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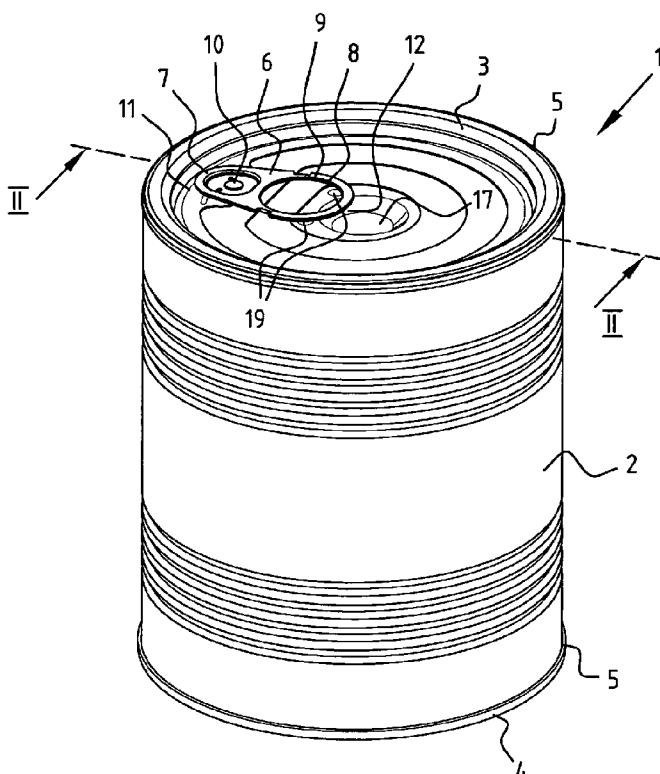


Fig. 1

(57) Abstract: The invention relates to a can, comprising a body provided with a panel, wherein the panel is provided with a tab comprising a front tab part and a rear tab part for gripping in forming by engagement of the front tab part with the panel of an opening in the panel, wherein the panel is provided with a flip panel area at least beneath the rear tab part, which panel area forms a depression beneath the rear tab part dependent on a negative pressure difference over the panel, and to a body and panel for such can.

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**CAN, AND A BODY AND PANEL THEREFORE**

5 The present invention relates to a can, and to a body and a panel therefore.

This can according to the invention may be of the type having a so-called easy opening closure. An easy opening closure is a metal closure for a can in which an opening 10 may be formed by using one or more fingers and without the requirement of a separate opening tool. To that extent the can is provided with a tab for forming an opening in the panel of the can. The tab functions as a lever.

In one aspect, the tab comprises a rear tab part which 15 is to be gripped by the user. By levering or tilting of the tab the front tab part is actuated. Actuation by levering or tilting results in popping an initial opening in the panel. The opening is defined by a score line. The score line is generally circumferential. With the tab in an 20 upright position a maximum popping opening is formed. Tearing the tab outwardly results in scoring out of the panel. Finally, by hinging the panel is torn apart from the can and the can opening is formed.

The can according to the invention may also be 25 provided with a smaller opening by the levering action of the tab, thereby forming a small opening just sufficient for emptying the content of the can.

Users of the types of can described above appreciate sometimes a problem in gripping the rear tab part. 30 Normally, this required that a nail or finger tip is inserted in between the panel and the rear tab part for starting the gripping action.

It is an object of the present invention to overcome or ameliorate at least one of the disadvantages of the prior art, or to provide a useful alternative.

The invention has for its object, in at least its 5 preferred form, to improve the initial gripping action by the user. This improvement is under the condition that other functions of the can and tab are not influenced, such as the manufacture, filling, handling and opening of the can by the tab.

10 The present invention is based on the insight that cans may have, after filling and closure, an internal pressure, which is different from the surrounding atmospheric pressure. There may be a negative pressure difference over the panel. Such negative pressure 15 difference may be the result of hot filling and/or cooking of the content of the can before closing it. After closure and cooling the gas phase above the content will reduce in volume, thereby forming a negative pressure difference over the panel and the surrounding. A positive pressure 20 difference may result from a permanent or transitional pressure build up after closure due to desired or unwanted gas generation and/or volume expansion due to heating. This pressure difference is used to have the panel acquire a depressed or concave form at least beneath the rear tab 25 part. This depressed or concave forms result in an increase of the space beneath the rear tab part. The increased space improves the gripping action. Obviously, this panel change occurs after manufacture of can and panel, after filling and closing. There is substantially no interference with 30 the traditional handling of such cans.

The change from the concave form into the convex form may occur as a result the changed pressure difference. However, the invention also encompasses the alternative after the change in pressure the changed in form does not

yet take place but requires an impact from the outside, such as a mechanical contact or other physical means (magnets) by which the change in form will be facilitated.

It is noted that when the pressure difference is 5 substantially zero the panel may be in the concave or convex form dependent on the structure of the panel. Thus, the pressure difference may result from internal and external pressures of which one or both are above or below atmospheric pressure. At zero pressure difference the panel 10 may be in a concave or convex form.

According to a first aspect, the present invention provides a can, comprising a body provided with a panel wherein the panel is provided with a tab comprising a front tab part and a rear tab part for gripping, the tab being 15 arranged such that by gripping and levering of the rear tab part the front tab part can be caused to engage with and to form an opening in the panel, wherein the panel is provided with a flip panel area at least beneath the rear tab part, which panel area forms a depression beneath the rear tab 20 part dependent on a negative pressure difference over the panel.

According to a second aspect, the present invention provides a can, comprising a body provided with a panel wherein the panel is provided with a tab comprising a front 25 tab part and a rear tab part for gripping, the tab being arranged such that by gripping and levering of the rear tab part the front tab part can be caused to engage with and to form an opening in the panel wherein the panel is provided with a flip panel area at least beneath the rear tab part, 30 which panel area forms a depression beneath the rear tab part dependent on a negative pressure difference over the panel, and wherein the flip panel area is a central part of a terrace structure, having concentric terrace rings which are radially inwardly at lower positions relative to each

other, which positions are maintained when the negative pressure difference is neutralized.

The flip panel may be formed by providing the panel with a particular material (such as steel and aluminium),  
5 structure and/or by providing the panel in the flip panel area with a different thickness.

The main influence factor, from all the material properties, is the Young modules (elastic). Furthermore, it is noted that two panel geometries may be identical but due  
10 to different manufacturing methods, their residual stress fields may be different which interacts with material properties. In essence it is required that the flip panel area has a higher flexibility than other parts of the panel such that by the pressure difference the concave form  
15 beneath the rear tab part is provided.

It is noted that jars, cans and bottles for fruit juice and marmalades may be provided with a screw cap having a similar flip panel area. However, these screw caps are not provided with a tab.

20 According to a first embodiment the flip panel area flips between a concave form and a flat form dependent on the pressure difference over the panel.

Thus, when the pressure difference is neutralized the flip panel parts flips from a concave form to a  
25 substantially flap form.

According to another embodiment the flip panel area flips between a concave form and a convex form dependent on a pressure over the panel. The provision of a convex form to the flip panel part does not interfere with the opening  
30 action using the tab because the tab is than in a more tilted position remote from the flip panel area.

According to a preferred embodiment the flip panel area is part of a terrace structure. Accordingly, there is a better controlled area in the terrace structure in which

the flipping of the flip panel part could take place. In this respect it is preferred on a consumer perspective that the flip panel area is a central terrace structure.

According to another embodiment the panel is provided 5 with a slanted or gradually depressing form (when the pressure difference exists). However, when the pressure difference is completely or partially neutralized the flip panel area flips from the slanted concave form to a flat or convex form.

10 In order to or precisely define or limit the substantial horizontal position of the tab prior to the opening of the can, it is preferred that the tab movement is limited by a panel rest structure. According to an embodiment the panel structure has the form of a dimple on 15 which the tab may rest or by which dimple the downward movement of the tab part is limited. Although it is preferred that the flip panel area is located in the central panel part, other locations off-centered are also suitable.

20 It is noted that preferably the pressure difference at which the transition from convex to concave occurs is preferably a negative pressure difference.

25 The panel may be connected to the body of the can by any known means. The panel may be unitary with the body or may be connected by any means, such as soldering, seaming and the like. It is preferred that the panel is seamed to the can body.

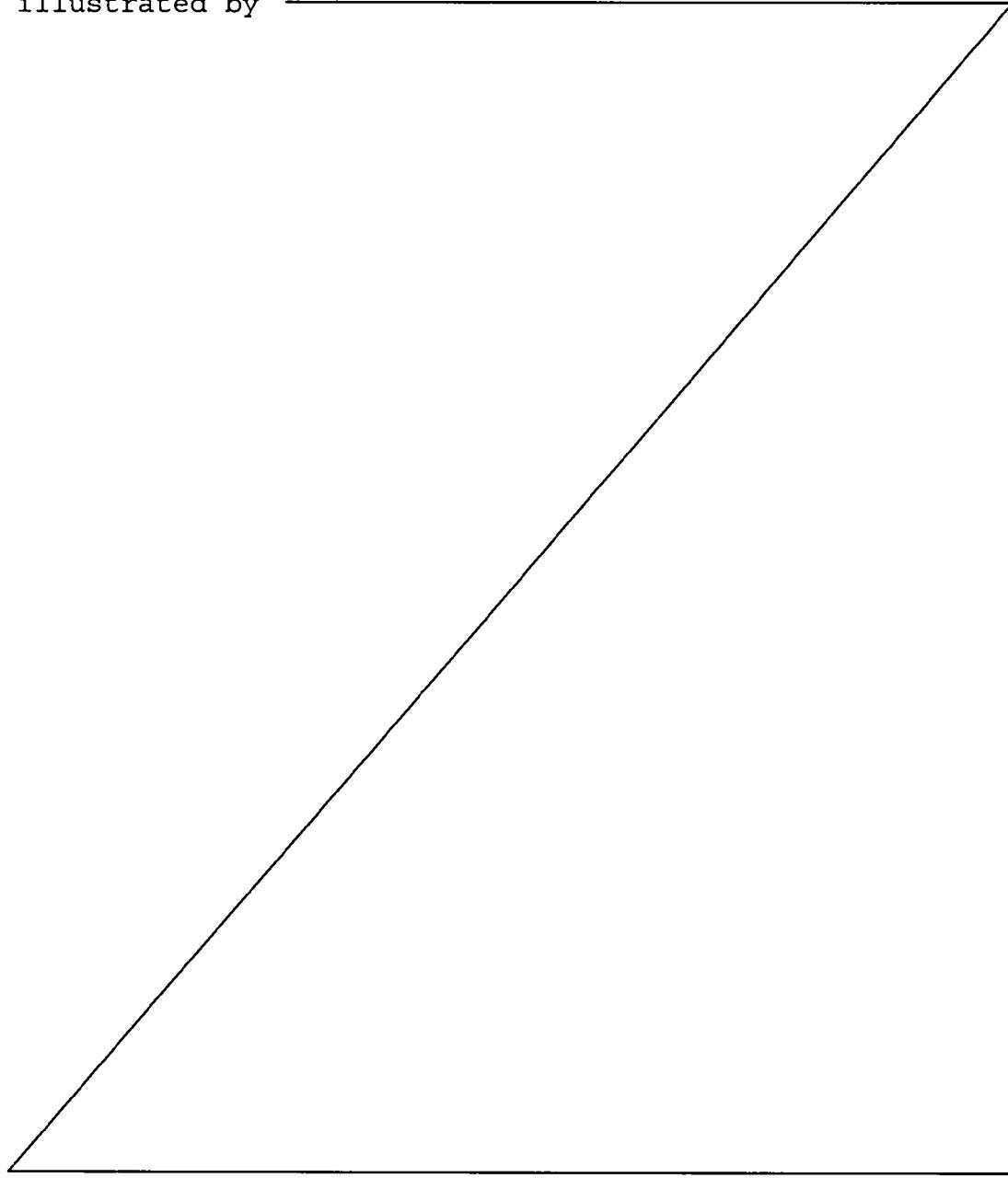
Another aspect of the present invention relates to a body provided with a panel according to the first or second 30 aspects.

Finally, a last aspect of the invention relates to a panel according to the first or second aspects.

Unless the context clearly requires otherwise, throughout the description and the claims, the words

5a

"comprise", "comprising", and the like are to be construed in an inclusive sense as opposed to an exclusive or exhaustive sense; that is to say, in the sense of "including, but not limited to".

- 5        Mentioned and other features of the can, body and panel according to the invention will be further illustrated by
- 

## 6

way of the following examples which are given for illustrative purposes and not intended to limit the present invention to any extent, while making reference 5 to the following drawings.

In the drawings is:

Figure 1 a perspective view of a can according to the invention;

Figures 2A and 2B a cross section following line 10 II-II given in Figure 1 and showing the flipping of the flip panel area according to the invention;

Figures 3A and 3B showing an alternative of the can according to the invention;

Figures 4A/4B and 5A/5B show other alternatives;

Figures 6A/6B/6C show other alternatives of which 15 figure 6D is an explanatory top view; and

Figures 7 and 8 shows still another alternatives of the easy opening panel of the invention.

Figure 1 shows a can 1 according to the 20 invention. The can comprises a body 2, a top panel 3 and a bottom panel 4. Top panel 3 and bottom panel 4 are seamed via a seam connection 5 to the body 2.

The top panel 3 is provided with a traditional tab 6. The tab 6 comprises a front tab part 7 and a rear 25 tab part 8. The rear tab part 8 is provided with an opening 9 into which a finger of the user may be inserted.

The tab 6 is connected to the top panel 3 via a rivet 10. Other methods for connection of the tab 6 30 include welding with metal or plastic welding material. The rivet 10 may be a separate rivet or may have been formed of material originating from the top panel and formed into a rivet shape.

The panel is provided with a score line 11 which is having a circular form. The score line defines the 5 opening in the can 1.

The can is opened by inserting a finger or nail beneath the rear tab part 8 in a so called gripping space 12. Levering or tilting the tab 6 results in a popping at the front tab part 7 in the score line 11 by a movement 10 illustrated in figure 2B.

Figure 2A shows more in detail and in cross section the top panel 3 according to the invention. The top panel 3 is provided with a terrace structure 13 having three concentric terrace rings 14-16 at a lower 15 position relative to the seam 5. The terrace structure comprises a central area, which is a flip panel area 17 according to the invention. As shown in figure 2A the flip panel area 17 has a concave structure for reasons that there exists a negative pressure difference over the 20 panel from the inside to the outside. That is, the atmospheric pressure at the outside is higher than the internal pressure at the interior 18 of the can 1 according to the invention.

It is noted that the downward movement of the tab 25 6 at its rear tab part is limited by the presence of a resting structure which has the form of a dimple 19.

After popping open the panel 3 thereby forming a popping opening 20, the pressure difference is neutralized resulting in a flipping of the flip panel 30 area 17 from the concave form illustrated in figure 2A into the convex form illustrated in figure 2B.

Obviously, by having a concave form as illustrated in figure 2A there is a larger and increased

gripping space 12 beneath the rear tab part 8 and the panel 3 at the location of the flip panel part 17.

5        Figures 3A and 3B show an alternative of the can 21 according to the invention. The can is provided with a panel 22 having a slanted form. The panel has a central area 23 (at least beneath the rear tab part 8 of the tab 6), thereby forming the gripping space 12 under the rear 10 tab part 8.

The panel 23 is soldered to the body 24. Due to the hot content of the can 21 after closure there will be an internal pressure which is lower than the atmospheric pressure and accordingly there is a negative pressure 15 difference over the panel 22. Due to this negative pressure difference the flip panel part 23 has a concave form.

20       Popping opens the panel 22 by levering or tilting the tab 6, the flip panel area 23 flips over into a convex form.

25       Figures 4A and 4B show another can 25 according to the invention. The top panel 26 has a central flip panel area 27 which has in cross-section a wavy shape. This wavy shape defines a depression 28 beneath the rear 12. tab part 8 thereby forming the increased gripping space

30       Figure 4B shows that upon opening the can 25 with the tab 6 and after pressure equilibration over the top panel 26, the flip panel 27 changed form such that the depression 28 is transformed in a more flat area 29. However, the trendline 30 changed from a substantially concave into a substantially convex form.

Figures 5A/5B show another can 31 according to the invention. The can 31 has a panel 32 comprising a flip panel area which has an annular depression 34 and a central flat portion 35. After neutralization of the negative pressure difference over the panel 32, the flip panel area 33 changes from the form depicted in figure 5A into the form depicted in figure 5B whereby the depression 34 has disappeared and the central portion 35 moved upwardly. Again, the trendline 36 has changed from a substantially concave form into a substantially convex form.

The can, body and/or panel may be made of metal, such as aluminium and steel.

The cans may be round or non-round (oval and rectangular). When round the can may have a diameter from about 52 to 153 mm. At lower diameters, the panel having a terrace structure will have about 1 or 2 terraces but at higher diameters the number of terraces may increase. The advantage of such terrace structures is to provide stiffness in the terrace structures and to allow the best flexible flipping properties controlled and relied to the flip panel area which is generally the central panel area.

When made of steel the panel may have a thickness as from 0.13 to 0.30 mm. The thickness may be less in the area forming the flip panel area.

In the following figures are the values for the metal thickness, diameters and radii in mm.

Figure 6 shows three variations of an easy opening panel according to the invention having a diameter of 73mm or larger. Only the concave form is

10  
shown. The values for the various diameters and angles  
are shown in the following table 1.

Table 1 (see figure 6)

metrik	R0	R1	R1	R1	R2	R2	R2	R3	R4	R4	R4	R5	R5
020404	10-05-20	844	05403	844	2244	05403	10543	344					
020404	10-05-20	844	05403	844	2244	05403	10543	344	(R2-09-06	06-442	0543		
020404	10-05-20	844	05403	844	2244	05403	10543	344				2144	05402

12

- R1 is the diameter of the panel  
R2 is the diameter of the flip panel area  
R3 is the diameter of the central flip panel area  
5 R4 is the diameter at the flip panel transition  
R5 is the diameter at the flip panel transition groove  
R6 is the diameter at the inner radius of the flip panel ring  
r0 is the central flip panel area radius  
10 r1 is the flip panel transition radius  
r2 is the radius at the flip panel ring  
r4 is the radius at flip panel transition  
r5 is the radius of the transition groove  
r6 is the inner radius of the flip panel ring  
15 a1 is the angle of the flip panel ring  
a2 is the angle of outer panel ring  
h4 is the height of the flip panel transition  
h6 is the height of the transition groove

For the configuration of figures 6A, 6B, and 6C  
20 is the height difference between the concave and convex form about 4.3 +/- 1.5mm. However, the transformation from concave to convex occurs for figure 6A at a pressure difference of 0.6 +/- 0.3bar (-20%), for figure 6B at a pressure difference of 0.5 +/- 0.3bar (-15%), and for  
25 figure 6C at a pressure difference of only 0.35 +/- 0.3bar (-5%). As shown by figure 6D in top view, is the geometry due to the presence of the easy opening tab not symmetrical. Furthermore, the outer concentric area beyond R3 forms a secondary geometry which could be rigid  
30 (flat) or flexible (wavy) which may have an additional effect on the pressure difference.

13

Figure 7 shows another variant of the easy opening panel according to the invention. In particular, for a can having a diameter of 65mm or larger.

5 Table 2 shows the various diameters and angles.

14

Table 2

metal thick.	$\text{r}0$	$\text{R}1$	$\text{r}1$	$\text{h}1$	$\text{R}2$	$\text{r}2$	$\text{R}3$	$\text{r}3$	$\text{h}2$	$\text{a}1$	$\text{R}4$	$\text{r}4$
0.16+/-0.4	30+/-10	(R20.6)+/-0.4	0.3-0.1+0.2	0.25+/-0.15	(R31.5)+/-0.2	0.3-0.1+0.2	85+/-2	2.16+1	0.15+/-0.1	5+/-2°	14.2+/-0	1+/-1

15

R0 is the radius of the central flip panel

R1 is the inner diameter of the central flip panel inner groove

5 R2 is the outer diameter of the central flip panel inner groove

R3 is the diameter of the central flip panel outer groove

R4 is the panel diameter

r0 is the radius of the central flip panel

10 r1 is the inner radius of the inner groove

r2 is the outer radius of the inner groove

r3 is the radius of the outer groove

h1 is the height of the inner groove

h2 is the height of the outer groove

15 a2 is the angle of the panel outer ring

The height difference between the concave and convex form is about 1.0 +/-0.5mm, and initiated by a pressure difference of only 0.15 +/- 0.05bar (-10%).

20 Finally, figure 8 shows another variant for a easy opening panel having a diameter of 65mm or larger. The flex panel is shown in convex shape position and only the main geometry is represented.

25 Table 3 shows the various diameters and angles.

Table 3

metal thick.	R1	R1	R2	R2	R3	R3	h1	R4	R4	R5	R5	R6	R6	
0.16+/-0.04	(R2)0.5+/-0.4	0.15-0.1+0.2	(R2)2+/-0.2	0.5-0.1+0.2	5.5+/-0.5	10+/-0.3	0.25+/-0.15	(R3+1.5)+/-0.2	0.5-0.1+0.2	0.15+/-0.05	(R4+0.5)+/-0.2	0.5-0.1+0.2	5+/-2 <sup>o</sup>	14.5+/-0

17

- R1 is the diameter of the panel central part  
R2 is the diameter at the inner groove edge  
R3 is the diameter at the center of the groove  
5 R4 is the diameter at the outer groove edge  
R5 is the diameter at the outer ring transition  
R6 is the panel diameter  
r1 is the radius at the panel central part  
r2 is the radius at the inner groove edge  
10 r3 is the radius of the groove  
r4 is the radius of the outer groove edge  
r5 is the radius at the outer ring transition  
h1 is the height of the groove  
h2 is the height at the outer groove edge  
15 a1 is the angle of the outer ring

In this case, the height difference due to the concave to convex transformation was 1.0 +/-0.5mm as a result of a pressure difference of 0.15 +/- 0.05bar (-20 10%).

It is noted again that the tab used may be a conventional tab. The object of the invention is to provide an improved and larger space available for the user for inserting nail and/or finger tip under the rear 25 tab part thereby improving the gripping action and the opening of the can.

CLAIMS

1. Can, comprising a body provided with a panel wherein  
5 the panel is provided with a tab comprising a front tab  
part and a rear tab part for gripping, the tab being  
arranged such that by gripping and levering of the rear tab  
part the front tab part can be caused to engage with and to  
form an opening in the panel, wherein the panel is provided  
10 with a flip panel area at least beneath the rear tab part,  
which panel area forms a depression beneath the rear tab  
part dependent on a negative pressure difference over the  
panel.
2. Can according to claim 1, wherein the flip panel  
15 area is part of a terrace structure.
3. Can according to claim 2, wherein the flip panel  
area is a central terrace structure.
4. Can according to any one of claims 1-3, wherein the  
flip panel area is formed in a slanted panel.
- 20 5. Can, comprising a body provided with a panel wherein  
the panel is provided with a tab comprising a front tab  
part and a rear tab part for gripping, the tab being  
arranged such that by gripping and levering of the rear tab  
part the front tab part can be caused to engage with and to  
25 form an opening in the panel wherein the panel is provided  
with a flip panel area at least beneath the rear tab part,  
which panel area forms a depression beneath the rear tab  
part dependent on a negative pressure difference over the  
panel, and wherein the flip panel area is a central part of  
30 a terrace structure, having concentric terrace rings which

are radially inwardly at lower positions relative to each other, which positions are maintained when the negative pressure difference is neutralized.

6. Can according to any one of the preceding claims,  
5 wherein the flip panel area has a concave form dependent on a negative pressure difference over the panel.

7. Can according to any one of the preceding claims,  
wherein the flip panel area flips between a concave form  
and a flat form dependent on the negative pressure  
10 difference over the panel.

8. Can according to any one of claims 1 to 6, wherein  
the flip panel area flips between a concave form and a  
convex form dependent on a negative pressure over the  
panel.

15 9. Can according to any one of the preceding claims,  
wherein the tab movement is limited by a panel rest  
structure.

10. Can according to claim 9, wherein the panel rest  
structure is a dimple.

20 11. Can according to any one of the preceding claims,  
wherein the panel is seamed to the can body.

12. A body provided with a panel according to any one of  
the preceding claims.

13. A panel according to any one of the preceding  
25 claims.

14. A can substantially as herein described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.

15. A body provided with a panel substantially as herein 5 described with reference to any one of the embodiments of the invention illustrated in the accompanying drawings and/or examples.

16. A panel substantially as herein described with reference to any one of the embodiments of the invention 10 illustrated in the accompanying drawings and/or examples.

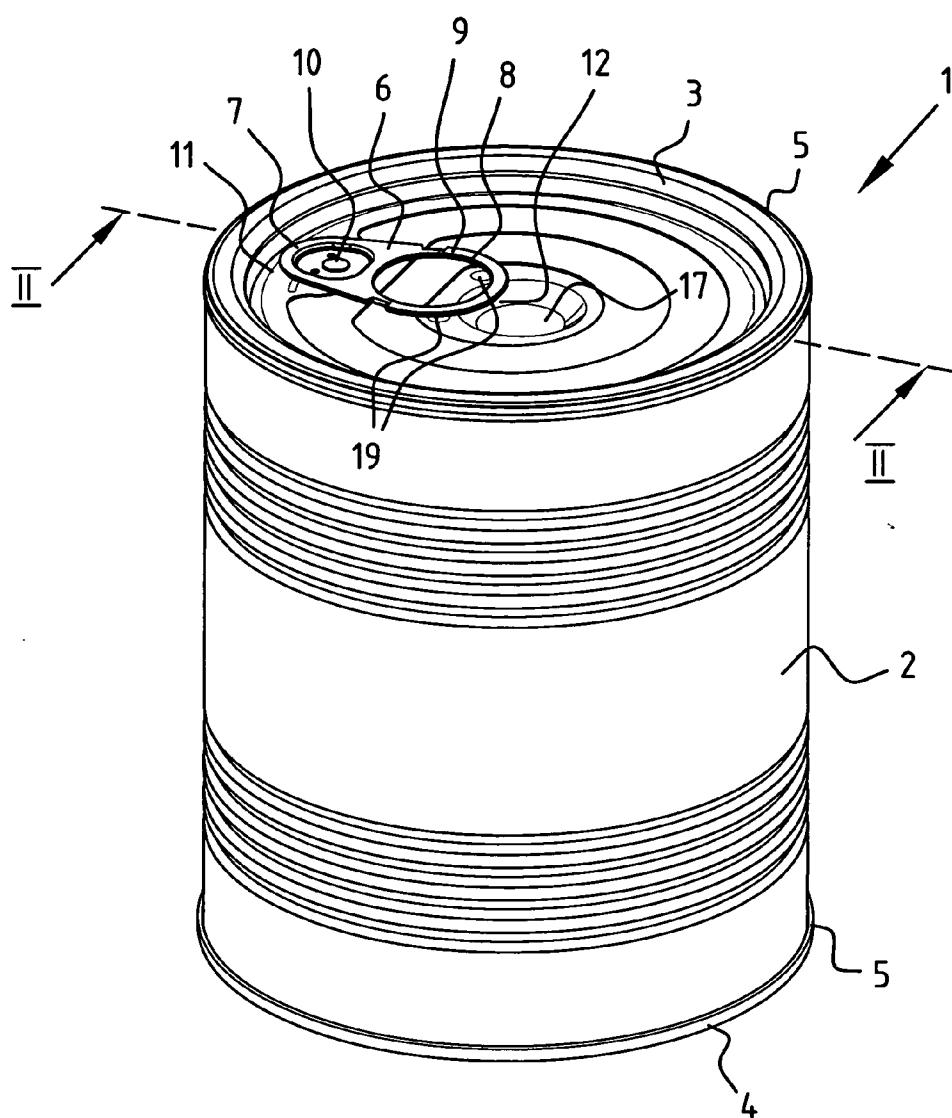


FIG. 1

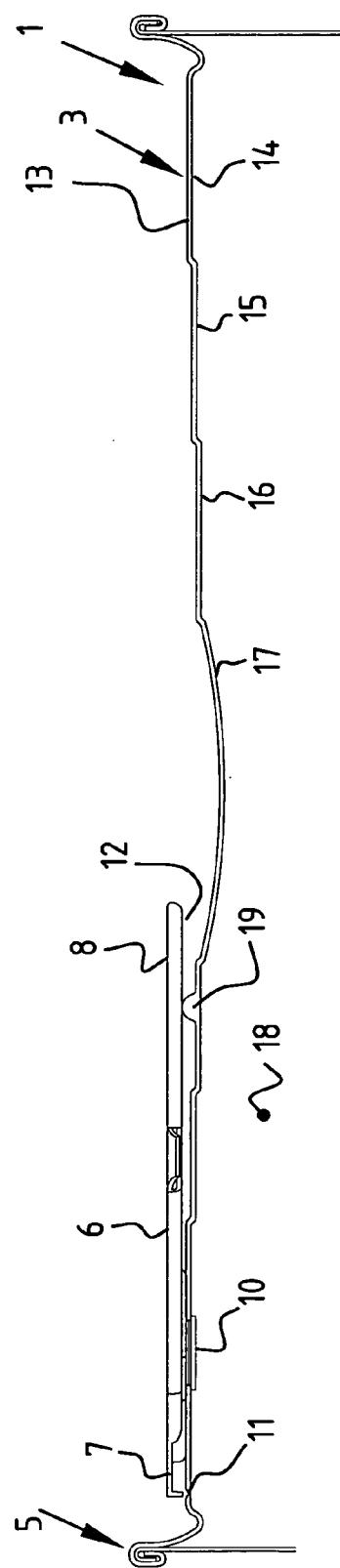


FIG. 2A

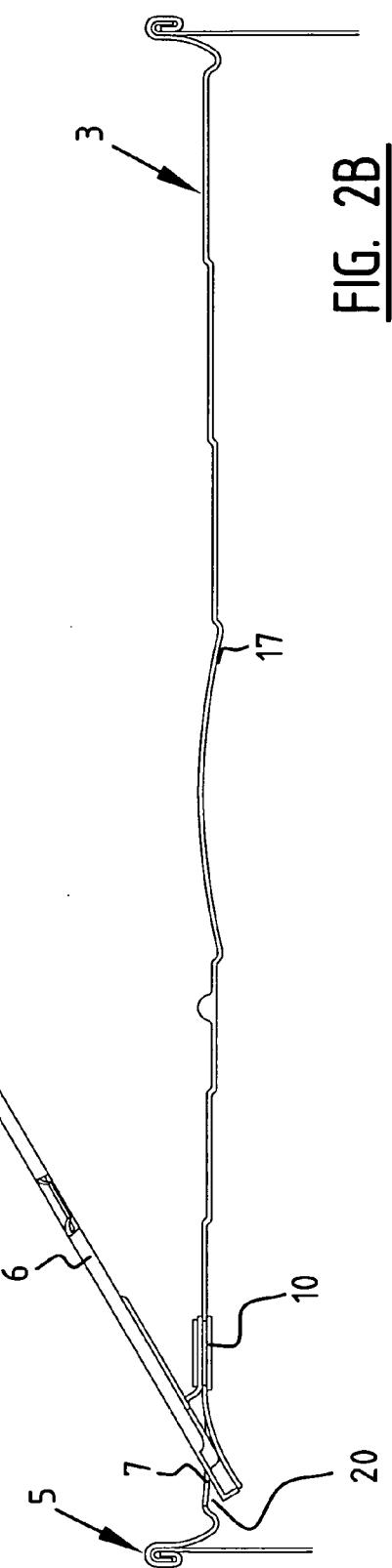


FIG. 2B

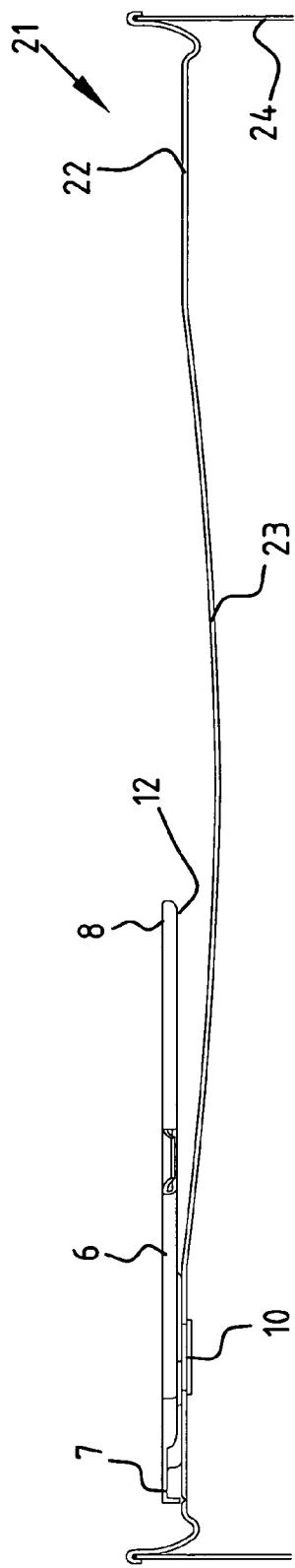


FIG. 3A

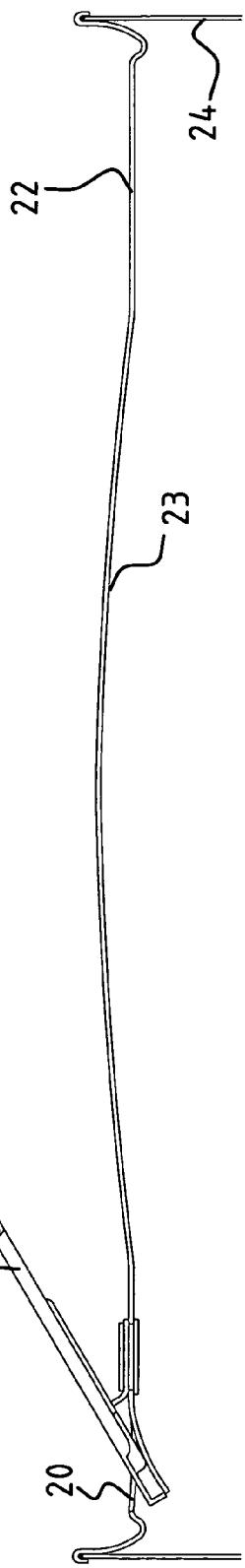


FIG. 3B

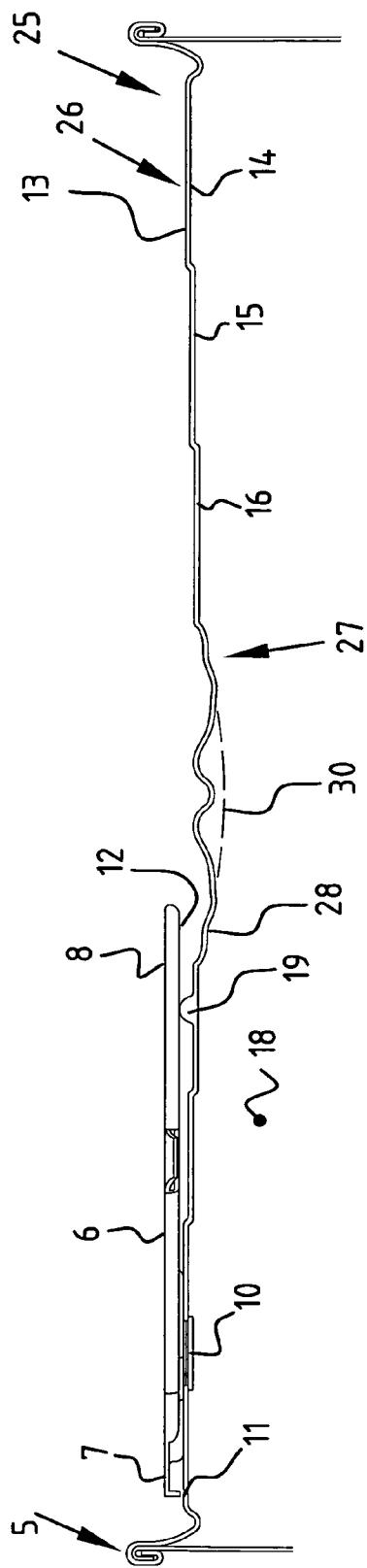


FIG. 4A

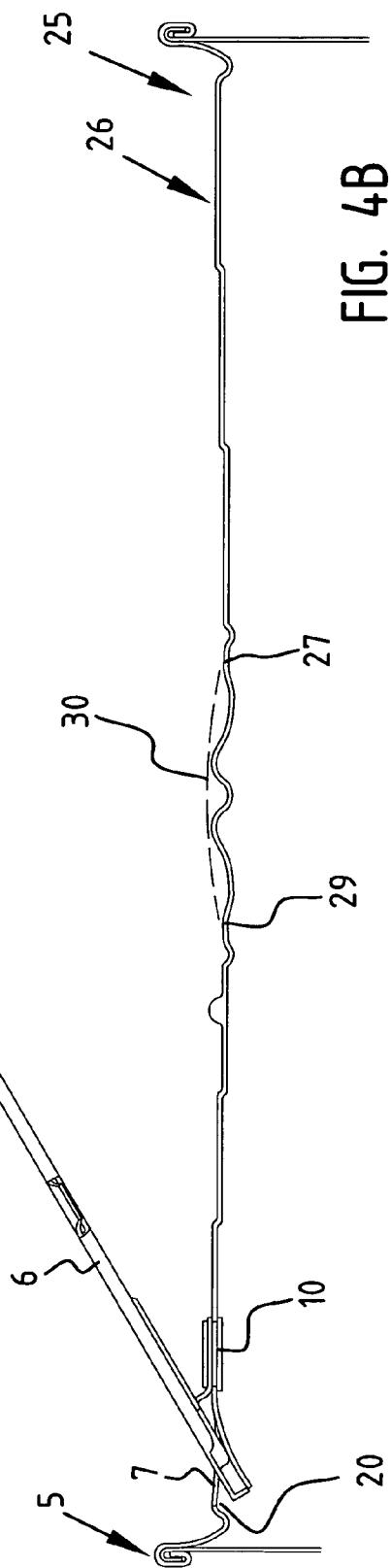


FIG. 4B

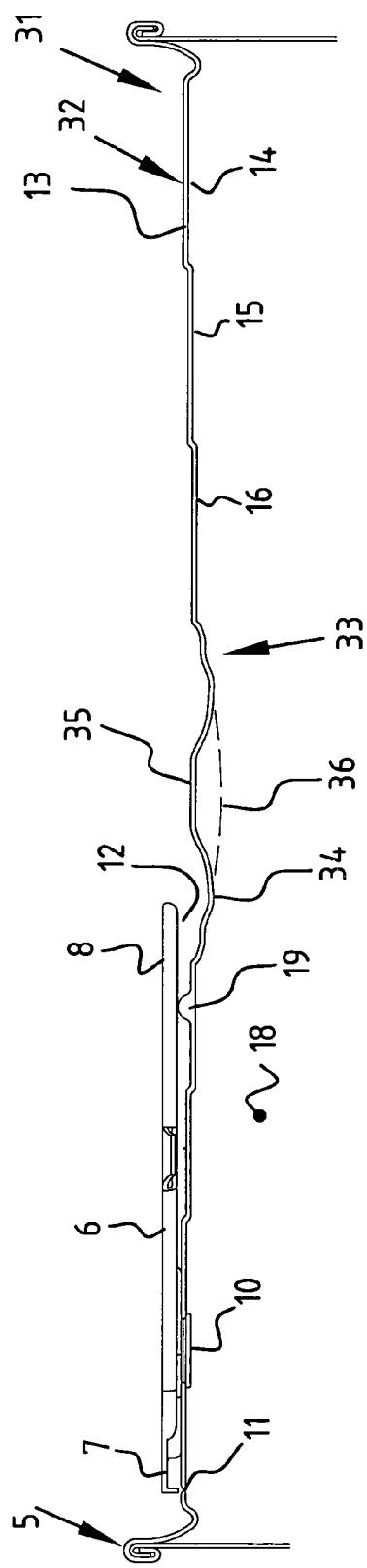


FIG. 5A

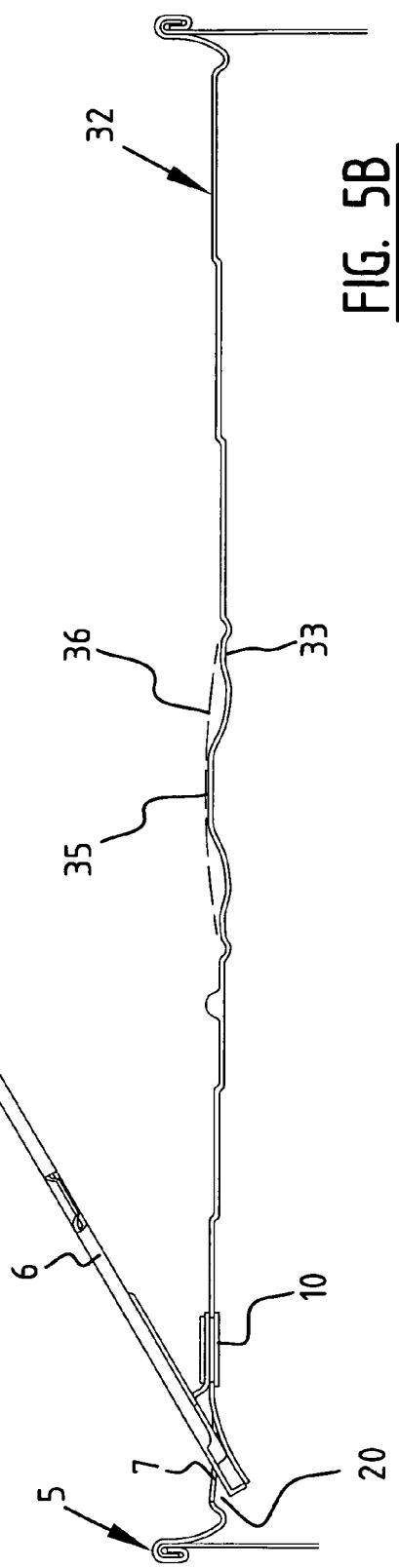


FIG. 5B

