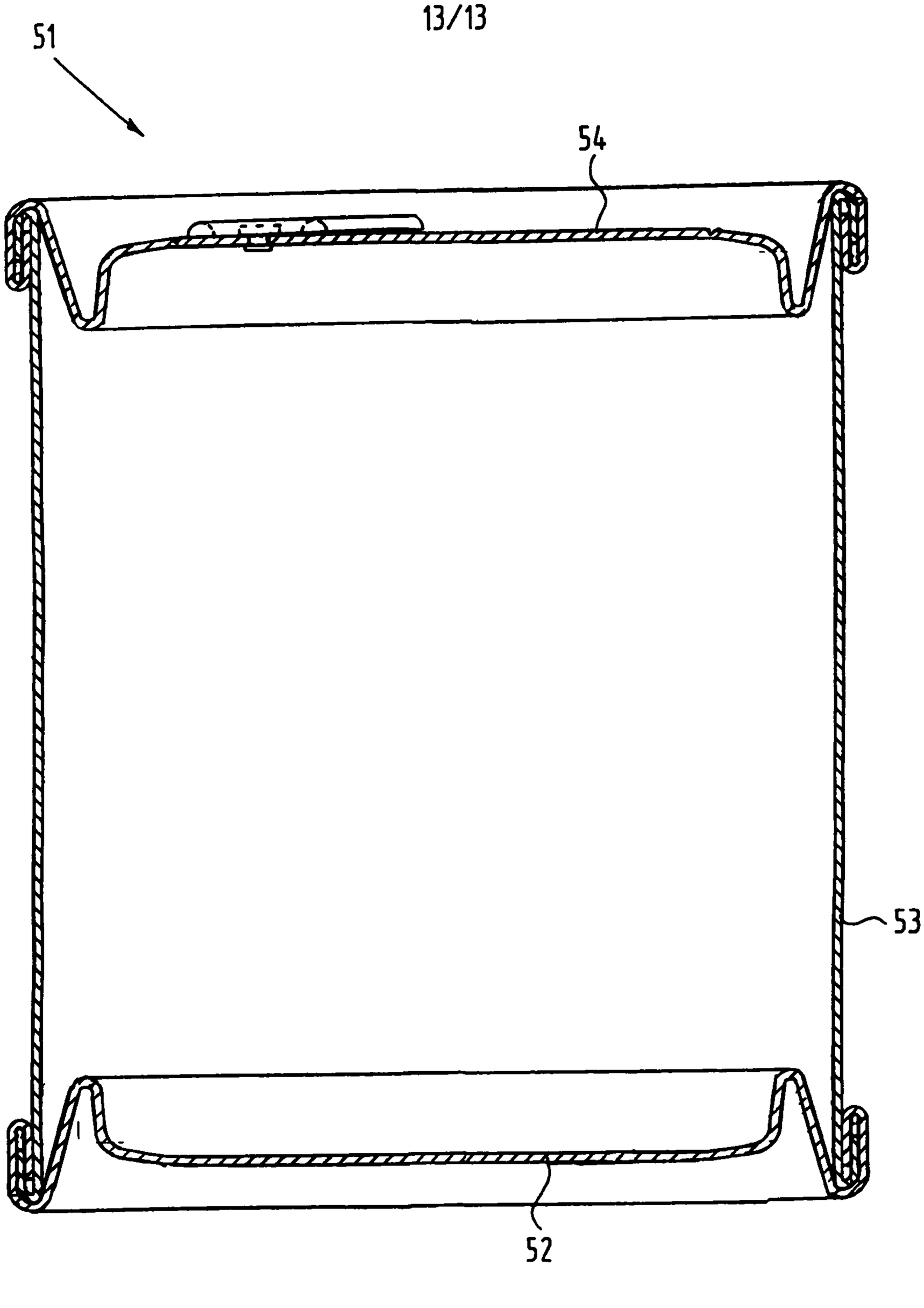
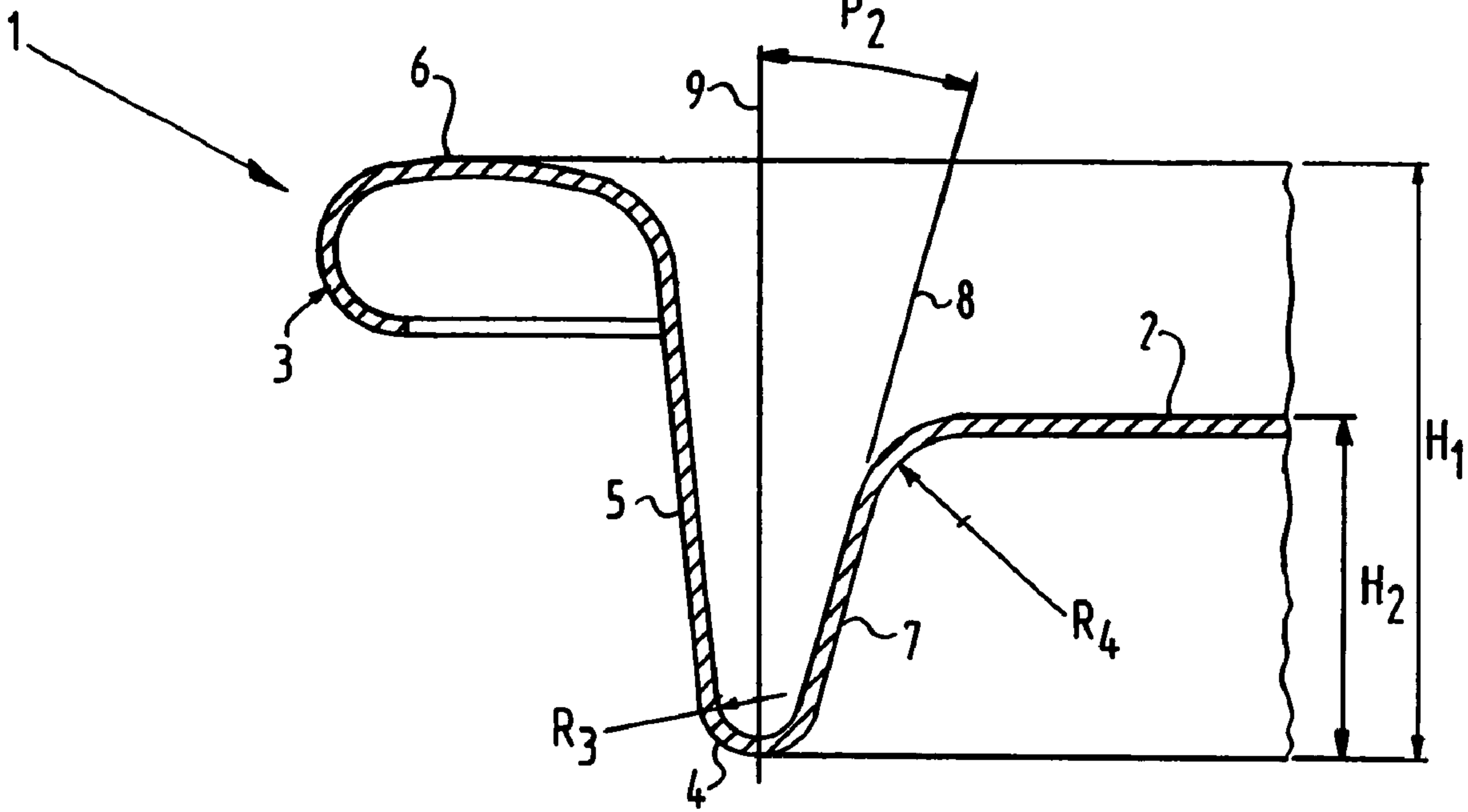


FIG. 16


1
6
9
P_2
3
8
2
5
7
R_4
H_1
H_2
R_3
4