United States Patent Office

3,551,940

Patented Jan. 5, 1971

1

3,551,940

BOX HINGE

Jack Roger Edison, Indianapolis, Ind., assignor to Eli Lilly and Company, Indianapolis, Ind., a corporation of Indiana

Filed Aug. 19, 1968, Ser. No. 753,603
Int. Cl. E05d 7/00
U.S. Cl. 16—150 3 Claims

ABSTRACT OF THE DISCLOSURE

A method for forming a hinge in plastic sheet material susceptible to formation by heat and pressure whereby two flush surfaces may be integrally hinged. The hinge is formed by conforming plastic sheet material into a pair of longitudinal valleys in a mold which are separated by a longitudinal ridge.

BACKGROUND OF THE INVENTION

In the container and packaging fields, production techniques frequently referred to as pressure forming, thermoforming and vacuum forming of plastic sheet material have been widely adopted. Usually, the plastic sheet material is from about 5 mils to 30 mils in thickness and is a vinyl, acetate or similar composition susceptible of being formed by applying heat and pressure forming or vacuum forming techniques. Numerous shapes of light weight containers can be formed in this manner. The plastic sheet material is relatively tough, flexible and semi-rigid. However, heretofore efforts to form integrally hinged covers and receptacles have been unsatisfactory.

In particular, hinges which are capable of flexing at least 180° have been proposed by employing cutout portions in a fold in the plastic sheet material. Although such cutouts along a creased portion of the material enhance the hinge's flexibility, the hinge is also weakened and is more susceptible to tearing. Hinges with a curved cross section have also been formed from plastic sheet material, thereby avoiding a sharp edge that is subjected to stress. However, these round type of hinges prevent the mating surfaces or edges of the box from staying flush with each other since the use of such a curved or rolled surface for the hinge causes bowing of the adjacent mating edges. This unwanted bowing can be partially avoided by providing a sharp crease in the sheet material to serve as a hinge. However, this type of arrangement when subjected to several flexing actions tends to break and tear.

SUMMARY OF INVENTION

Briefly, my invention comprises the forming of a hinge from plastic sheet material whereby the hinge has a pair of hollow and parallel quarter-round valleys which extend outwardly along the length of the hinge. Each of these quarter-round edges has a first side connected to one of the mating surfaces and has a second side connected to a like side of the other quarter-round edge, thereby forming a ridge surface which is parallel to the valleys. This unique configuration provides a hinge that is capable of withstanding many flexing operations extending over at least a 180° range. The three surfaces absorb the various forces resulting from flexing the hinge and prevent any tearing or unwanted strain on the hinge. In addition these three hinge surfaces cooperate to maintain the two mating surfaces of the container flush without any bowing effect.

Thus it is one object of this invention to provide a new and improved hinge formed from plastic sheet material. Another object of this invention is to provide a method for forming a hinge from plastic sheet material in accordance with conventional thermoforming techniques. Other

2

objects and advantages of this invention will be apparent upon reading the following descriptions in connection with the drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a box with the integral hinge of this invention;

FIG. 2 is a partial view of a mold for forming the box and hinge of FIG. 1 taken in cross section on a line transversing the cover and box mold elements;

FIG. 3 is an end view of the hinge of this invention as it appears when removed from the mold; and

FIG. 4 is an end view of the hinge when its associated cover and bottom are closed.

DETAILED DESCRIPTION OF INVENTION

Referring to the drawing, a container **11** is illustrated which in the particular embodiment comprises a rectangular box. Container **11** has a cover **13** and a base **14**. Cover **13** has raised surface **16** which is surrounded by a flange **17**. Base **14** has a bottom surface **19** surrounded by four walls **20** and a flange **21**.

It is to be understood that the invention described herein is applicable to a variety of containers, receptacles and the like and is not restricted to the particular type container shown in the drawing. Cover **13** and base **14** are integrally joined by hinge **23**. It is to be noted that this hinge is formed with a pair of hollow and parallel valleys **25** and **26** (FIG. 1) which extend outwardly along the length of the hinge. Each of these valleys has an arcuate cross section thereby avoiding a sharp creased effect.

Valley **26** has a first side **28** (FIG. 4) which is connected to flange **21** on base **14**. Likewise valley **25** has a first side **29** connected to flange **17** on cover **13**. Valleys **25** and **26** each have a second side **31** and **32** respectively which cooperate to form a ridge **33** extending along the length of the two valleys. Thus hinge **23** comprises a pair of identical shaped quarter-round valleys which extend outwardly with a ridge therebetween.

In forming the hinge of this invention by conventional thermoforming techniques, a mold **35** is used which has a flat surface **36** (FIG. 2). Formed into the flat surface of this mold are a pair of parallel recesses **38** and **39** which will form the two quarter-round valleys **25** and **26** of the hinge. Each recess may have an arcuate surface **40** and a flat surface **41** meeting on a sharp junction line. Positioned between these two recesses is an upwardly extending longitudinal ridge which in the preferred embodiment is a creasing rule die **43** that forms the longitudinal ridge **33** (FIG. 4) of the hinge. The height of the rule die should not exceed the depth of the recesses **38** and **39** and is preferably even with the mold's surface **36**. Its width is preferably less than the radius for arcuate surface **40**. The remaining configurations on the mold surface will depend on the particular design used for forming the integral cover and base.

Thus it can be seen that the integrally connected cover and base of the receptacle are formed in substantially one primary horizontal plane. This forming occurs by placing a flat sheet of plastic material of the desired thickness over the flat surface **36** of the mold. During the application of heat and pressure and/or vacuum, the flat sheet material is deformed to assume the configuration comprising the recesses and ridges in the mold surface.

After the sheet material has been accordingly formed and cooled, it may be removed from the mold surface. The formed sheet material may now be immediately folded along its hinged portion with the outer or top surfaces of flanges **17** and **21** doubled onto each other to assume the inner surfaces of the container. This folding action results in the quarter-round valleys **25** and **26** extending outwardly with the ridge surface **33** extending in-