

PATENT SPECIFICATION

(11)

1 302 450

DRAWINGS ATTACHED

- (21) Application No. 32152/70 (22) Filed 2 July 1970
(23) Complete Specification Filed 16 June 1971
(44) Complete Specification published 10 Jan. 1973
(51) International Classification B65B 51/10 51/26 51/06
(52) Index at acceptance
B8C 12B7 13A 24B3 24B6 25A 25B 25C 25D 29C
B2E 229 23Y 242 243 244 245 246 259 268 339 44Y 461
575 576 58Y 668
B5K 3
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(54) PLASTICS FILM SEALING METHOD

(71) We, IMPERIAL CHEMICAL INDUSTRIES LIMITED, of Imperial Chemical House, Millbank, London, S.W.1., a British Company, do hereby declare the invention, 5 for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

This invention relates to a method of closing 10 ing the ends of containers made of plastics film, including tubular film containers, bags, wrappers and the like. It is well known that two opposed faces of plastics film may be sealed together by heat and pressure, and 15 such seals can generally be made to withstand forces to which they may be subjected in normal use. However, when the contents of the packages are such that substantial peel forces are continuously or inter- 20 mittently exerted against the seal, for example when superatmospheric pressures are developed inside the package, the seals readily fail under the resulting peeling forces, unless the package itself first fails by stretch- 25 ing or by bursting. For example, it has previously been proposed to pack beer in plastics film containers closed at their ends by flat seals; but such packs have been found to be unreliable for the reasons just 30 described.

It is an object of the present invention to provide a method of closing the ends of plastics film containers by flat seals, the seals having an improved resistance to peel- 35 ing forces. By the expression "flat seals" we mean seals made between the opposed layers without pleating or bunching them to form a neck; the seals may however themselves be crimped, or otherwise patterned, by the surface of the sealing device 40 used.

In accordance with the present invention, a method of closing an open end of a plastics film container comprises forming an elongated heat-seal between the flat, opposed 45 [Price 25p]

layers of the plastics film at or towards their edges and along the whole length of said open end, folding the end of the container over, inwardly of the seal, so that the seal lies wholly against the external 50 surface of one wall of the container, and fastening the folded-over end in such position by means of a strip of flexible material adhered over the edge of the folded-over end, along substantially the whole length 55 thereof, the adhered strip extending beyond that edge of the heat-seal which is further from the edge of the folded-over end.

The invention further comprises a plastics-film container, and a package made there- 60 with, the container having at least one end closed by a method as described.

The fact that the strip of flexible material extends beyond the inner edge of the seal results in the strip having an unexpected 65 local reinforcing effect on the seal, especially against peeling forces from inside the container. The strip may extend at its ends beyond the ends of the folded-over portion, and this may in some cases be ad- 70 vantageous, as will be explained hereinafter.

The method of the invention is particularly useful for forming containers for contents under superatmospheric pressure, and especially for forming containers, suitable 75 for such use, from a length of tubular plastics film, closed at at least one end, and preferably at both ends, by the method as described. These containers, when filled with a liquid or other material under super- 80 atmospheric pressure, give packages of substantially chisel- or saddle-ended form, the two ends being separated (when the container is sufficiently long in proportion to its width, as will usually be the case) by 85 a body portion which assumes a substantially cylindrical form on inflation of the container. When the contents of such a package are under superatmospheric pressure, the cylindrical body portion, which is subjected 90

to greater stress than are the end portions, is preferably surrounded by a supporting sleeve. For example, a strip of paper may be wrapped around the cylindrical portion of the container after filling, and adhered into tubular form. If such a sleeve is applied to the package while the contents are chilled, it will firmly support the cylindrical part of the package when this expands on warming up to ambient temperature.

It may often be advantageous for the strip of flexible material to be wide enough to extend over and beyond the fold of the container, since this will reduce the tension exerted on the top edge of the folded-over end when the container has been filled. When the package is to be provided with a supporting sleeve over its cylindrical portion, as described, the strip of flexible material may extend over and beyond the fold of the container, and may further be extended so that its edges, across the width of the container, will extend to that portion of the container which assumes a substantially cylindrical form on inflation: thus, in the finished package, the said edges will each lie just within the tubular sleeve after this has been applied to the package. When the strip of flexible material extends over the fold of the container, it is preferred that its edges project beyond the sides of the flat container and that the opposed projecting portion be sealed together, forming fins at the sides of the chisel- or saddle-shaped ends when the container is inflated. This provides a still further reinforcing effect.

When the containers are intended for contents under superatmospheric pressure, the end closures are preferably each formed before the containers are filled. The containers may then be filled through an aperture in the wall, and the aperture sealed by a patch applied after filling. For example, the containers may be filled with beer or other carbonated liquids in such manner by the process described in Specification No. 1 251 672. This method comprises: locating an aperture in the wall of the closed container over an orifice in a substantially smooth surface, said orifice being connected to a source of a gas at superatmospheric pressure; inflating the container by the introduction of said gas while the container wall surrounding said aperture is held substantially in gas-tight contact with said surface; and, while said container is still fully inflated and in gas-tight contact with said surface, sliding it along relative to said surface to bring that portion of the wall of the container which surrounds said aperture into contact with a supported flexible sealing strip held in substantially continuous relationship to said surface; and sealing the sealing strip to the wall of the

container around said aperture, by applying heat if necessary.

The present invention will now be more particularly described by way of example with reference to the accompanying drawings, of which:

Figure 1 is a section through the end of the container, after the elongated heat-seal has been formed;

Figure 2 is a section of the end of the container after the sealed end has been folded over and a strip of flexible material applied;

Figure 3 is a side view of the end of the container as shown in Figure 2; and

Figure 4 is a view of a finished package, with contents under superatmospheric pressure.

In these Figures: 1 and 2 represent the opposed walls of the container; and 3 is a flat, elongated heat-seal between the walls, extending across the whole width of the container and having its inner edge at 4. 5, in Figures 2 and 3, is the fold-line located inwardly of the seal, and 6 is the strip of flexible material adhered over the edge region of the folded-over end, and, at 7 (Figure 2), to the adjacent portion of the container wall. The strip 6 extends beyond the inner edge, 4, of the seal. In Figure 4 is shown a container that has been filled with, for example, beer or another carbonated drink, the container being constructed in the manner illustrated by Figures 1 to 3 except that the strip of flexible material, 6a, extends across the saddle-shaped top of the container (that is, across the fold-line 5 of Figures 2 and 3 in the empty container) and downwards upon each wall until its end edges are just covered by a supporting sleeve, 8. This sleeve has been formed by wrapping and securing a paper strip round the package after the container has been filled with chilled liquid, and sealed. The side edges of the strip 6a are sealed together, forming the fins 9.

The strip of flexible material used in the method of the invention may be, for example, a length of self-adhesive tape, or a length of heat-sealable tape, or of tape coated with a heat-activated adhesive, activated at a temperature below the crystalline melting point of the plastics film forming the container. The tape may be made of plastics film, the same as, or different from, that from which the container is made; or it may be of paper or of a woven or bonded fabric having a heat-sealable or contact adhesive coating. When a heat-sealable tape or a heat-activated adhesive is used, the folded-over end (if the outer surface of the container is heat-sealable) may additionally become sealed to the adjacent wall of the container; this is often advantageous in further strengthening the seal.

If desired, a further reinforcement may be provided by adhering to the outer side of the seal (that is, to the left-hand side in Figure 1, which is outermost when the end has been turned over) another, narrower strip of flexible material (hereinafter referred to as a ribbon), this being adhered to the container wall along the whole length of the seal and beyond at least the edge thereof that faces the contents of the container, and eventually being covered over by the said strip. This ribbon may be adhered to the wall of the container after the seal has been formed but before the end of the container has been turned over. It may be of material similar to that used for the first-mentioned strip, and may be sealed to the container wall by similar methods.

In making containers required to withstand superatmospheric internal pressures, it is much preferred that the flexible strip be heat-sealed or otherwise adhered to one wall of the container, at least over an area including the inner edge of the seal closing the end of the container and also including the line of the intended fold, before the end of the container is folded over. This prevents the occurrence of any looseness between the strip and the end of the container when the end is turned over. If a further reinforcing ribbon is used, as described, this is applied upon the end seal, or at least upon the inner margin thereof, before the strip is applied to the wall.

Because containers made from oriented plastics films, such as polyethylene terephthalate film, will withstand considerable internal pressures without stretching or bursting, and because such films tend to give heat seals that are brittle or of low peel strength, the method of the invention is used with particular effect for sealing containers made from such films. The film is preferably in tubular form and is preferably biaxially oriented. For containing gas under pressure, it preferably bears a coating of vinylidene chloride copolymer or other gas-impermeable coating material. We have found that neither the seal between the opposed surfaces, nor the seal between the applied flexible strip and the container walls (or between the turned over portion and the container wall) need be particularly strong. The combined effect of the seals, however, is to give a remarkable degree of resistance to peeling forces exerted from inside the container. As previously indicated, the method is particularly useful for closing the ends of plastics film containers, particularly tubular film containers, intended for contents under superatmospheric pressure, such as beer and other carbonated drinks. However, the seals may usefully be provided to close the ends of any con-

tainer in which the seals are subjected to peeling forces by the contents. For example, they may be used for closing the ends of bags, including gusseted bags, for heavy and mobile contents which impose considerable peeling forces on the seals during handling.

Our invention is further illustrated but in no way limited by the following Examples.

EXAMPLE 1

A 9-inch (22.86 cm) length of biaxially oriented lay-flat tubing of polyethylene terephthalate coated externally with a vinylidene chloride copolymer, having a wall thickness of 0.001 inch (0.0254 mm) and a flat width of 2½ inches (6.35 cm), was sealed at each end by a heat seal ¼ inch (6.35 mm) wide, spaced ½ inch (6.35 mm) from the end of the tubing. Each seal was formed by a constant-temperature heat-sealer at 240°C for 2½ seconds. Each sealed end was turned over immediately beside the seal, so that the seal lay wholly against one wall of the tubing. A length of tape 1½ inch (3.81 cm) wide, having a coating of ethylene/vinyl acetate copolymer hot melt adhesive, was sealed over the folded-over end by heat-sealing at a temperature of 120°C for 5 seconds. The tape was positioned as shown in Figure 3 of the drawings, with one of its edges closely adjacent to the fold in the container; the upper part of its width was firmly adhered to the turned over portion, and the lower part to the wall of the container.

A number of containers so made were filled with beer each through an aperture in its wall, by the method described in Specification No. 1 251 672. The beer was filled into the containers at a temperature of 4°C, and the pressure within the containers at the time of sealing the aperture was 20 p.s.i. (1.41 kg/cm²). After 12 weeks' storage at an average room temperature of 21°C the seals were still intact and the beer had retained a satisfactory degree of carbonation.

EXAMPLE 2

A 9½-inch (24.76 cm) length of biaxially oriented lay-flat tubing of polyethylene terephthalate, having a wall thickness of 0.0012 inch (0.030 mm) and a flat width of 2.7 inches (6.90 cm), and coated externally with a vinylidene chloride copolymer, was used in forming a package as shown in Figure 4, by the following method.

Container units were successively formed from a length of the lay-flat tubing by heat-sealing it transversely at intervals of one container length, the seals being formed by a constant-temperature heat-sealer at 245°C for 2 seconds, and each seal being ½ inch (12.7 mm) wide. The tubing was transversely cut along the centre of each

seal and thus divided into individual containers, each having a seal $\frac{1}{4}$ inch (6.35 mm) wide along each end edge. To each end of the container a strip of biaxially oriented film of polyethylene terephthalate 0.001 inch (0.025 mm) thick, $2\frac{1}{2}$ inches (6.35 cm) wide and 3 inches (7.6 cm) long, and having a heat-seal coating of hot-melt polyester adhesive, was heat-sealed to an outer surface of the end of the container, this seal extending substantially from the end of the container and being about $\frac{1}{2}$ inch (1.27 cm) deep. It covered the inner margin of the seal closing the end of the container, and the line of the intended fold. The strip was symmetrically arranged before sealing, with its longer sides parallel to the end edges of the tubing and its longer axis lying along the intended fold line; its shorter edges thus projected slightly beyond the side folds of the flat tubing. The end of the tubing was then folded over, together with the attached strip, which was outermost, to form a fold along a line $\frac{1}{8}$ inch (3.17 mm) behind the inner edge of the heat-seal closing the end of the container unit. The entire folded-over portion (i.e. including the whole of the attached folded strip) was then pressed between heat-sealing jaws at 130°C for 5 seconds. The attached strip became strongly adhered over its whole area to the walls of the container, and its edges projecting beyond the side folds of the container became adhered to each other. Sealing also took place between the vinylidene chloride copolymer layer of the folded-over portion of the container end. The attached strip extended for $1\frac{1}{4}$ inches (3.175 cm) down each wall of the container; this length had been predetermined so that the longer edges of the strip would lie against the substantially cylindrical portion of the container when inflated.

A number of such containers were filled with beer by the method described in Specification No. 1 251 672; each was provided with a supporting sleeve by wrapping and securing a strip of paper round the cylindrical part of the container after filling but while the beer was still chilled. After 12 weeks' storage at an average room temperature (about 20°C) the seals of each container were still intact and the beer had retained a satisfactory degree of carbonation.

WHAT WE CLAIM IS:

1. A method of closing an open end of a plastics-film container that comprises forming an elongated heat-seal between the flat, opposed layers of the plastics film at or towards their edges and along the whole length of said open end, folding the end of the container over, inwardly of the seal, so that the heat-seal lies wholly against

the external surface of one wall of the container, and fastening the folded-over end in such position by means of a strip of flexible material adhered over the edge of the folded-over end along substantially the whole length thereof, the adhered strip extending beyond that edge of the heat-seal which is further from the edge of the folded-over end.

2. A method as claimed in Claim 1 in which the strip of flexible material extends over the fold of the folded-over end.

3. A method of forming a container that comprises closing at least one end of a length of oriented tubular plastics film by a method as claimed in Claim 1 or Claim 2.

4. A method as claimed in Claim 3 in which the oriented tubular plastics film is of polyethylene terephthalate.

5. A method as claimed in Claim 4 in which the tubular film of polyethylene terephthalate is biaxially oriented.

6. A method as claimed in Claim 4 or Claim 5 in which the tubular film is coated with a vinylidene chloride copolymer.

7. A method of closing an open end of a plastics-film container substantially as hereinbefore described with reference to Figures 1 to 3 of the drawings.

8. A method of forming a package, substantially as described in the foregoing Example 1.

9. A method as claimed in any one of Claims 2 to 7 in which the flexible strip at the or each closed end extends over the fold of the folded-over end and on each side of the container to such a depth that its edges lie upon the part of the container that will assume a substantially cylindrical form if the container is inflated.

10. A method as claimed in any one of Claims 2 to 8 in which the flexible strip at the or each closed end extends over the fold of the folded-over end and the ends of the strip project beyond the sides of the container, the opposed edges of the strip being adhered one to the other in this region.

11. A method of forming a container substantially as hereinbefore described with reference to Figure 4 of the drawings.

12. A method as claimed in any one of the preceding claims in which, before said strip is adhered upon the seal, an additional ribbon of flexible material is adhered to the container wall along the whole length of the same side of the seal and beyond at least the edge thereof that faces the contents of the container, said ribbon subsequently being wholly covered by said strip.

13. A method as claimed in any one of the preceding claims in which the flexible strip is adhered to one wall of the container, at least over an area including the

seal and thus divided into individual containers, each having a seal $\frac{1}{4}$ inch (6.35 mm) wide along each end edge. To each end of the container a strip of biaxially oriented film of polyethylene terephthalate 0.001 inch (0.025 mm) thick, $2\frac{1}{2}$ inches (6.35 cm) wide and 3 inches (7.6 cm) long, and having a heat-seal coating of hot-melt polyester adhesive, was heat-sealed to an outer surface of the end of the container, this seal extending substantially from the end of the container and being about $\frac{1}{2}$ inch (1.27 cm) deep. It covered the inner margin of the seal closing the end of the container, and the line of the intended fold. The strip was symmetrically arranged before sealing, with its longer sides parallel to the end edges of the tubing and its longer axis lying along the intended fold line; its shorter edges thus projected slightly beyond the side folds of the flat tubing. The end of the tubing was then folded over, together with the attached strip, which was outermost, to form a fold along a line $\frac{1}{8}$ inch (3.17 mm) behind the inner edge of the heat-seal closing the end of the container unit. The entire folded-over portion (i.e. including the whole of the attached folded strip) was then pressed between heat-sealing jaws at 130°C for 5 seconds. The attached strip became strongly adhered over its whole area to the walls of the container, and its edges projecting beyond the side folds of the container became adhered to each other. Sealing also took place between the vinylidene chloride copolymer layer of the folded-over portion of the container end. The attached strip extended for $1\frac{1}{4}$ inches (3.175 cm) down each wall of the container; this length had been predetermined so that the longer edges of the strip would lie against the substantially cylindrical portion of the container when inflated.

A number of such containers were filled with beer by the method described in Specification No. 1 251 672; each was provided with a supporting sleeve by wrapping and securing a strip of paper round the cylindrical part of the container after filling but while the beer was still chilled. After 12 weeks' storage at an average room temperature (about 20°C) the seals of each container were still intact and the beer had retained a satisfactory degree of carbonation.

WHAT WE CLAIM IS:

1. A method of closing an open end of a plastics-film container that comprises forming an elongated heat-seal between the flat, opposed layers of the plastics film at or towards their edges and along the whole length of said open end, folding the end of the container over, inwardly of the seal, so that the heat-seal lies wholly against

the external surface of one wall of the container, and fastening the folded-over end in such position by means of a strip of flexible material adhered over the edge of the folded-over end along substantially the whole length thereof, the adhered strip extending beyond that edge of the heat-seal which is further from the edge of the folded-over end.

2. A method as claimed in Claim 1 in which the strip of flexible material extends over the fold of the folded-over end.

3. A method of forming a container that comprises closing at least one end of a length of oriented tubular plastics film by a method as claimed in Claim 1 or Claim 2.

4. A method as claimed in Claim 3 in which the oriented tubular plastics film is of polyethylene terephthalate.

5. A method as claimed in Claim 4 in which the tubular film of polyethylene terephthalate is biaxially oriented.

6. A method as claimed in Claim 4 or Claim 5 in which the tubular film is coated with a vinylidene chloride copolymer.

7. A method of closing an open end of a plastics-film container substantially as hereinbefore described with reference to Figures 1 to 3 of the drawings.

8. A method of forming a package, substantially as described in the foregoing Example 1.

9. A method as claimed in any one of Claims 2 to 7 in which the flexible strip at the or each closed end extends over the fold of the folded-over end and on each side of the container to such a depth that its edges lie upon the part of the container that will assume a substantially cylindrical form if the container is inflated.

10. A method as claimed in any one of Claims 2 to 8 in which the flexible strip at the or each closed end extends over the fold of the folded-over end and the ends of the strip project beyond the sides of the container, the opposed edges of the strip being adhered one to the other in this region.

11. A method of forming a container substantially as hereinbefore described with reference to Figure 4 of the drawings.

12. A method as claimed in any one of the preceding claims in which, before said strip is adhered upon the seal, an additional ribbon of flexible material is adhered to the container wall along the whole length of the same side of the seal and beyond at least the edge thereof that faces the contents of the container, said ribbon subsequently being wholly covered by said strip.

13. A method as claimed in any one of the preceding claims in which the flexible strip is adhered to one wall of the container, at least over an area including the



line of the intended fold, before the end of the container is folded over.

14. A method of forming a package, substantially as described in the foregoing
5 Example 2.

15. A plastics-film container whenever formed by a method as claimed in any one of Claims 1 to 8.

10 16. A plastics-film container as claimed in Claim 15 having a filling aperture in the wall thereof.

17. A plastics-film container whenever formed by a method as claimed in any one of Claims 8 to 14.

15 18. A plastics-film container as claimed in Claim 17, having a filling aperture in the wall thereof.

19. A package comprising a container as claimed in Claim 15 or Claim 16, with
20 contents therein.

20. A package as claimed in Claim 19 in which the container is formed from a

length of oriented tubular plastics film with both ends similarly closed, and the contents are under superatmospheric pressure. 25

21. A package as claimed in Claim 20 in which the contents are beer or another carbonated drink.

22. A package comprising a container as claimed in Claim 17 or Claim 18, and 30 contents therein.

23. A package as claimed in Claim 22 in which the container is formed from a length of oriented tubular plastics film with both ends similarly closed, and the contents are under superatmospheric pressure. 35

24. A package as claimed in Claim 23 in which the contents are beer or another carbonated drink.

25. A package substantially as herein- 40 before described with reference to the drawings.

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Printed for Her Majesty's Stationery Office by The Tweeddale Press Ltd., Berwick-upon-Tweed, 1972.
Published at the Patent Office, 25 Southampton Buildings, London WC2A 1AY from which copies may be obtained.

