

FANCIFUL ENDS FOR CANS

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates generally to the subject of containers, for example cans for containing food and beverage products. More particularly, the invention relates to cans and can ends in which the can end contains fanciful printing over a substantial area extent of the center panel. The printing may form an image a character, such as for example a historical figure, sports figure, or cartoon character, or alternatively the printing may form an image of a sports scene with a ball positioned over the location of the pour opening.

Description of Related Art

Figure 1 is a perspective view of a conventional prior art beverage can 10. The can 10 is formed from a one-piece drawn and ironed cup. The cup walls are stretched in a can body making station to form the side wall 12 of the can. A neck 14 is formed on the upper portion of the can by a set of necking stations, such as described in the patent to Caleffi et al., U.S. No. 4,774,839 or Tung et al., U.S. No. 5,755,130. After the neck 14 is formed on the upper portion 16 of the can 10, the can is sent to a flanging station where a flange is formed around the upper peripheral edge of the can. The flange is seamed to the peripheral edge of a can end 18 after the can is filled, in accordance with well-known techniques.

Referring to Figure 2, the can end 18 includes a generally flat center panel 19, integrally connected to a circumferential countersink which is surrounded by a peripheral flange or curl. The center panel includes score lines which defines a panel, which when opened, allows the contents of the can to be removed.

The scored portion 20 cooperates with a manually manipulable tab 22 so as to enable the user to either remove, for example, most of the center panel, such as in a full panel easy open end that is used for cans containing cat food, snacks or other foods, or to remove or open the pour panel of a beverage can.

On a typical beverage can, such as shown in Figure 2, the score 20 defines a pour

panel 21 which, after opening, remains attached to the center panel by a hinge (not shown). The pour panel is opened by the tab 22. Tab 22 is secured to the center panel 19 by a rivet 32. The user inserts a finger underneath the tab 22 and lifts the tab up, causing the rivet 32 to pull up, which initiates the pop or initial fracture of the score line 20. Further lifting of the tab 22 further propagates the severing of the score to complete the opening of the can. At that point the user may pour the contents out of the can or drink from the can.

Prior art references describing ornamental, promotional, or other similar features for beverage containers include the patents to Goodwin, U.S. No. 4,203,240; Januchowski, U.S. No. 1,257,710; Park, U.S. Patent Des. 365,021; and Rheingold, U.S. No. 1,878,541. U.S. Patent No. 4,557,505 to Schaefer et al. describes a stress-opacifying tamper indicating tape that is applied to the openings of containers, in which a visible message is displayed in the tape indicative of whether the seal has been opened or tampered with. Minder, U.S. Patent 3,822,496 shows a can with a detachable display plate or button that is affixed to a pull-ring of a can. Additionally, beverage cans have been previously sold in the United States with alpha-numeric characters formed on the tab with ink-jet printing. Published PCT application PCT/GB00/00463, publication no. WO 00/47487 published August 17, 2000 discloses methods and apparatus for printing on tabs and various features for promotional containers and container ends.

Spanish Industrial Models 144347 and 144348 show several embodiments of an end design in which beer mugs, footballs, stars, and other objects are mold stamped onto a can end to form "eyes" of a face, wherein the nose and mouth are formed by the tab and score opening features on the can end, respectively. Other references of interest directed to fanciful lids include Sloot, U.S. Patent 6,659,833 and Dotson, US Design Patent 379,065 and Merino, US. Design Patent 284,563.

SUMMARY OF THE INVENTION

In a first aspect, a can is described having a can body comprising a side wall and a base and defining an interior region for containing a product. The can includes an end having a center panel. A printing is applied over a substantial area extent of the center panel, the printing comprising an illustration of head and facial features of a character. The character may include the face and head of a real person, or, alternatively, may depict a fictional character, historical figure, or a cartoon character.

In preferred embodiments, the end may further comprise a scored portion in the center panel for defining an opening in the end and a manually manipulable tab secured to the end. In one embodiment, the tab and printing are positioned relative to each other such that forms the nose of the character. In another embodiment, the end includes a score portion defining a pour opening, and wherein the printing is applied to the end such that the pour opening is generally in the location of the mouth of the character.

This first aspect is directed to the combination of the can end and the can body. In another aspect, the invention relates to the can end alone. In this second aspect, an end for a can body is provided wherein the end includes a center panel and a peripheral edge. A printing is applied over a substantial area extent of the center panel, the printing illustrating head and facial features of a character. In preferred embodiments of these first and second aspects, the printing covers substantially the entire surface of the center panel of the end.

In another aspect, a method is provided for forming a can end. The method comprises the steps of: a) forming a shell from a sheet of end material, the shell comprising a flat center panel and a peripheral edge; and b) applying a printing to the shell, wherein the printing is applied over a substantial area extent of the center panel, the printing comprising an illustration of head and facial features of a character. In a typical embodiment, after the printing is applied, the shell is sent to a shell conversion press for completion of the opening features in the shell.

In still another aspect, the printing of the end can occur at the beginning of the end manufacturing process. In this aspect, a method is provided for forming a can end, comprising the steps of: a) applying a printing to a sheet of end material, wherein the printing is applied over a substantial area extent of the sheet of end material in the area where a center panel of a can end is to be formed in the sheet of end material, the printing comprising an

illustration of head and facial features of a character; b) introducing the sheet of end material into a press and operating on the sheet of end material in the press so as to form can end features in the sheet of end material, including the center panel; and c) blanking a can end from the sheet of end material.

5 In still other embodiments, a can and can end are provided which includes fanciful printing on the end, but the printing does not form that of the head and facial features of a character. In one embodiment the end has a center panel and score portion defining a pour opening and a printing is applied over a substantial area extent of the center panel, the printing comprising an illustration of a ball, the ball positioned in the location of the pour opening.
10 When the pour opening is opened, the ball is no longer visible on the center panel. Examples of this design include a ball selected from the group of balls consisting of a soccer ball, a baseball, a golf ball, a football, a tennis ball and a basketball. The printing on the center panel may comprise a printing of a sports scene that corresponds to the selected ball, such as a golf green and golf hole for a golf ball printed on the pour panel.

15 These and other aspects of the invention will be more completely appreciated from the following description of presently preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

20 Presently preferred embodiments of the invention are described below in conjunction with the drawings, in which like reference numerals refer to like elements in the various views, and in which:

Figure 1 is an illustration showing the construction of a prior art, conventional beverage can.

25 Figure 2 is a plan view of the end of the can of Figure 1.

Figure 3 is a plan view of a first embodiment of a can end with printing over substantially the entire surface of the end forming an illustration of a character.

Figure 4 is a plan view of a second embodiment of an end with printing over substantially the entire surface of the end forming an illustration of a character.

30 Figure 5 a plan view of a third embodiment of an end with printing over substantially the entire surface of the end forming an illustration of a character.

Figure 6 a plan view of a fourth embodiment of an end with printing over substantially the entire surface of the end forming an illustration of a character.

Figure 7A is a view of a fifth embodiment of an end with printing over substantially the entire surface of the end forming an illustration of a character, with the printing forming the mouth portion of the character located over the pour panel; Figure 7B shows the
5 embodiment of Figure 7A with the pour panel opened.

Figure 8A is a view of a sixth embodiment of an end with printing over substantially the entire surface of the end forming an illustration of a character, with the printing forming the mouth portion of the character located over the pour panel; Figure 8B shows the
10 embodiment of Figure 8A with the pour panel opened.

Figure 9A is an illustrated of a seventh embodiment with the printing forming a sports scene had having a soccer ball printed over the pour panel portion of the end; Figure 9B shows the embodiment of Figure 9A with the pour panel opened.

Figure 10A an illustrated of an eighth embodiment with the printing forming a sports
15 scene had having a golf ball printed over the pour panel portion of the end; Figure 10B shows the embodiment of Figure 10A with the pour panel opened.

**DETAILED DESCRIPTION OF THE PREFERRED
EMBODIMENTS OF THE INVENTION**

5 Figures 3-8 are plan views of several examples of an inventive end 18 for a can in which the end includes printing forming a head and facial features of a character. Figures 9 and 10 shows embodiments of fanciful ends 18 which do not include characters.

The end 18 is adapted to be affixed to a can body, which may take a variety of forms. For example, the end 18 could be adapted to be seamed onto a one piece drawn and ironed can body. Such can body can be used to contain food or other comestibles, or may contain
10 beverages such as beer, carbonated beverages or juices. The examples of Figures 3-10 depict ends 18 for attachment to can bodies in which the can bodies have a side wall and a base and define an interior region for containing a product, wherein the product is a beverage.

The end 18 includes a center panel 19 and a peripheral curl area 40, the extreme periphery of which is seamed to a flange on the can body, as is conventional.

15 During manufacture of the end, a printing 42 is applied over a substantial area extent of the center panel 19. The printing may be in one ore more colors, lacquers, or other pigment. For example, the printing may take the form of blue printing for the face of the character, white for the eyes, black for the eyebrows, contrasting color for background, etc. As is shown in Figures 3-8, the printing comprises an illustration of head and facial features
20 44, 46, respectively, of a character 50. The character may, for example, comprise a real person or a historical figure. As another alternative, the character may comprise a fictional character, or a cartoon character such as Thomas the Tank Engine (Figure 3), a character from the film "Monsters, Inc." (Figures 4, 7 and 8), a character from the film "The Lion King" (Figure 5), or Kermit the Frog (Figure 6). Other examples of cartoon characters could be
25 Bugs Bunny, Tweety Bird, or any other cartoon character now known or later created. The characters could be animal cartoons (e.g., Kermit the Frog) or could be monsters, fanciful characters like Thomas the Tank Engine, or other characters. (Obviously, permission from the copyright and/or trademark holder may be needed where the character is copyrighted or
30 trademarked). Examples of characters that are historical persons whose image could be printed on the center panel include Abraham Lincoln, Buffalo Bill, Sacagawea, Einstein, Mozart, contemporary sports figures such as Michael Jordan, etc.

In contradistinction with the Spanish Design registrations cited above, the printing includes other features of the head and face, including cheeks, chin, head, ear and/or other body features. For example, in Figure 3, the printing includes shaded features illustrating the cheek 52, chin 54 and lips 56, as well as the eyes 58 and eyebrows 59 of the character 50. Also note that multiple colors may be used: a dark blue for inside wall 60 of the peripheral curl, light blue for face area 52, 54, 56, etc., white for the whites of the eyes 58, and black for the eyebrows 59. As shown in Figures 3-6, the printing of the character preferably covers substantially the entire surface of the center panel 19 of the can end 18. As shown in Figure 4, the printing may form an illustration of the body, head and face of the character.

In the example of Figures 3-6, the tab 22 forms the nose of the cartoon character. The tab may also be printed. For example, the tab 22 in Figure 3 is printed with a blue ink that matches the blue ink forming the face 46 of the cartoon character. Similarly, the tab 22 in Figure 5 is printed in a golden brown color that matches the color of the face and head of the lion character. The printing on the tab may include printing in a contrasting or other color also.

The can end further comprises a scored portion in the center panel for defining an opening in the end. The score is present in the ends of Figures 3-6 but is not shown in black lines in order to more clearly illustrate the characters printed on the center panel 19.

In other possible embodiments, the center panel can include areas in which the at least one color printed on the center panel has been removed (e.g., with a laser) to reveal the base color of the material forming the center panel, e.g., silver for an aluminum end.

The can having the fanciful ends of this invention can contain any product, examples of which are cans containing a human or animal food product. In some embodiments, the can may comprise a metal (aluminum) beverage can and the can end is a conventional beverage can end as shown in Figures 3-6. For example, the tab 22 is secured to the end 18 by a rivet 32 or other suitable structure that allows the tab 22 to remain fixed to the end 18 when the tab is manipulated by the user to open the can.

Ends with Pour Opening Features

With reference now to Figure 7A, the printing 42 forms the head and facial features of a fanciful monster character. The printing is applied to the end such as the printing of the

mouth of the character is generally in the location of the pour panel 21 defined by a score portion 20. (Exact registry between the mouth of the character and the pour panel 21 is not required). The user lift up the tab 22, and in the process the score portion 20 is broken to open the pour panel and deflect it downwards into the interior of the can, as shown in Figure 5 7B. From the perspective of the viewer, the eyes 58 of the character are revealed within the finger hole in the distal portion of the tab 22 as shown in Figure 7B. The opening 70 of the end defined by the broken score portion appears as an open mouth of the character 50, adding to the fanciful nature of the end design.

Figures 8A and 8B show a similar embodiment with the printing of the mouth 10 contained within the perimeter of the score 20 defining the pour panel 21. When the end is opened (Figure 8B) the opening 70 appears as an open mouth of the character 50.

Non-Character Ends with Opening Features

Figures 9 and 10 illustrate ends that use printing that is oriented in a particular manner 15 relative to opening features in the end to thereby achieve a fanciful result. In the example of Figure 9A, the printing 42 features a sports scene (white soccer ball net on a blue background simulating the sky) and a soccer ball 80. The soccer ball is printed on the end within the perimeter of the score line 20 defining the pour panel 21. The user lifts up the tab 22 and the nose of the tab breaks the score line 20 and this action deflects the pour panel 21 downwardly 20 into the interior of the container 10. The resulting opening 70 is shown in Figure 9B. The ball of Figure 9A is no longer visible on the center panel 19 of the end. The combination of the ball 80 being printed over the pour panel 21, in combination with the printed sports scene 42 (soccer net), and then after opening the ball no longer visible on the end when the end is opened, simulates a fanciful "goal".

Figure 10A is an illustration of yet another embodiment, with the printing 42 being a 25 sports scene in the form of a golf scene in color (e.g., golf green, red pin flag, white golf ball 80 swirling into grey cup 82). The printing is such that the golf ball 80 and golf cup 82 are both contained within the perimeter of the score line 20 defining the pour panel 21. When the user lifts up on the tab 22, the tab 22 fractures the score line 20 and the pour panel is bent 30 inwardly into the container. The result, Figure 10B, shows the opening 70 of the container. The golf ball is no longer visible on the center panel 19. The opening of the container thus

simulates the dropping of the golf ball 80 of Figure 10A into the cup 82. Accordingly, an end has been described in which a fanciful action is presented in the combination of the printing 42 on the end and opening features in the end (tab 22 and pour panel 21).

5 Manufacturing Considerations

The can ends shown in Figure 3-10 can be formed in a method comprising the steps of first forming a shell from a sheet of end material, the shell comprising a flat center panel and a peripheral edge. This shell process can be performed in a convention shell press known in the art. A "shell", as is known in the art, is a blank end which has a center panel and some
10 peripheral pre-curl, but typically no other opening features, e.g., tab or score line. In conventional practice, shells are blanked from a sheet of end material in one press and subsequently fed to a shell conversion press for completion of the opening features. See the patent of Turner et al., U.S. Patent 6,533,518, for a more detailed explanation.

After the shell is formed, the shells are fed to a station where a printing is applied to
15 the shell. The printing can be in one or more colors as described previously. The printing is preferably applied over a substantial area extent of the center panel. The printing is an illustration of head and facial features of a character, as shown in Figures 3-8 or other fanciful printing, examples shown in Figures 9 and 10. In a typical embodiment, after the printing is applied to the shell, the shell is sent to a shell conversion press (a known machine) for
20 completion of the opening features in the shell, e.g., forming score opening features and attachment of the tab 22.

To achieve proper alignment of the tab 22, score line 20 and the printing 42 on the center panel of the end, the end 18 can be engraved with a registration or timing mark, which is used for orientation purposes. This mark is used to align the end with printing apparatus in
25 the printing station such that the printing is applied to the end in a particular orientation with respect to the end. Subsequently, the timing mark is used again to orient the end with respect to an apparatus in the shell press that attaches the tab 22 onto the end 18. In this respect, the use of timing marks for orientation of the end may be similar to the technique disclosed in U.S. Patent 5,893,286. The techniques of the '286 patent could be adapted to the printing of
30 ends and attachment of tabs to achieve the proper orientation as disclosed in Figure 3.

Thus, in one possible embodiment of this invention, a method is provided for forming

a can end, comprising the steps of:

a) forming a shell from a sheet of end material, the shell comprising a flat center panel and a peripheral edge; and

5 b) applying a printing to the shell, wherein the printing is applied over a substantial area extent of the center panel 19. The printing may comprises an illustration of head and facial features of a cartoon character 50 (Figures 3-8) or a ball and sports scene as shown in Figures 9 and 10.

10 The shell is then fed to a conversion press where the opening features are formed in the shell and the tab attached to the shell. In a preferred embodiment, the tab 22 is attached to the shell such that the printing on the shell is aligned with the tab in a predetermined manner such that the tab forms a part of the character. For example, as shown in Figures 3-6, the tab forms the "nose" of the character.

15 As another alternative, the end may be made using a process in which the printing is first applied to the sheet of end material, the shell (including center panel) are formed, and then the shell is blanked and sent to a conversion press to complete the opening features.

In still another alternative, the end can be formed in a process comprising the steps of:

20 a) applying a printing to a sheet of end material, wherein the printing is applied over a substantial area extent of the sheet of end material in the area where a center panel of a can end is to be formed in the sheet of end material. The printing may comprise an illustration of head and facial features of a character or a ball and sports scene.

b) introducing the sheet of end material into a press and operating on the sheet of end material in the press so as to form can end features in the sheet of end material, including the center panel; and then

c) blanking a can end from the sheet of end material.

25 A press suitable for steps (b) and (c) is described in the above referenced Turner et al., U.S. Patent 6,533,518. The printing of step (a) can be performed using any known press for applying printing to a sheet of material (e.g., aluminum). The advantage of this latter technique is that the registration of the printing relative to the tab is easy to maintain, since the tab is attached to the end while the end is still contained in the sheet of end material, i.e.,
30 before blanking the end from the sheet.

Variation from the particular embodiments described above is contemplated and

within the scope of the invention. This true scope of the invention is defined by the appended claims, to be interpreted in light of the foregoing specification.

CLAIMS

1. A can, comprising:
a can body comprising a side wall and a base and defining an interior region for
5 containing a product;
an end for said can body having a center panel;
wherein a printing is applied over a substantial area extent of the center panel, the
printing comprising an illustration of head and facial features of a character.
- 10 2. The can of claim 1, wherein the end further comprises a scored portion in the center
panel for defining an opening in said end and a manually manipulable tab secured to said end,
wherein the tab forms the nose of the character.
3. The can of claim 1, wherein the character comprises a cartoon character.
- 15 4. The can of claim 1, wherein the printing comprises at least one color.
5. The can of claim 4, wherein the center panel further comprises areas in which the at
least one color has been removed to reveal the base color of the material forming the center
20 panel.
6. The can of claim 4, wherein a color is applied to the tab and wherein the color applied
to the tab is substantially the same as the color printing applied to the center panel.
- 25 7. The can of claim 4, wherein the printing comprises three or more colors.
8. The can of claim 1, wherein the printing includes chin, lip, and/or mouth features of
the character.
- 30

9. The can of claim 1, wherein said can comprises a can for containing a human or animal food product.

10. The can of claim 1, wherein said can comprises a metal beverage can.

11. The can of claim 1, wherein the printing covers substantially the entire surface of the center panel of the can end.

12. The can of claim 1, wherein the printing comprises an illustration of the body, head and face of the character.

13. An end for a can body, comprising:
a center panel and a peripheral edge,
wherein a printing is applied over a substantial area extent of the center panel, the printing illustrating head and facial features of a character.

14. The end of claim 13, wherein the end further comprises a scored portion in the center panel for defining an opening in said end and a manually manipulable tab secured to said end; the tab forming the nose of the character.

15. The end of claim 13, wherein the character comprises a cartoon character.

16. The end of claim 13, wherein the printing comprises at least one color.

17. The end of claim 16, wherein the center panel further comprises areas in which the at least one color has been removed to reveal the base color of the material forming the center panel.

18. The end of claim 16, wherein a color is applied to the tab and wherein the color applied to the tab is substantially the same as the color printing applied to the center panel.

19. The end of claim 16, wherein the printing comprises three or more colors.
20. The end of claim 13, wherein the printing includes chin, lip, and/or mouth features of the character.

5

21. The end of claim 13, wherein the printing comprising the character covers substantially the entire surface of the center panel of the can end.

22. A method of forming a can end, comprising the steps of:

10

a) forming a shell from a sheet of end material, the shell comprising a flat center panel and a peripheral edge; and

b) applying a printing to the shell, wherein the printing is applied over a substantial area extent of the center panel, the printing comprising an illustration of head and facial features of a character.

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23. The method of claim 22, further comprising the step:

c) attaching a tab to the shell, wherein the tab is attached to the shell such that the printing on the shell is aligned with the tab in a predetermined manner such that the tab forms a part of the character.

20

24. The method of claim 23, wherein steps a), b) and c) are performed in that order.

25. A method of forming a can end, comprising the steps of:

a) applying a printing to a sheet of end material, wherein the printing is applied over a substantial area extent of the sheet of end material in the area where a center panel of a can end is to be formed in the sheet of end material, the printing comprising an illustration of head and facial features of a character;

b) introducing the sheet of end material into a press and operating on the sheet of end material in the press so as to form can end features in the sheet of end material, including the center panel; and

30

c) blanking a can end from the sheet of end material.

26. The method of claim 25, wherein step b) includes a step of attaching a tab to the sheet of end material.

5 27. The method of claim 25, further comprising the step of feeding the can end blanked in step c) into a machine and attaching a tab to the can end in a predetermined orientation with respect to the printing on the center panel of the can end.

28. The method of claim 25, wherein the character comprises a cartoon character.

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29. The can of claim 1, wherein the end further comprises a score portion defining a pour opening, and wherein the printing is applied to the end such that the pour panel is generally in the location of the mouth of the character.

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30. The end of claim 13, wherein the end further comprises a score portion defining a pour opening, and wherein the printing is applied to the end such that the pour panel is generally in the location of the mouth of the character.

20

31. A can, comprising:

a can body comprising a side wall and a base and defining an interior region for containing a product;

25

an end for said can body having a center panel and score portion defining a pour panel;

wherein a printing is applied over a substantial area extent of the center panel, the printing comprising an illustration of a ball, the ball positioned within the score portion.

30

32. The can of claim 31, wherein the ball is selected from the group of balls consisting of a soccer ball, a baseball, a golf ball, a football, a tennis ball and a basketball.

33. The can of claim 32, wherein the printing further on the substantial area extend of the center panel comprises a printing of a sports scene that corresponds to the selected ball.

34. The can of claim 33, wherein the printing is in color.

5

35. The can of claim 31, wherein the end further comprises a tab which lifts to fracture the score portion and open the pour panel, and the printing of the ball is sized and positioned relative to the pour panel such that when the pour panel is opened the ball is no longer visible on the center panel of the can end.

10

36. An end for a can body comprising a center panel and score portion defining a pour panel;

wherein a printing is applied over a substantial area extent of the center panel, the printing comprising an illustration of a ball, the ball positioned within the score portion.

15

37. The end of claim 36, wherein the ball is selected from the group of balls consisting of a soccer ball, a baseball, a golf ball, a football, a tennis ball and a basketball.

20

38. The end of claim 36, wherein the printing further on the substantial area extend of the center panel comprises a printing of a sports scene that corresponds to the selected ball.

39. The end of claim 36, wherein the printing is in color.

25

40. The end of claim 36, wherein the end further comprises a tab which lifts to fracture the score portion and open the pour panel, and the printing of the ball is sized and positioned relative to the pour panel such that when the pour panel is opened the ball is no longer visible on the center panel of the can end.

30

41. A method of forming a can end, comprising the steps of:

a) applying a printing to a sheet of end material, wherein the printing is applied over a substantial area extent of the sheet of end material in the area where a center panel of a can

end is to be formed in the sheet of end material, the printing comprising an illustration of a sports scene and a ball;

b) introducing the sheet of end material into a press and operating on the sheet of end material in the press so as to form can end features in the sheet of end material, including the center panel, wherein a score line defining a pour panel is formed in the center panel, wherein
5 the printing of the ball positioned within the score line; and

c) blanking a can end from the sheet of end material.

10 42. A method of forming a can end, comprising the steps of:

a) forming a shell from a sheet of end material, the shell comprising a flat center panel and a peripheral edge and a score portion defining a pour panel; and

b) applying a printing to the shell, wherein the printing is applied over a substantial area extent of the center panel, the printing comprising an illustration of a sports scene and a
15 ball, the printing of the ball within the score line.

Fig. 1
PRIOR ART

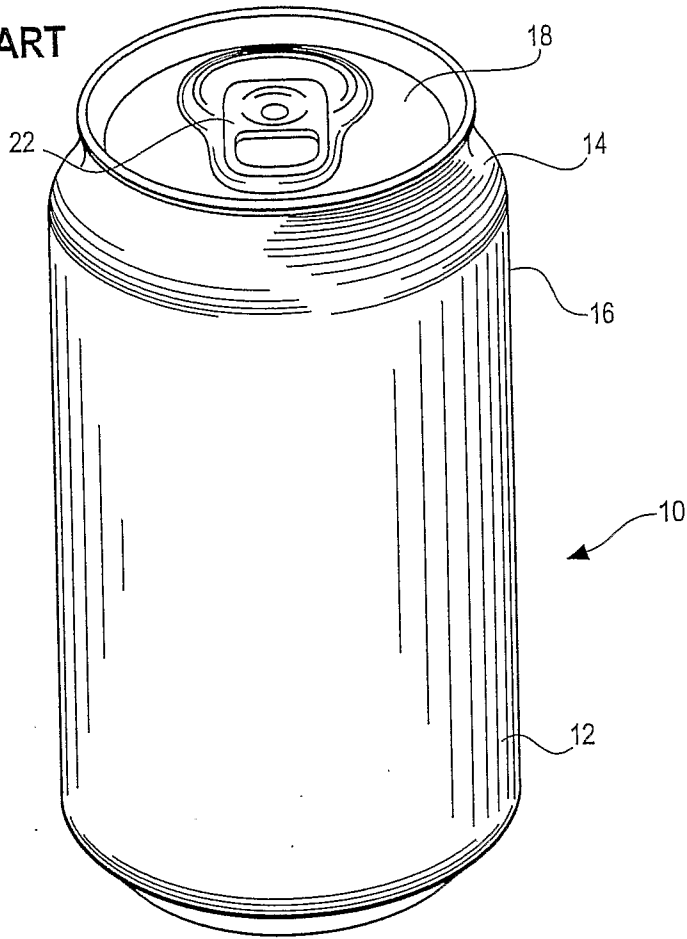


Fig. 2
PRIOR ART

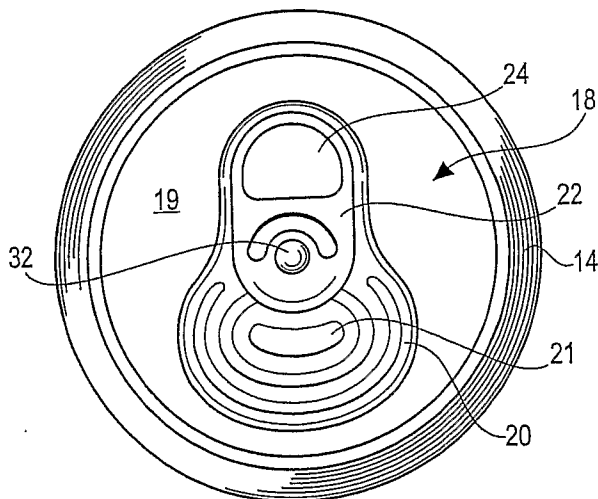


Fig. 3

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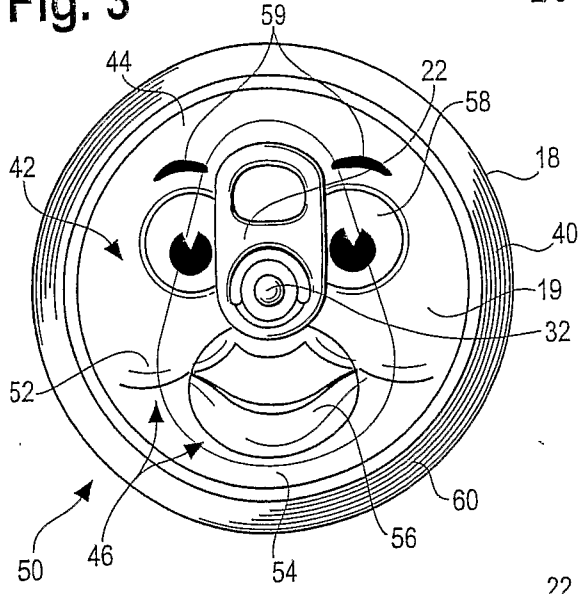


Fig. 4

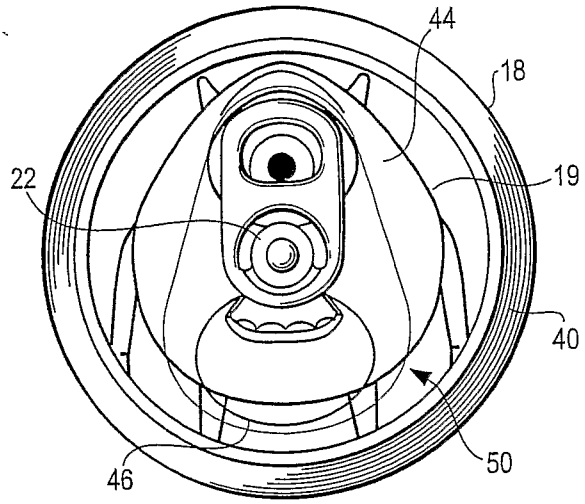


Fig. 5

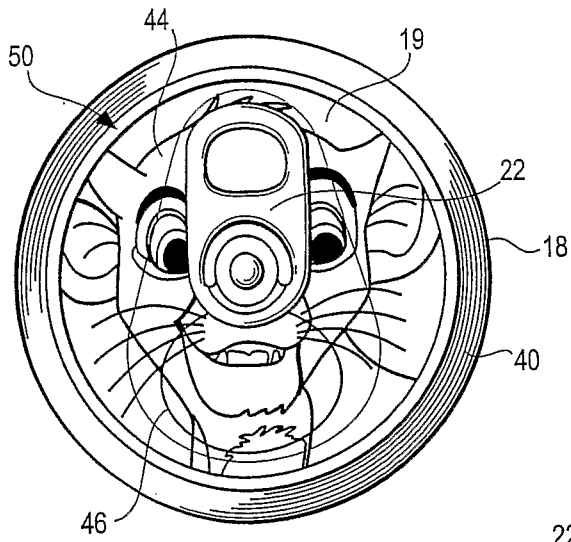


Fig. 6

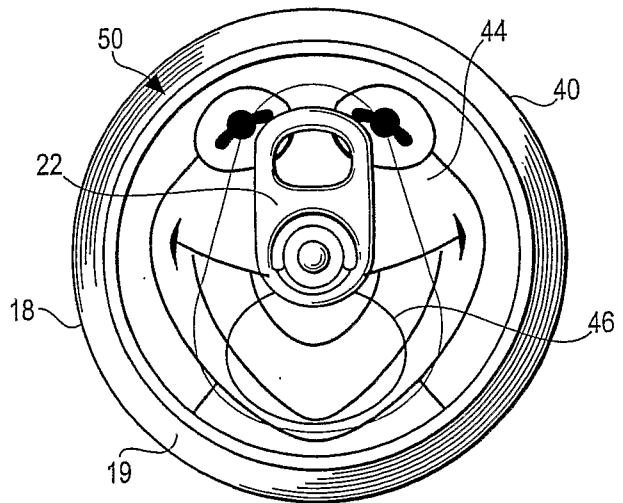


Fig. 7A

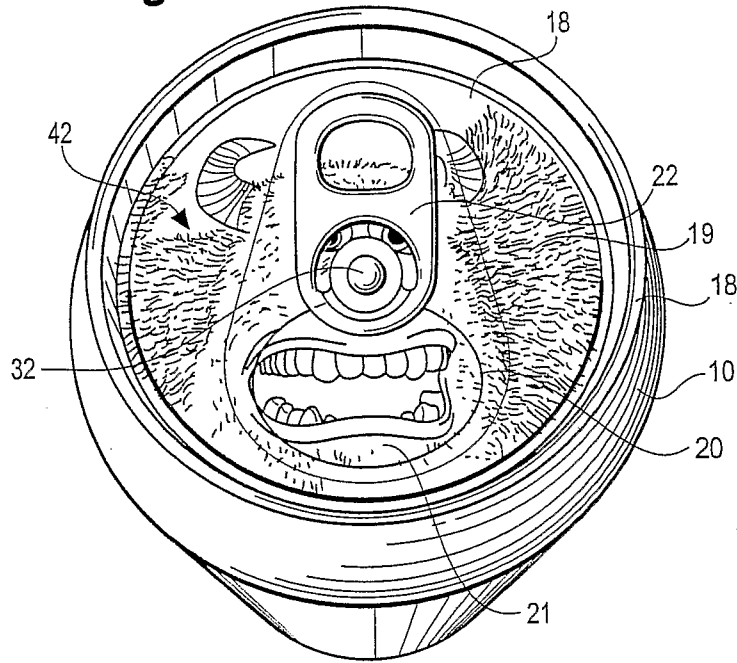


Fig. 7B

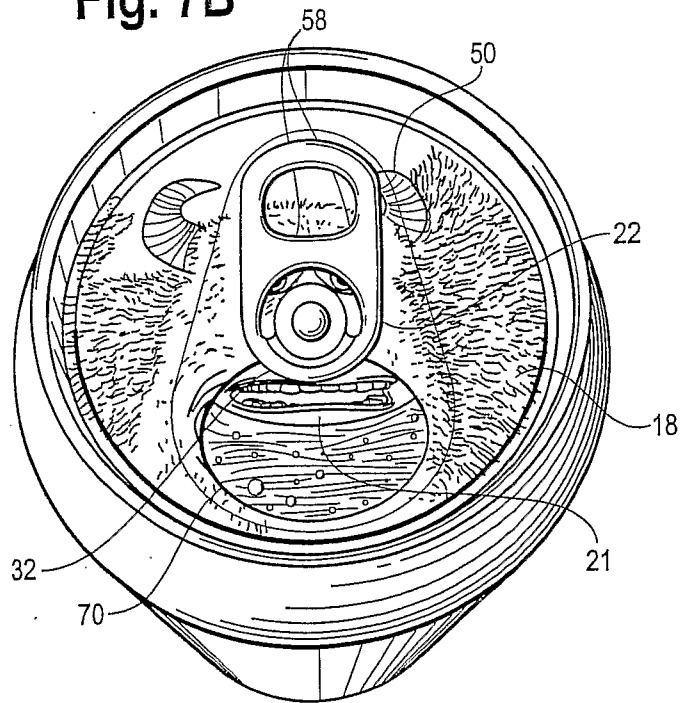


Fig. 8A

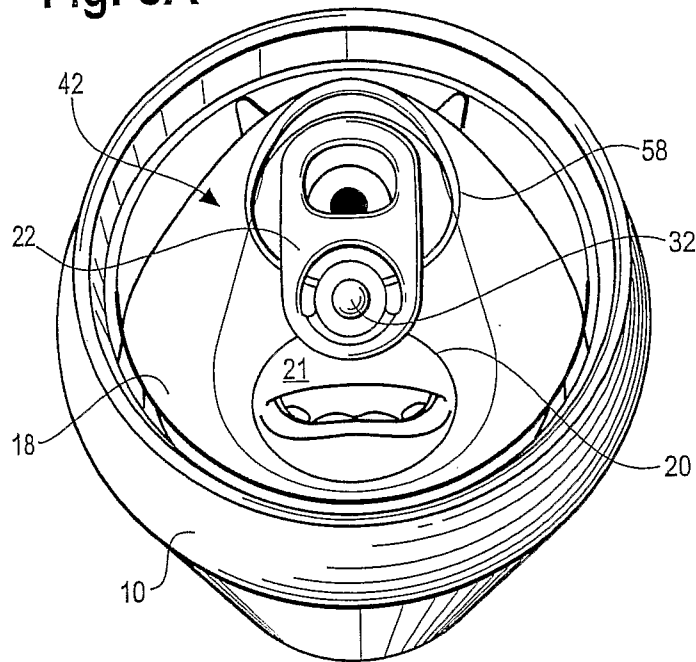


Fig. 8B

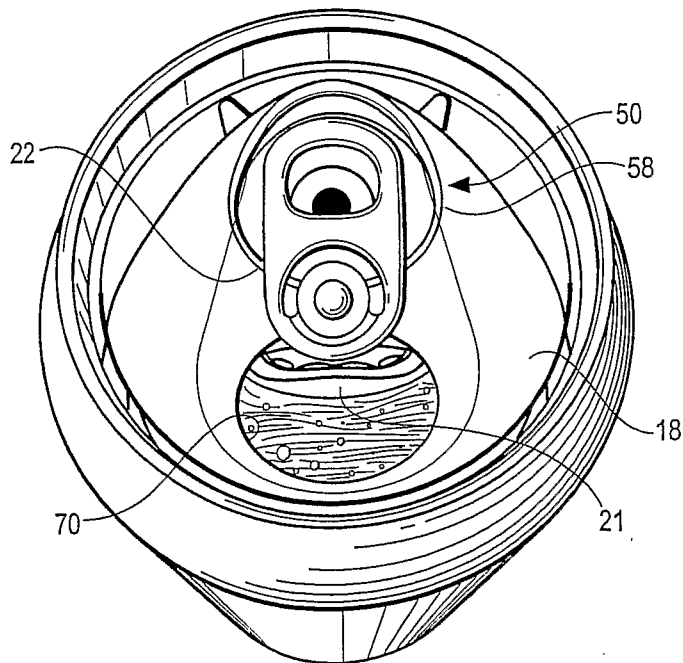


Fig. 9A

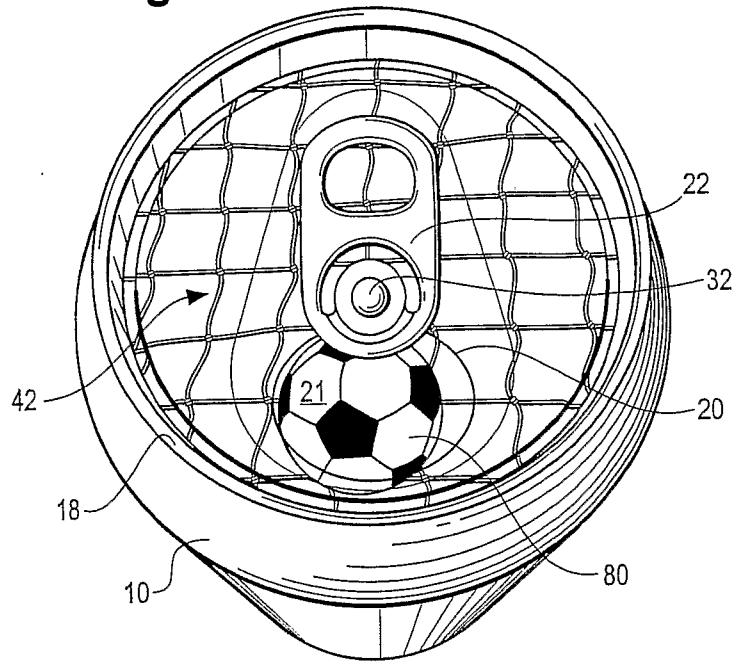


Fig. 9B

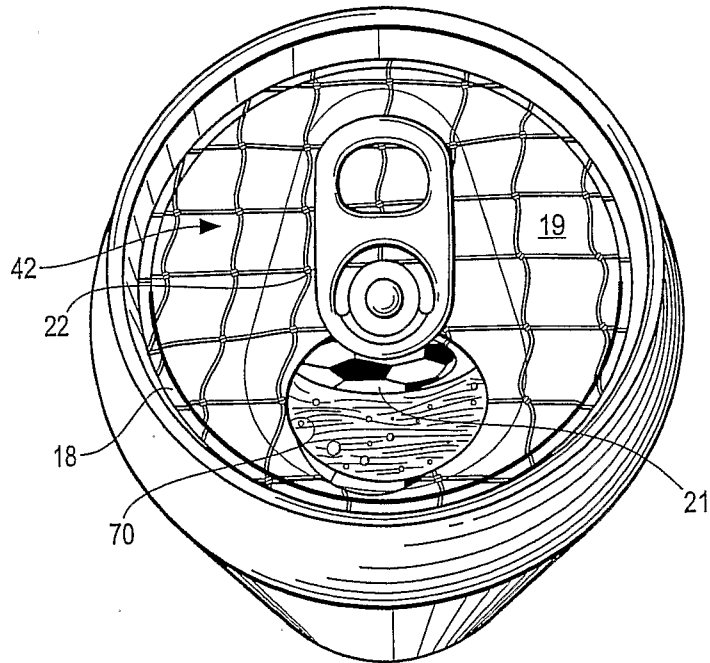


Fig. 10A

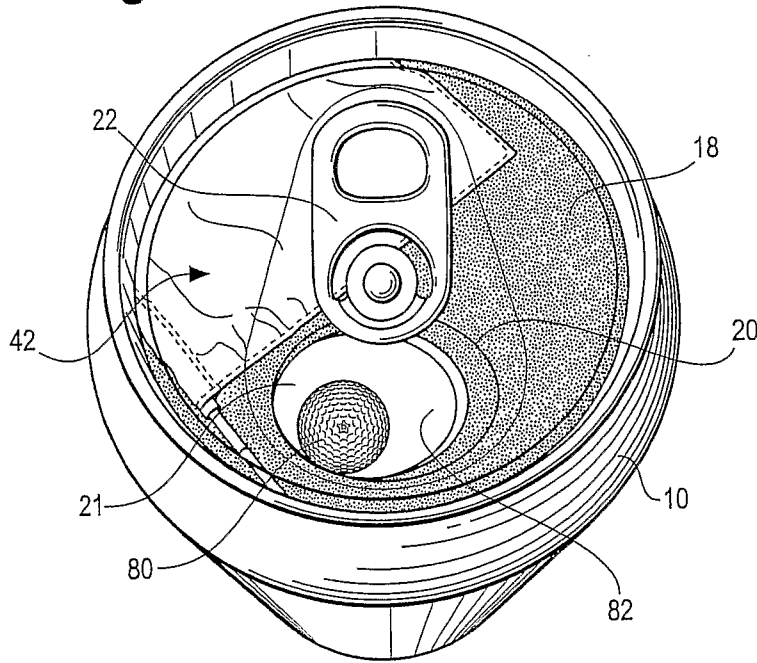


Fig. 10B

