

Tool and Method for Heat Sealing LidstockField of the Invention

- 5 The invention relates to heat sealing tools for sealing lidstock to plastic containers to form sealed packages, particularly disposable packages for contact lenses known as blister packages.

Background to the Invention

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Soft hydrogel contact lenses have been increasing in popularity ever since they were first introduced in the 1970's. Such contact lenses are conventionally packaged in the hydrated state and in a storage solution. Many contact lenses are packaged, along with the aqueous storage solution, in a disposable blister package typically formed from a rigid polymer. Examples of blister packages can be seen in US Patent Nos. 15 4,691,820; 5,524,419; 5,578,331, 5,649,410, 5,722,536 and 6,082,533. The base of a blister package can either be part of the original contact lens mould or a separately moulded base, typically formed from a rigid polymer. In the above mentioned package types, the base that contains the contact lens and any aqueous storage 20 solution, is sealed by a flexible lidstock. This lidstock is typically a laminated foil which can be pulled back by a user to access the lens contained in the base. Typically, this lidstock is sealed to the area surrounding the portion of the base containing the contact lens. This sealing area of the base has typically been a substantially flat surface area, or a raised flattened annular surface as seen, for 25 example, in US Patent No. 5,722,536.

However, it has been found that this sealing area, whether raised or not, can pose problems during the sealing process. If a moulding process is used to form the blister package, for example, the material may have some shrinkage, resulting in somewhat concave or convex sealing surface rather than a flat surface. Although to the naked
5 eye, the sealing surface may seem flat, the curvature may be sufficient to lead to a poor seal between the lidstock and the sealing surface of the package.

The sealing tool for sealing the lidstock to the flange of a plastic container typically has a lower face which supports the container directly below the flange, and an upper
10 face which presses the lidstock against the surface sealing surface of the flange of the package, supported by the lower face which is in contact with the lower surface of the flange of the package. Typically, the upper face is heated in order to provide a seal by melting a thermoplastic basal layer of the lidstock to the sealing surface of the flange. Prior art sealing tools generally have flat faces where they contact the
15 lidstock and lower surfaces of the flange of the package for sealing.

One method to improve seal reliability would be to increase the sealing pressure or temperature applied by the tool. However this can also lead to increased strength of the seal or weld formed, such that the consumer may have difficulties in removing the
20 lidstock from the rest of the package when opening the package. This is undesirable and can lead to spillage of the contents of the package.

Accordingly, it is an object of the present invention to provide a heat sealing tool for sealing the lidstock onto blister packages that provides improved seal reliability while
25 maintaining ease of opening.

Summary of the Invention

5 A first aspect of the invention provides a heat sealing tool for sealing a lidstock to a rigid polymeric container comprising a well and a flange having a curved upper sealing surface and a lower surface wherein the tool comprises a first plate adapted to contact the lower surface of the flange and a second plate adapted to press the lidstock against the sealing surface of the flange, wherein the second plate is curved
10 with substantially the same curvature as the sealing surface of the flange. Preferably, the first plate is also curved with substantially the same curvature as the lower surface of the flange. Ideally the second plate is curved with an identical curvature as the sealing surface of the flange and the first plate is curved with an identical curvature as the lower surface of the flange.

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By providing the second plate with substantially the same curvature as the curved sealing surface of the flange, when the second plate comes into contact with the lidstock to press the lidstock against the sealing surface of the flange, substantially uniform contact time and contact pressure will be delivered over the sealing surface
20 of the flange, leading to greater uniformity in the strength of the seal over the entire flange. This uniformity may be further improved by providing the first plate with substantially the same curvature as the lower surface of the flange, such that as the plates are squeezed together sandwiching the lidstock and the flange, substantially uniform pressure is applied over the entire sealing surface of the flange over the
25 entire time span of the sealing process.

Description of Preferred Embodiments

- 5 It has been found that the moulding process, typically thermoforming, conventionally used to form the rigid polymeric container of the blister package, may lead to uneven shrinkage of the container after moulding, and this leads to the sealing surface of the flange of the container taking on a concave or a convex shape. This curvature may not be readily visible to the naked eye, and the radius of curvature may be
- 10 established by measuring the elevation of the blister ends from a flat reference surface.

- Although the curvature may be small (i.e. the radius of curvature is large), it may be sufficient to lead to significant differences in seal strength over the sealing surface of
- 15 the flange if flat plates are used for the heat sealing tool.

- Suitably, in use, the first plate is not heated and is at ambient temperature, while the second plate is heated to a suitable temperature such that a hermetic seal is formed by heat transmitted through the lidstock when the plates are brought together to
- 20 sandwich the lidstock and flange.

- The lidstock is suitably a laminated foil with a basal layer which melts to form a seal when heated in contact with the sealing surface of the flange. Preferably, the upper layer of the laminated foil is a surface upon which printing may be carried out. A
- 25 suitable upper layer is a metal foil such as aluminium foil.

The container is suitably moulded from a rigid polymer, for example a thermoplastic polymer such as polypropylene or polystyrene. The container comprises a well for holding the material to be packaged, such as a soft contact lens with hydrating solution, and has a flange around the well to which the lidstock is sealed to form the
5 sealed package. The flange may simply be the top surface of the package itself, or may be in the form of a raised area surrounding the well and provided on the top surface of the package. The sealing surface of the flange may be all or part of the upper surface of the flange, provided the sealing surface surrounds the well such that when a seal is made, the contents of the well are hermetically sealed. The nature of
10 the moulding process can lead to the top surface of the package and hence the flange, and the sealing surface of the flange, having a concave or a convex upper surface. This may arise from uneven shrinkage of the polymer forming the container during the moulding process to form the well.

15 Where the container starts as a flat sheet of polymer and then is moulded simply to form a well, leaving the remaining surface as the flange of the well, the upper sealing surface of the flange and the lower surface of the flange will be endowed with the same curvature as a result of the uneven tensions set up in the moulding process, but with the upper surface being concave and the lower surface convex or vice versa.

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Another aspect of the invention is concerned with a method for providing a heat sealing tool according to the first aspect of the invention, comprising the steps of preparing a rigid polymeric container comprising a well and a flange with a curved upper sealing surface and a lower surface, measuring the curvature of the upper
25 sealing surface and preparing a second plate for the heat sealing tool having substantially the same curvature as the upper sealing surface.

The method may further comprise the steps of measuring the curvature of the lower surface of the flange and preparing a first plate for the heat sealing tool having substantially the same curvature as the lower surface of the flange.

- 5 Typically, many examples of polymeric containers will be prepared and measured such that the average curvature may be used for preparing the curvatures of the second and/or first plates for the heat sealing tool.

The curvature of the lower and upper sealing surfaces of the flange may be
10 measured by any suitable means such as microscopy or interferometry.

Another aspect of the invention provides a method for sealing a lidstock to a rigid polymeric container comprising a well and a flange with a curved upper sealing surface and a lower surface using a heat sealing tool comprising a first plate adapted
15 to contact the lower surface of the flange and a second plate adapted to press the lidstock against the sealing surface of the flange, wherein the second plate is curved with the same curvature as the sealing surface of the flange. Preferably, the first plate is curved with the same curvature as the lower surface of the flange.

20 In order to better control the strength of the seal made by heat sealing tools according the invention, it is preferred if the tools are calibrated such that when the first and second plates are brought together to sandwich the lidstock and the flange of the container, the force applied is controlled within a preferred range. Such a calibration may be achieved by means of pressure or displacement readings on the
25 plates, and associated calculation formulae. However, a preferred method is to use a strain sensing load cell (such as a semiconductor load cell) mounted into a replica blister package with the surface of the load cell at the same position as the sealing

surface of the blister package to be used with the tool of the invention. The replica blister package is mounted onto the first plate and then the first and second plates are brought together to their normal sealing position and the applied force shown by a display monitor connected to the load cell. The normal sealing position may then be
5 adjusted and set to give the required sealing force as shown by the display.

Drawing

The invention will now be further described, by way of example only, with reference
10 to the accompanying drawing.

Figure 1 shows an exploded view of a tool according to the invention with a sealed blister pack between the plates of the tool. The curvature of the surfaces has been greatly exaggerated.

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The lower first part 1 of the tool has a recess 2 in the first face 8 to accommodate well 7 of the blister pack as sealing takes place. The lidstock 5 is in contact with the upper sealing surface of the flange 4 of the blister pack 6. The first face 8 is curved with the same curvature as the lower surface of the flange 4. The second face 9 of
20 the upper second part 3 of the tool is curved with the same curvature as the upper sealing surface of the flange 4.

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Claims

1. A heat sealing tool for sealing a lidstock to a rigid polymeric container comprising a well and a flange with a curved upper sealing surface and a lower surface wherein the tool comprises a first plate adapted to contact the lower surface of the flange and a second plate adapted to press the lidstock against the sealing surface of the flange, wherein the second plate is curved with substantially the same curvature as the sealing surface of the flange.
2. A heat sealing tool according to claim 1 wherein the second plate is curved with an identical curvature as the sealing surface of the flange.
3. A heat sealing tool according to claim 1 or claim 2 wherein the first plate is curved with the substantially same curvature as the lower surface of the flange.
4. A heat sealing tool according to claim 3 wherein the first plate is curved with an identical curvature as the lower surface of the flange.
5. A method for providing a heat sealing tool according to any preceding claim comprising the steps of preparing a rigid polymeric container comprising a well and a flange with a curved upper sealing surface and a lower surface, measuring the curvature of the upper sealing surface and preparing a second plate for the heat sealing tool having substantially the same or an identical curvature as the upper sealing surface.
6. A method according to claim 5 further comprising the steps of measuring the curvature of the lower surface of the flange and preparing a first plate for the heat

sealing tool having substantially the same or an identical curvature as the lower surface of the flange.

7. A method for sealing a lidstock to a rigid polymeric container comprising a well and a flange with a curved upper sealing surface and a lower surface using a heat sealing tool comprising a first plate adapted to contact the lower surface of the flange and a second plate adapted to press the lidstock against the sealing surface of the flange, wherein the second plate is curved with the substantially same curvature as the sealing surface of the flange.

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8. A method according to claim 7 wherein the first plate is curved with substantially the same curvature as the lower surface of the flange.

9. A method according to any one of claims 5 to 8 using a tool as claimed in any one of claims 1 to 4.

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