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(54) **Lid for a pail.**

(57) An improved lid (14) for a pail body (10) includes an annular inclined portion (17) which forms part of a domed shape (30) of the lid when the latter is deformed following a drop test.

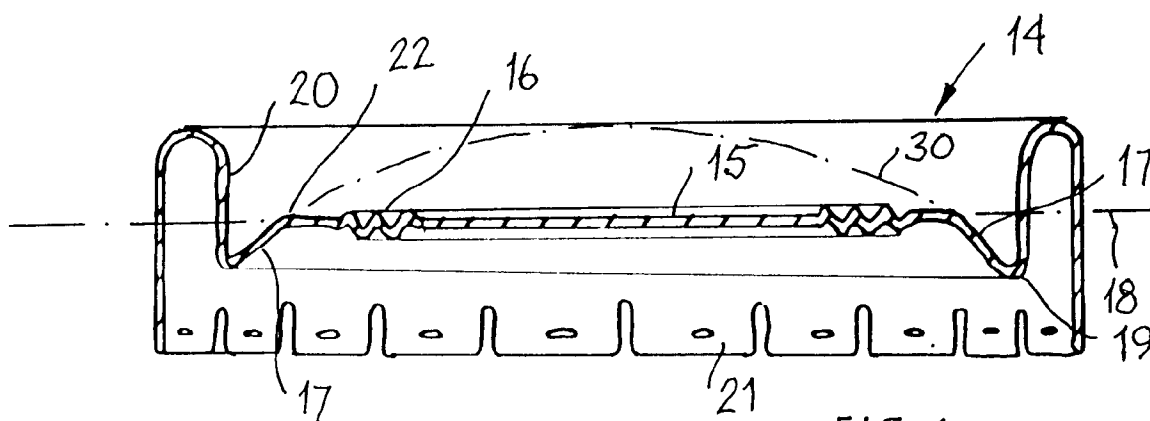


FIG. 1

This invention relates to a lid for a pail which is used for the storage and transportation of materials and which is especially useful in the transportation of dangerous goods such as paint.

The word "pail" is used in this specification to indicate a cylindrical container closable at one end by a removable lid. Sometimes such a container is called a "drum" although the latter term is more often used to indicate a container having irremovable end closures one of which at least is normally formed with a small opening for filling and/or emptying the container.

It is important in transporting materials which are corrosive or flammable that secure packages are used which are not readily susceptible to damage and leakage, for example if they are dropped during loading and unloading. Specifications for packaging have been raised over the years and it can be expected that they will be raised further.

The present invention seeks to provide a lid for fastening a pail body which is more secure than lids at present in use on conventional pails and is less susceptible to damage and leakage if dropped.

Conventionally, a lid is clamped to the head seam of the pail. One such head seam is described in GB-A-2189229. The head seam comprises a compound curl formed around the outside of the upper rim of the pail. A channel is formed around the periphery of the lid with downwardly directed flanges located at intervals around the lid. A sealing compound is run into the channel on the lid and the lid is clamped onto the curl on the pail by means of a clamping tool applied to the flanges, thus squeezing the channel onto the curl around the periphery of the pail to create a seal.

The present invention provides an improved lid compared with conventional lids.

According to one aspect of the present invention there is provided a lid for attachment to the rim of a pail body, the lid comprising a central planar region, a plurality of concentric corrugations around the central region and an upstanding cylindrical wall portion, the upper extremity of which extends outwardly and then downwardly and has lugs at its outermost periphery, is **characterised in that**, an inclined portion is provided which extends in a direction generally from the plane of the said planar region and in a direction which, when the lid is attached to the pail body, is towards the inside of the pail body, with a stiffening fold around the outer circumference of the inclined portion connecting it to the upstanding cylindrical wall portion, and in that the shape of the inclined portion approximates to part of a dome which would be formed by the lid if the corrugations and the planar region were domed without significant stretching of the metal of the lid.

Preferably the inclined portion is either frusto-conical or part spherical.

In a further aspect of the invention there is provid-

ed a pail comprising a pail body to which is fixed a lid constructed in accordance with the present invention and this aspect is featured in following claim 5.

The invention will be further described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a section through a pail lid according to the invention,

Figure 2 is a section through a pail showing the lid of Figure 1 in position on the rim of the pail prior to clamping the lid to the pail,

Figure 3 shows, in greatly enlarged section, the lid of Figure 1 fully clamped in position to close the pail,

Figure 4 is a section through the upper rim of a pail after the pail has been subjected to a drop test and shows the lid of Figure 1 sealed to the rim of the pail as deformed by the drop test, and

Figure 5 is a perspective view of the top of the pail showing the domed lid as depicted in Figure 4.

A pail, shown in part in Figure 2, has a capacity of 20 litres and its body 10 is made from 27 gauge (0.43 mm thick) mild steel. The first stage in the manufacture of the pail body 10 is a conventional procedure involving rolling to form a cylinder and crush welding to produce a longitudinal seam to form the pail body 10. Other welding techniques may be used to form this longitudinal seam. The pail body 10 has a compound curl 12 formed at its upper rim exactly as described in GB-A-2189229, and a bottom wall 13 joined to the pail body 10 exactly as described in GB-A-2189215.

A lid 14 which is constructed in accordance with the present invention is shown in Figure 1 and comprises a metal disc (typically 27 gauge (0.43 mm thick) mild steel). The lid 14 comprises a central generally planar region 15 and a plurality of concentric circular corrugations 16. Around the circumference of the outermost of the corrugations 16 is an inclined portion 17 which extends from a ring 22 in a plane 18 which includes the planar region 15, generally outwardly and in a direction which, when the lid 14 is attached to the pail body 10, is towards the inside of the pail body. Around the outer circumference of the inclined portion 17 is formed a stiffening fold 19 which leads to an upstanding cylindrical wall 20 which is of the same diameter as that of the inside surface of the rim of the pail body 10, to which the lid is to be fixed. The upper region of the wall portion 20 is curved outwardly and downwardly and has a series of lugs 21 formed at the outermost periphery of the lid 14.

The shape of the inclined portion 17 is very important. The portion 17 may be frusto-conical or it may be part-spherical. In either case the shape approximates to that of part of an imaginary dome, based on that which would be formed by the lid if the corrugations 16 and the planar region 15 were domed without significant stretching of the metal of the lid.

It has been found that if the portion 17 is vertical, excessive pressure within the pail sufficient to cause the lid to become domed, will cause the lid to rupture at the regions 19 and 22 because of the double curvature at these regions. However by making the portion 17 inclined as discussed above this does not happen.

The lid 14 of Figure 1 is offered to the curl 12 of the pail body 10 and the dimension D (see Figure 3) of the upstanding wall 20 is such that the planar region 15 lies in the plane 18 normal to the pail body 10 but below the lowest part of the compound curl 12.

A sealing compound 23 is placed in the recess formed in the lid 14 to form a seal between lid 14 and body 10 and the lugs 21 of the lid are clamped below the compound curl 12 of the pail body exactly as described in GB-A-2189229. Figure 3 shows the lid 14 clamped in place on the top rim of the pail body 10.

In use of a filled pail, should the pail be dropped on its rim, the compound curl 12 tends to tighten the seal at the rim, as described in GB-A-2189229. Any increase in pressure within the pail which is sufficient to cause the lid 14 to become domed, tends to bend the planar region 15 and straighten out at least some of the corrugations 16 to a shape which approximates to that of a dome with the inclined portion 17 becoming a part of the dome shape without significant distortion or rupture of the metal. The domed shape is shown schematically at 30 in Figures 4 and 5.

Referring to Figures 4 and 5, there is shown the lid 14 and top rim portion of the pail body after it has been subjected to an internal test pressure of 1.2 bar and dropped from a height of 1.8 metres on to its top rim. It will be seen from both Figure 4 and Figure 5 that the lid 14 has assumed a domed shape similar to that used on pressure vessels, which domed shape includes the vertical wall 20, the stiffening fold 19, the inclined portion 17, the corrugations 16 and the erstwhile planar region 15, and from Figure 5 that this has an indicated height of H which, in the case of one pail of 20 litres capacity tested, was some 70 mm. This doming has occurred without rupture of the metal of the lid, and the seal has remained substantially intact. In fact in certain drop tests which have been carried out, the gasket 23 is more likely to be blown out before the metal of the lid ruptures. This is not the case with conventional lids where the metal ruptures in regions 19 and 22 at significantly lower internal pressures and when dropped from much lower heights than 1.8 metres.

cylindrical wall portion (20), the upper extremity of which extends outwardly and then downwardly and has lugs (21) at its outermost periphery, characterised in that an inclined portion (17) is provided which extends in a direction generally from the plane of the said planar region (15) and in a direction which, when the lid (14) is attached to the pail body (10), is towards the inside of the pail body, with a stiffening fold (19) around the outer circumference of the inclined portion (17) connecting it to the upstanding cylindrical wall portion (20), and in that the shape of the inclined portion (17) approximates to part of a dome (30) which would be formed by the lid (14) if the corrugations (16) and the planar region (15) were domed without significant stretching of the metal of the lid (14).

2. A lid according to claim 1, **characterised in that** the inclined portion (17) is frusto-conical.
3. A lid according to claim 1, **characterised in that** the inclined portion (17) is part spherical.
4. A pail comprising a cylindrical pail body (10) closed at one end by a bottom wall (13) and at the other end by a lid secured to a composite curl (12), **characterised in that** the lid is as claimed in any one of claims 1 to 3.
5. A pail as claimed in claim 4, **characterised in that** on generation of a sufficient pressure within the pail the lid (14) will assume a domed shape which includes sheet metal taken from the wall portion (20), stiffening fold (19) inclined portion (17), corrugations (16) and erstwhile planar region (15).
6. A pail as claimed in claim 5, **characterised in that** it has a capacity of 20 litres and the height (H) of the domed lid after deformation is some 70 mm.
7. A pail as claimed in claim 5 or claim 6, **characterised in that** the planar region (15) lies in a plane (18) normal to the axis of the pail body (10) and below the lowest part of the compound curl (12) formed as the top rim of the body (10).

Claims

1. A lid (14) for attachment to the rim (12) of a pail body (10), the lid (14) comprising a central planar region (15), a plurality of concentric corrugations (16) around the central region and an upstanding

