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(54) **Process for closing metal cans**

(57) A process for closing a metal can body, suitable for containing an edible product, with a can lid, to provide a metal can suitable for heating in a retort. The process comprises: placing a metal lid over and in contact with an open end of a metal can body; applying an inwardly

directed mechanical force to the lid such that at least a central portion of the lid is deformed into the interior space of the metal can body; and seaming the lid to the can body to form an airtight seal between the lid and the can body.

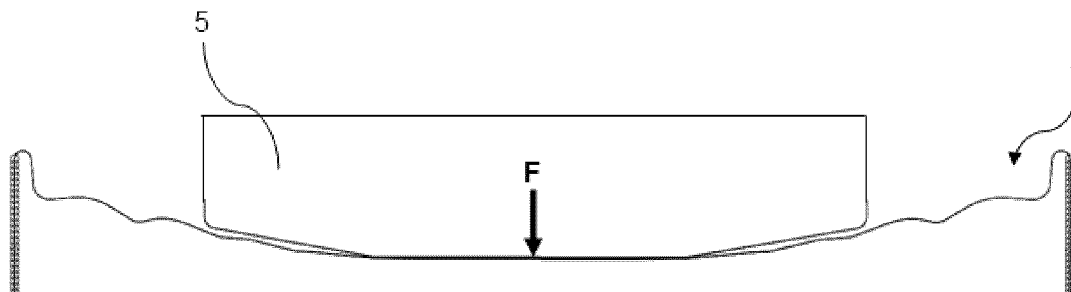


Fig 4

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Description

Technical Field

[0001] The present invention relates to a process for closing a metal can body, suitable for containing an edible product, with a can lid.

Background

[0002] Canning is the process of preserving an edible product by processing and sealing it in an airtight metal can. Cans are typically either two-piece or three-piece cans. In the case of a two-piece can, a can body is formed by punching a metal plate to form a cylinder closed at one end. The can is then filled and the open end closed by seaming a lid to the can body during the canning process. In the case of a three-piece can, a can body, open at both ends, is formed by rolling and seaming a metal plate. A first end is closed by seaming a lid to the can body. The can is then filled and the second end closed by seaming a lid to the can body during the canning process.

[0003] Once a metal can has been filled and sealed, it is typically heated in order to cook and/or sterilise the edible product and interior of the can. Heating the can in this way increases the internal pressure of the can. Cooking generally takes place within a cooker referred to as a "retort". The retort pressure is set in an attempt to balance the internal and external pressures to which the can is subjected, i.e. to minimise the pressure differential and the stresses to which the can is subjected. This pressure balancing allows the metal thickness, and therefore costs, of the cans to be reduced because it minimises the possibility that the cans will fail during the cooking process. Nonetheless, in some retorts this pressure balancing is not precise, and cans are still subjected to large pressure differentials during the cooking process, requiring that the cans have some minimum level of structural integrity.

[0004] It is noted that, in some canning processes, cans are filled with a hot product prior to seaming the end closure onto the can body. When the product subsequently cools, the internal pressure is reduced relative to the external pressure. It is sometimes desirable to minimise this negative pressure, again as a way of reducing the metal thickness. FR 1,119,542 and in FR 2,753,684 describe can lid structures and canning processes with the aim of mitigating this problem. Specifically, lids are provided which deform inwardly, in a concave manner, following seaming and cooling. As well as reducing the negative pressure, the lids are able to temporarily return to their original, flat, position when the can and its contents are subsequently heated (e.g. during a cooking and/or sterilisation process) in order to minimise the increase in internal pressure.

Summary

[0005] It is an object of the present invention to mitigate the problems that arise from the extreme positive and negative pressure differentials to which metal cans are subjected during a cooking/sterilisation process. This object is achieved by providing an improved process for sealing a metal can such that the can is able to better withstand extreme pressure differentials.

[0006] According to a first aspect of the invention there is provided a process for closing a metal can body, suitable for containing an edible product, with a can lid, to provide a metal can suitable for heating in a retort. The process comprises: placing a metal lid over and in contact with an open end of a metal can body; applying an inwardly directed mechanical force to the lid such that at least a central portion of the lid is deformed into the interior space of the metal can body; and seaming the lid to the can body to form an airtight seal between the lid and the can body.

[0007] Embodiments of the present invention provide an improved process for closing metal cans with lids that are able to withstand an increase in internal pressure without having to increase thickness of the metal used to form the can body and/or the lid. Particularly preferred embodiments may provide an improved process for closing metal cans with lids that are able to withstand an increase in internal pressure even when the thickness of the metal used to form the can body and/or the lid is reduced. The improved process forms a concave deformation in the lid which is independent of the filling temperature of the metal can, and which enables the metal can to better withstand extreme positive and negative pressure differentials. In a particularly preferred embodiment, the process can be carried out without requiring existing canning machines to be modified in order to accommodate a lid with a side profile of greater thickness.

[0008] For an unfilled metal can body with an open bottom, the step of seaming the lid to the can body may be carried out before the step of applying an inwardly directed mechanical force, or the step of seaming the lid to the can body may be carried out after the step of applying an inwardly directed mechanical force.

[0009] For a filled metal can body with a closed bottom, the step of seaming the lid to the can body may be carried out after the step of applying an inwardly directed mechanical force.

[0010] The central portion of the lid may be deformed inwardly to the extent that the headspace volume inside the metal can is reduced by between 50% and 100%.

[0011] The metal can may be cylindrical and the lid may be circular.

[0012] The lid may be deformed by the inwardly directed force to a generally more domed shape.

[0013] The lid may comprise one or more beads extending across the surface.

[0014] Prior to being deformed, the lid may be capable of passing horizontally through a slot having an opening

of less than 6mm for a lid of nominally 153mm diameter.

Brief Description of the Drawings

[0015]

Figure 1 is a flow diagram outlining steps of a process according to an embodiment of the present invention;
 Figure 2 is a lid that can be seamed to a metal can body and suitable for use with the process of Figure 1;
 Figure 3 is a cross-section through a lid prior to it being seamed to a metal can, together with a punch part of a seaming tool;
 Figure 4 is a cross-section through the lid of Figure 3 during seaming;
 Figure 5 is the lid of Figures 3 and 4 on completion of seaming; and
 Figure 6 is the lid of Figure 5 deformed outwardly during a cooking process.

Detailed Description

[0016] As previously discussed, the extreme positive and negative pressure differentials to which metal cans are subjected during a cooking/sterilisation process can cause the structural integrity of the can to fail. A new process for seaming a lid onto a can will now be described, with reference to the figures, that mitigates these extreme positive and negative pressure differentials and the problems arising from them. The sealed can resulting from the process is capable of withstanding both negative and positive internal pressure with respect to an ambient external pressure. This is facilitated by deforming a substantially flat lid immediately before seaming the lid onto the can body. Substantially flat in this context is taken to mean that the overall profile of the lid is flat, such that any corrugations in the centre panel profile (i.e. the central portion of the lid) do not project above the seaming panel or below the bottom of the countersink.

[0017] Figure 1 is a flow diagram which describes the steps of a canning process which includes a process for closing the metal can according to an embodiment of the present invention. The steps of the process are as follows:

- A1. Transfer the edible product into an empty open metal can body.
- A2. Place a substantially flat lid over and in contact with the open end of the can.
- A3. Apply downwards pressure on central region of the lid to deform the lid into the interior space of the can and allow displaced air to escape.
- A4. Seam the lid to the can body.
- A5. Heat the can in order to cook and/or sterilise the contents.

[0018] In Step A1, as there is no fill temperature requirement, the edible product can be hot or cold as it is transferred into the can body. The can body may be intended to form a "two-piece" can, whereby the first piece is the body of the can which is formed by punching the body from a sheet of metal, and the second piece is the lid that is used to seal close the open end of the metal can. Alternatively the can body may be intended to form a "three-piece" can, whereby the body of the can has two open ends, and is closed at each open end by a lid. In the context of this process, an "open can" may be a two-piece can with no lid, or a three-piece can which is closed by a lid at only one of the two open ends.

[0019] Once the open metal can has been filled to the desired level with the edible product, a substantially flat lid is placed over and in contact with the open end of the can. The substantially flat lid may be a lid such as that described in FR 1,119,542. Figure 2 shows an example of a lid 1 that may typically be used in the process according to an embodiment of the present invention. The lid is substantially flat such that it can pass through existing size restrictions within standard machines used in a manufacturing and/or canning factory without any substantial adjustments being required to the machinery. Typically, size restrictions within such machinery are such that the lids of nominally 153mm diameter would be able to pass horizontally through a slot with a height of less than 6 mm. The lid of Figure 2 is made deformable by circular beads that form an area of circular corrugation 2 extending radially inwards from the outside edge of the lid 3 towards a flat central part of the lid 4.

[0020] Figure 3 is a cross sectional view of a lid at step A2 of the process. At this point, the lid is loosely placed onto the open end of a metal can body. The corrugated portion is shown in area 2 of the lid, and the flat central portion is shown in area 4 of the lid. Figure 3 also shows a forming block, or "punch", 5, which may be part of a can seaming tool. The punch 5, although not shown as such in Figures 3 and 4, may have a lower surface that conforms to the shaped profile of the lid. The punch 5 is used to apply a downward force F on the lid 1 in Step A3 and as shown in Figure 4. The side wall of the metal can body provides an opposing force to hold the outside edge of the lid in place. By applying a downwards force, a central region of the lid is deformed part way into the interior space of the metal can. This deformation gives the lid a generally more inwardly domed shape. Some of the air from the top of the can between the edible product and the lid (known as the "headspace") is displaced. At this stage, the lid is only held in place on top of the metal can body by the punch 5 that is applying the force F, and is not yet seamed to the can body. Therefore, the air displaced from the headspace is able to escape the metal can through the unsealed gap between the lid and the side wall of the can body. Once the lid has been deformed by the desired amount, the lid is then seamed to the metal can in step A4 to create an airtight seal between the lid and the can body. The force F may still be applied to the

lid while the seaming process is carried out.

[0021] Figure 5 is a cross section through the lid after step A4. The dotted line 8 in Figure 5 shows the original position and shape of the lid in Step A2, and the arrow A shows the extent of the concave deformation. The lid is deformed to the extent that the headspace volume of the metal can (i.e. the volume of air in the headspace of the can) is reduced by between 50% and 100%.

[0022] The can is then heated in a retort in order to cook and/or sterilise the edible product inside in Step A5. During the heating process, the lid can be "pushed out" by the rise in internal pressure within the metal can to form a convex deformation, or dome, such as that shown in Figure 6. In figure 6, the dotted line 10 shows the position and shape of the lid after seaming and prior to the can being heated. The arrow B shows the extent to which the lid is deformed by the increase in internal pressure.

[0023] The embodiments described herein refer to a metal can body of circularly cylindrical shape and a circular lid. However, the can body and lid are not restricted to these shapes, and may, for example, be generally square cylindrical and square respectively. Further examples may include elliptical or rectangular lids, and suitably shaped respective can bodies.

[0024] It will be appreciated by the person of skill in the art that various modifications may be made to the above described process without departing from the scope of the present invention. For example, the process may also comprise in Step A3 applying an inwardly directed force on a central region of a second lid that is seamed to the bottom of the metal can to elastically deform the bottom lid into the can to allow a larger volume of air to be displaced from inside the can prior to seaming the top lid onto the open end of the can body.

[0025] A further alternative may be that the can body does not contain the edible product and is not sealed at the bottom at the time the lid is deformed and seamed to the top end of the can. In this alternative, as there is no can bottom on the can body, once the substantially flat lid has been placed over and in contact with the top open end of the can body, it can either be deformed first by a downwards pressure and then seamed to the can body, or it can be seamed first and then deformed by the downwards pressure. Even if the lid is seamed to the can body first, the air displaced when deforming the lid is able to escape the can through the open bottom. The can body with the deformed top can then be filled through the opening in the bottom prior to it being sealed with a can bottom.

Claims

1. A process for closing a metal can body, suitable for containing an edible product, with a can lid, to provide a metal can suitable for heating in a retort, the process comprising:

placing a metal lid over and in contact with an open end of a metal can body;
applying an inwardly directed mechanical force to the lid such that at least a central portion of the lid is deformed into the interior space of the metal can body; and
seaming the lid to the can body to form an airtight seal between the lid and the can body.

2. A process as claimed in claim 1, wherein, for an unfilled metal can body with an open bottom, the step of seaming the lid to the can body is carried out before the step of applying an inwardly directed mechanical force.
3. A process as claimed in claim 1, wherein, for an unfilled metal can body with an open bottom, the step of seaming the lid to the can body is carried out after the step of applying an inwardly directed mechanical force.
4. A process as claimed in claim 1, wherein, for a filled metal can body with a closed bottom, the step of seaming the lid to the can body is carried out after the step of applying an inwardly directed mechanical force.
5. A process as claimed in claim 4, wherein the central portion of the lid is deformed inwardly to the extent that the headspace volume inside the metal can is reduced by between 50% and 100%.
6. A process as claimed in any one of the preceding claims, wherein the metal can is cylindrical and the lid is circular.
7. A process as claimed in any one of the preceding claims, wherein the lid is deformed by the inwardly directed force from a generally flat shape to a generally domed shape.
8. A process as claimed in any one of the preceding claims, wherein the lid comprises one or more beads extending across the surface.
9. A process as claimed in any one of the preceding claims, wherein, prior to being deformed, the lid is capable of passing horizontally through a slot with a height of less than 6mm for a lid of nominally 153mm diameter.

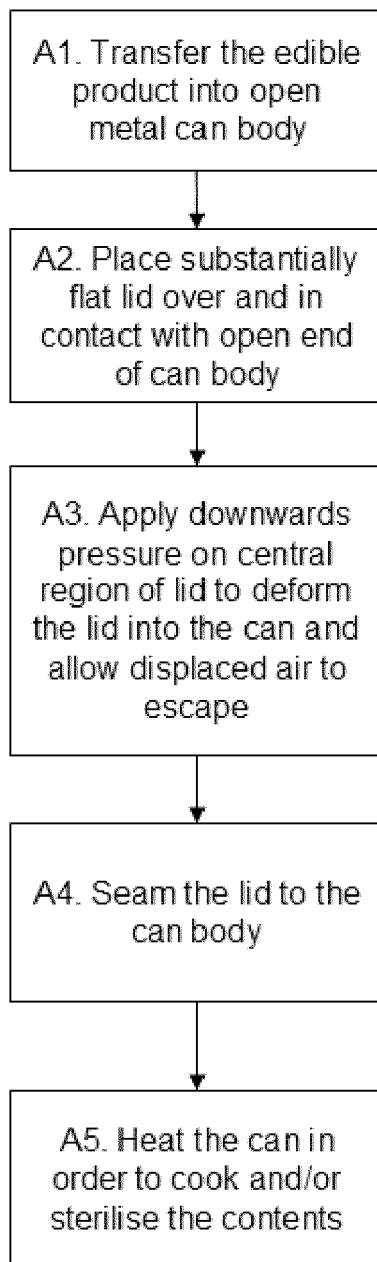


Fig 1

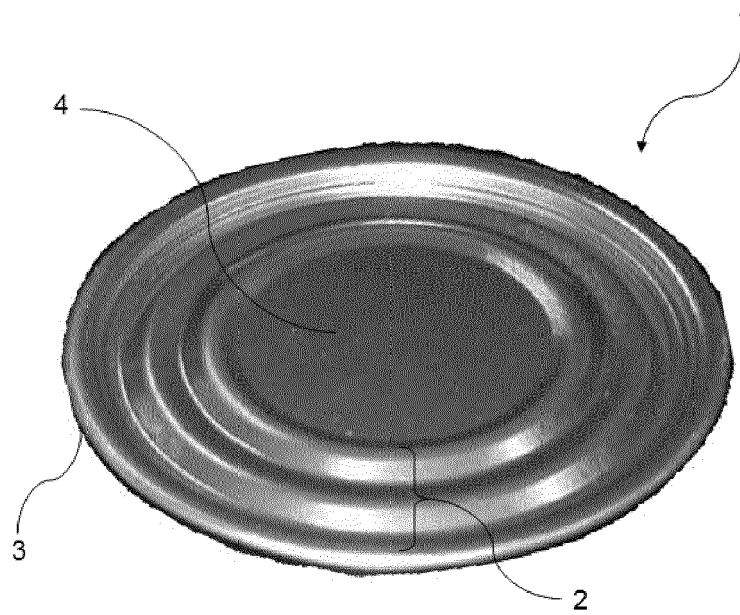


Fig 2

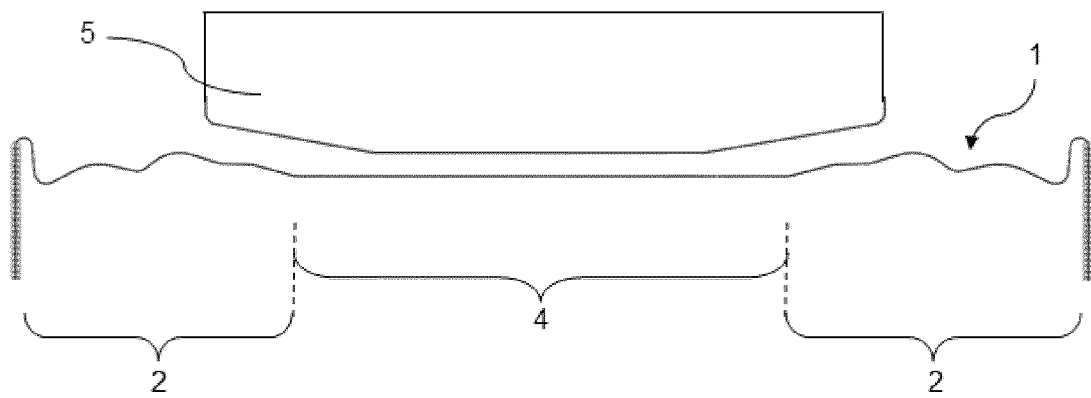


Fig 3

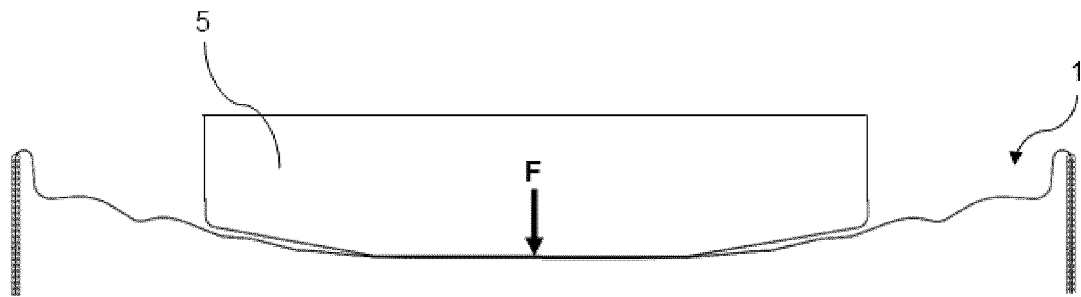


Fig 4

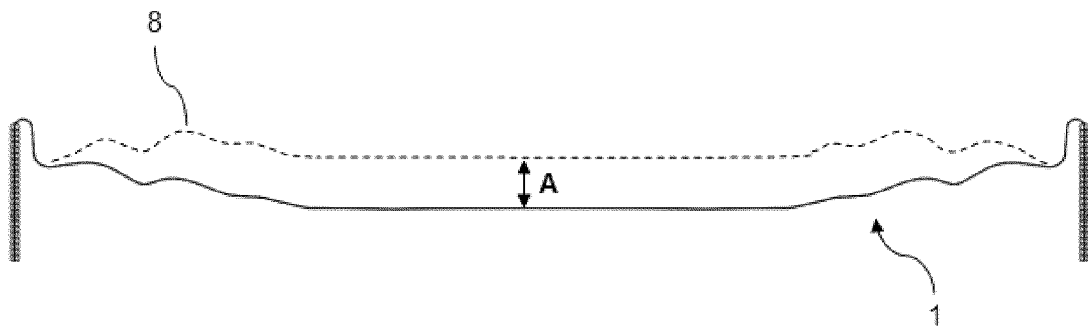


Fig 5

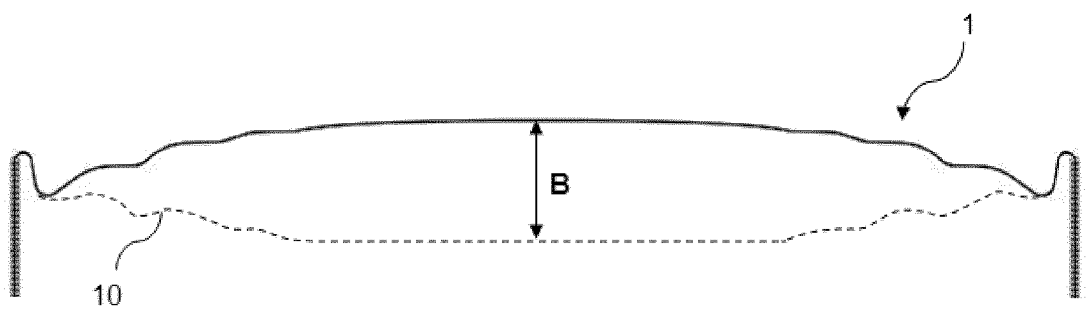


Fig 6



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Application Number
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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