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Geigle et al.

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(54) **FILM STRUCTURE PUNCTURE TESTING TOOL AND METHOD**

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(51) **Int. Cl.**

G01N 3/42	(2006.01)
G01N 33/00	(2006.01)
G01N 3/04	(2006.01)
B65D 77/20	(2006.01)
B65B 7/28	(2006.01)

(52) **U.S. Cl.**

CPC ***G01N 3/04*** (2013.01); ***B65B 7/2878*** (2013.01); ***B65D 77/20*** (2013.01); ***G01N 33/00*** (2013.01); *G01N 2033/0081* (2013.01); *G01N 2203/0282* (2013.01)

(58) **Field of Classification Search**

CPC ... G01N 2203/0282; G01N 2033/0081; G01N 33/00; G01N 3/04; B65D 77/20; B65D 81/2084; B65D 25/10; B65D 1/34; B65D 77/2052; B65D 75/305; B65D 77/204; B65B 7/2878; B65B 9/04; C08J 5/18; B32B 27/00; B32B 27/34; B32B 27/36; B32B 27/08; B32B 27/32; B31B 50/81

See application file for complete search history.

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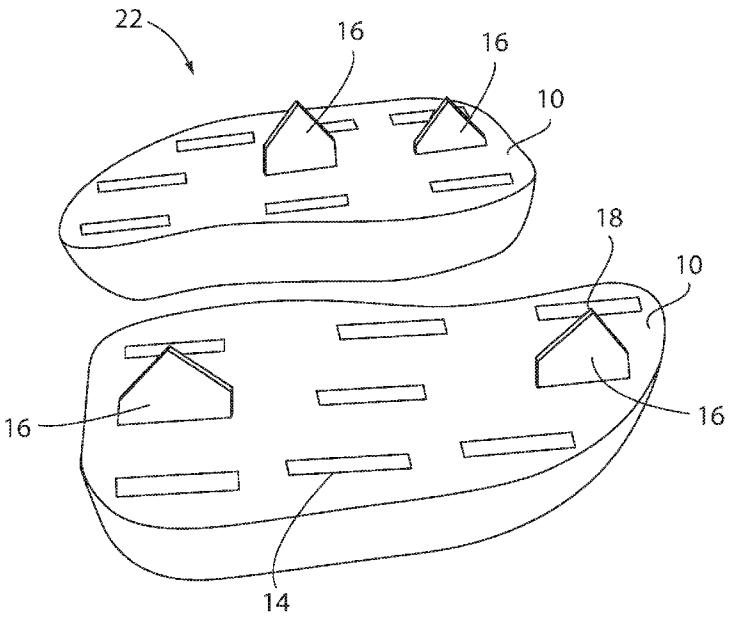
(57) **ABSTRACT**

A film structure puncture testing tool for testing the resistance to puncturing of a film structure for a product package and a method for analyzing film structures resistance to puncturing.

18 Claims, 5 Drawing Sheets



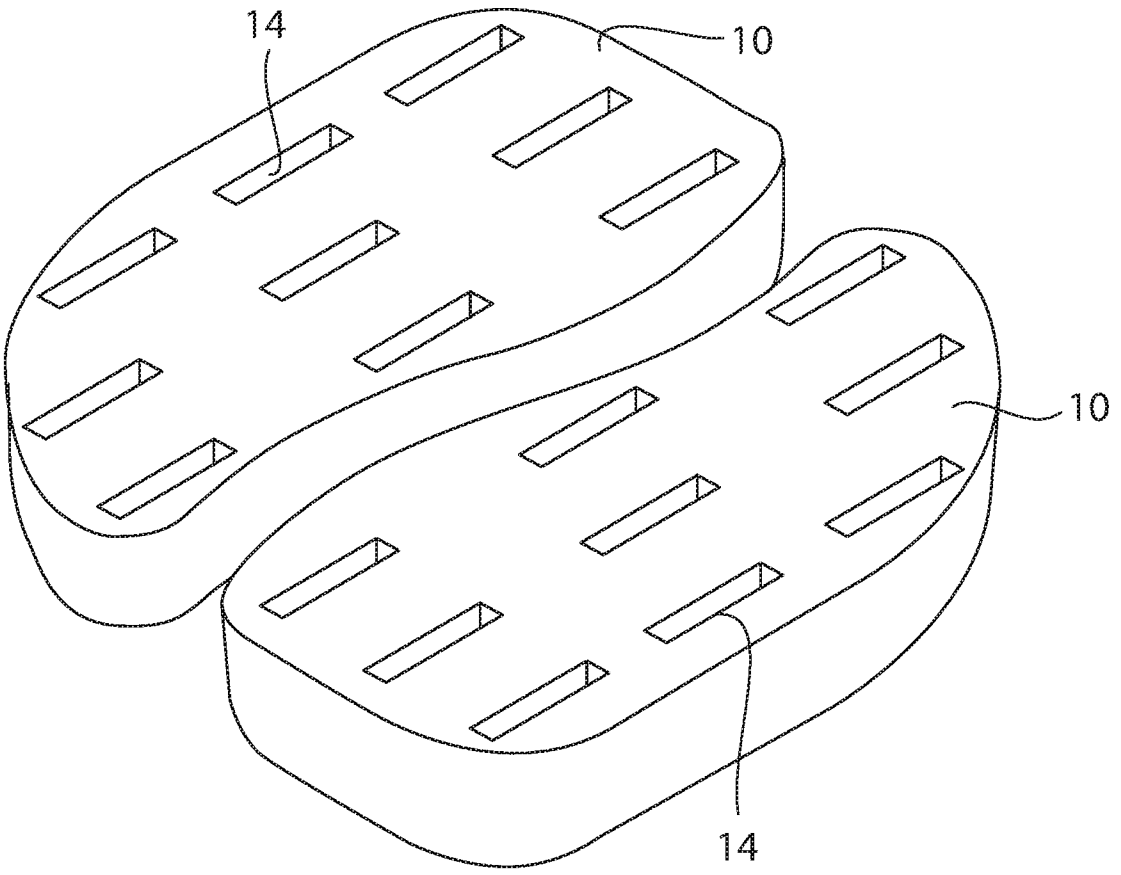


FIG. 1

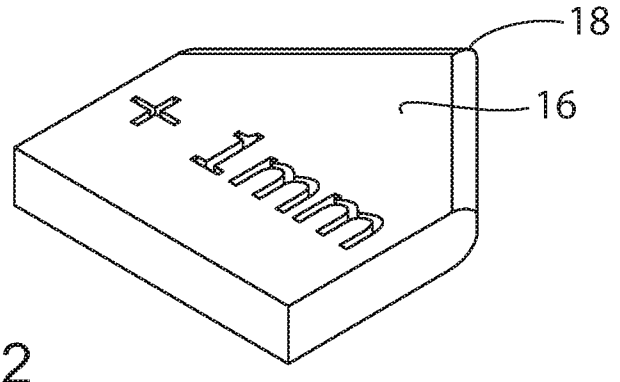


FIG. 2

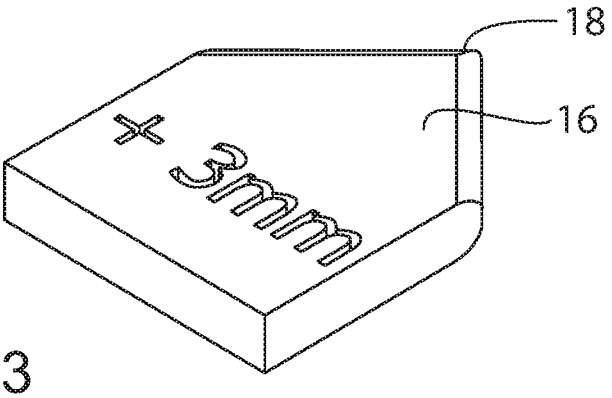


FIG. 3

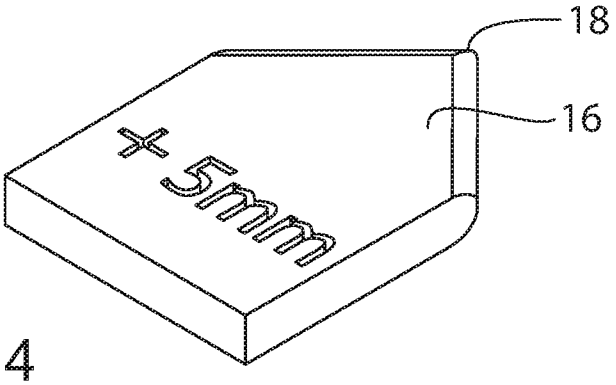


FIG. 4

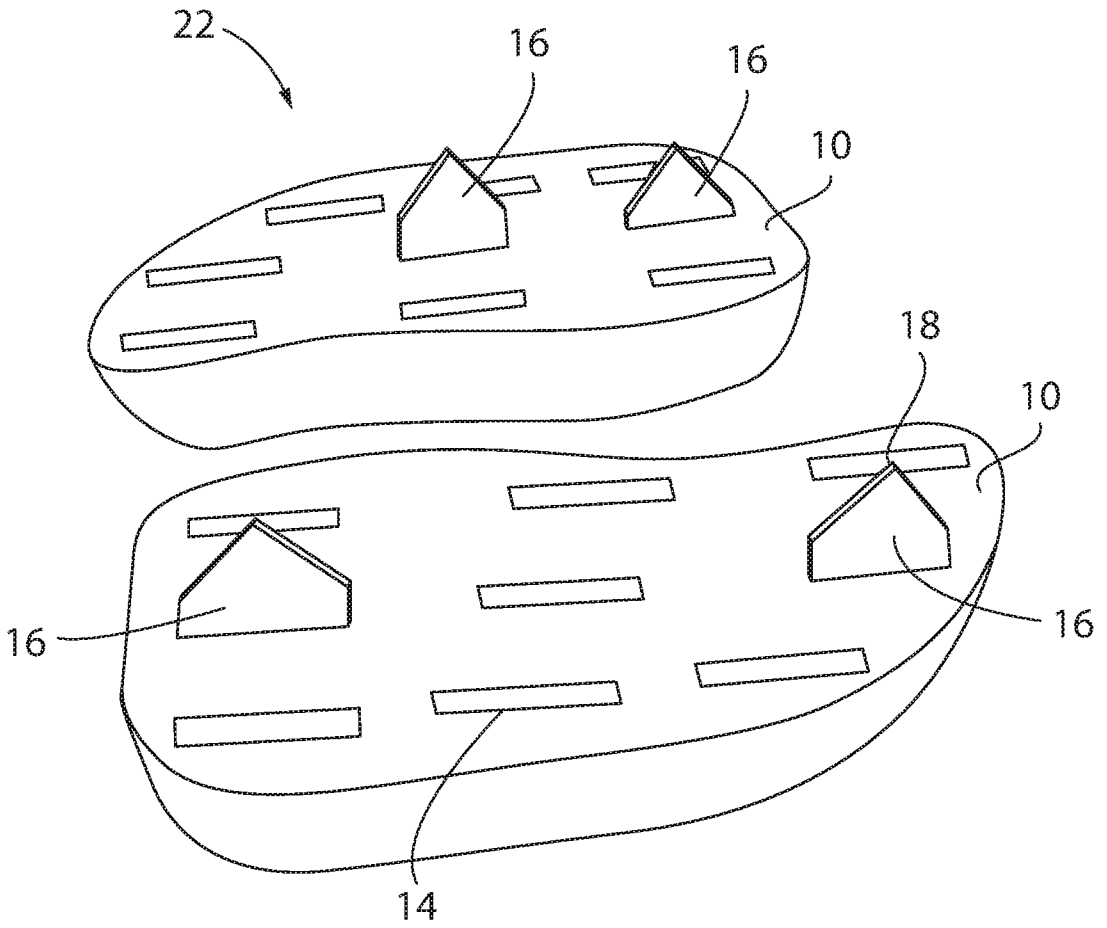


FIG. 5

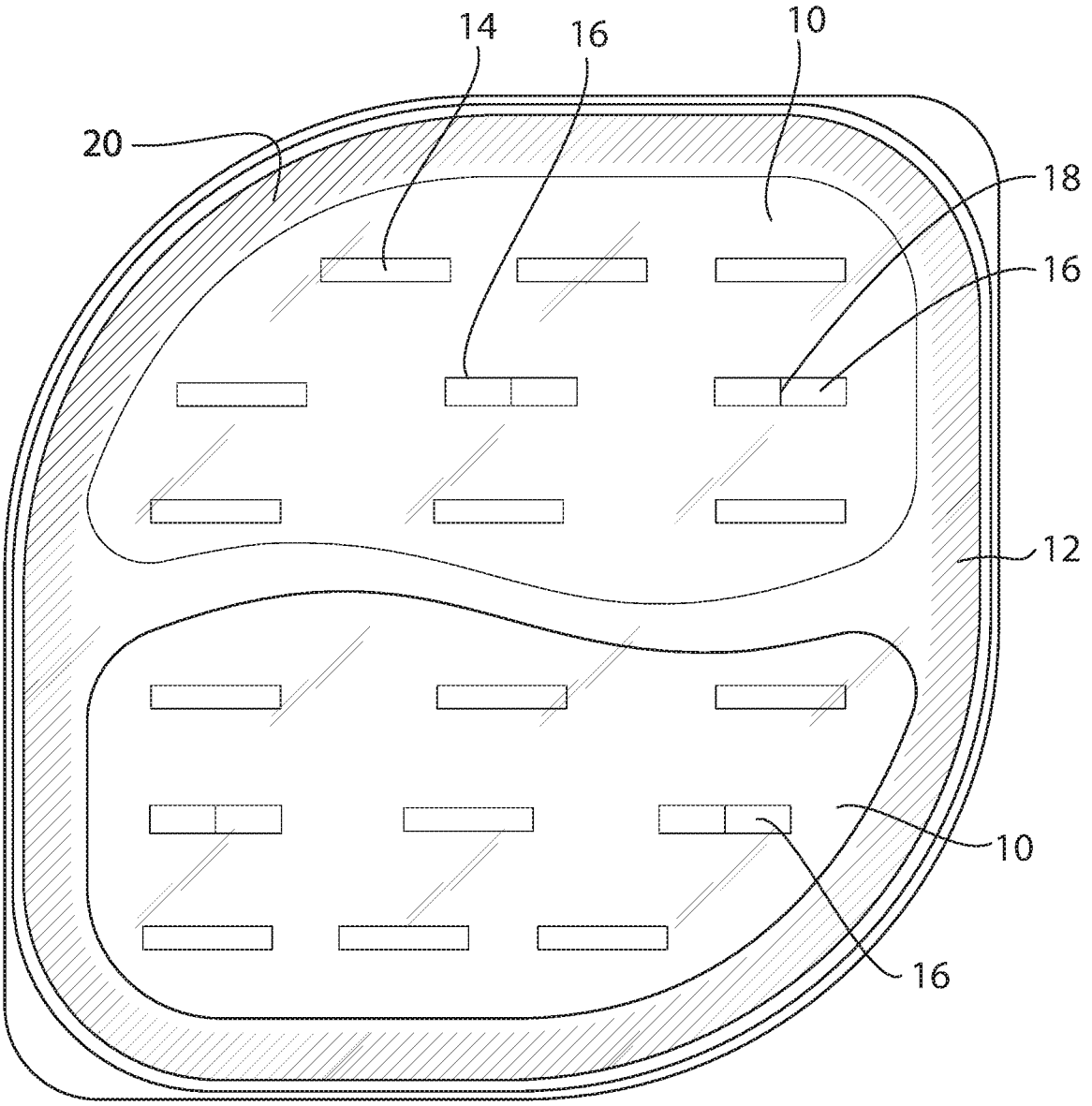


FIG. 6

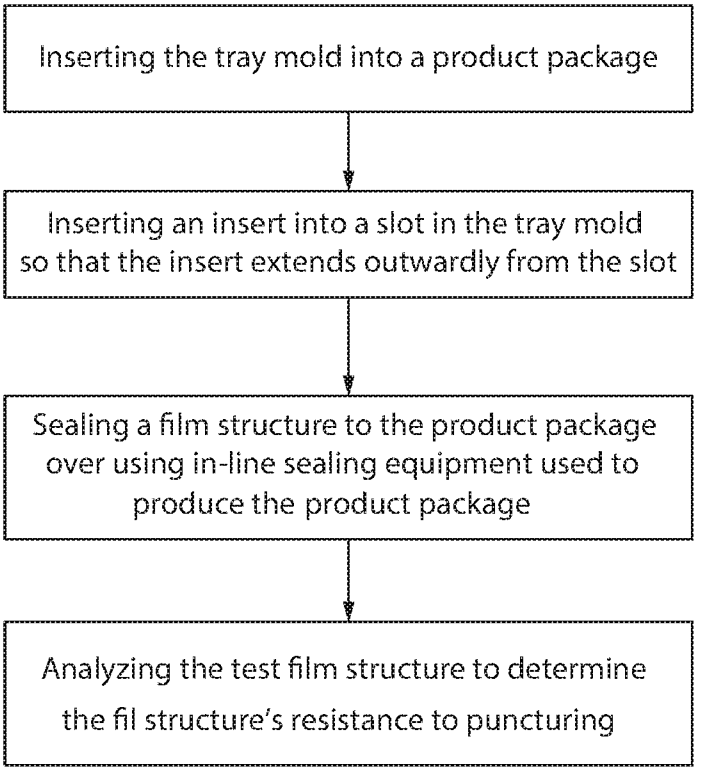

Inserting the tray mold into a product package
Inserting an insert into a slot in the tray mold so that the insert extends outwardly from the slot
Sealing a film structure to the product package over using in-line sealing equipment used to produce the product package
Analyzing the test film structure to determine the fil structure's resistance to puncturing

FIG. 7

FILM STRUCTURE PUNCTURE TESTING TOOL AND METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of and claims priority to U.S. application Ser. No. 17/003,126, filed Aug. 26, 2020, the entire contents of which is incorporated herein by reference.

FIELD OF THE INVENTION

The present disclosure relates to a comparative and replicable testing method that provides for the puncture testing of film structures that are used to seal product packages.

BACKGROUND OF THE INVENTION

Testing a film structure's resistance to puncturing has previously involved the use of a testing probe. Such probe testing systems are typically expensive to purchase and have maintenance fees attached to them.

SUMMARY OF THE INVENTION

In one construction, the disclosure provides a film puncture testing tool for testing resistance to puncturing of a film structure for a product package comprising a mold insertable into a product package and including a slot and an insert positioned in the slot in an orientation extending outwardly of the slot to simulate an object in the product package.

In another construction, the disclosure provides a film puncture testing tool for testing resistance to puncturing of a film structure for a product package comprising a mold insertable into a product package and an insert extending outwardly from the mold so that a film structure to be tested can be sealed to the product package over the mold and the insert.

In another construction, the disclosure provides a film puncture testing tool for testing resistance to puncturing of a film structure for a product package comprising a mold insertable into a product package, the mold having a plurality of slots, and a plurality of inserts, each positionable in a slot in an orientation extending outwardly of the mold.

In another construction, the disclosure provides a method for testing the resistance of a film structure on product package to puncturing including the steps of inserting a mold having a slot into a product package, inserting an insert into the slot, the insert extending outwardly from the mold and covering the mold and the insert with a film structure to be tested.

In another construction, the disclosure provides a method for testing the resistance of a film structure on product package to puncturing including the steps of inserting a mold into a product package, the mold having a portion adapted to simulate an object in the product package and covering the mold and the insert with a film structure to be tested.

Other aspects of the disclosure will become apparent by consideration of the detailed description and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view of a tray mold;

FIG. **2** is a perspective view of a 1 mm insert;

FIG. **3** is a perspective view of a 3 mm insert;

FIG. **4** is a perspective view of a 5 mm insert;

FIG. **5** is a perspective view of the tray mold with inserts inserted therein;

FIG. **6** is a perspective view of the tray mold positioned in a product tray with inserts inserted in the tray mold and a film structure sealed to the product tray; and

FIG. **7** is a flowchart of a method of the present invention.

DETAILED DESCRIPTION

Before any constructions of the disclosure are explained in detail, it is to be understood that the disclosure is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the following drawings. The disclosure is capable of other constructions and of being practiced or of being carried out in various ways.

With reference to FIGS. **1-6**, there is shown a tray mold **10** shaped to fit into a product package **12**. The figures illustrate two tray molds in one product package **12**, however, one tray mold can also be utilized. The tray mold **10** is preferably manufactured from plastics (including, but not limited to, PLA, Poly Carbonate, ABS, PETG, Nylon, ULTEM) using a 3d printing process, however, other materials and processes such as metals (including, but not limited to, aluminum, stainless steel and titanium) can also be utilized. The tray mold **10** can fill the entire product package **12** as shown, however, it can also be designed to fill only a portion of the product package **12**.

The tray mold **10** includes at least one and preferably a plurality of slots **14**. The slots **14** as shown are rectangular, however, other shapes can also be utilized such as including, but not limited to round, square, oval, hexagonal, octagonal.

FIGS. **2-4** specifically illustrate three examples of the inserts **16**. The inserts **16** preferably include a pointed end **18** and are preferably shaped as an irregularly shaped pentagon, however, other shapes and other ends can also be utilized with the present invention. The inserts **16** have a height and preferably have different heights such as the illustrated 1 mm, 3 mm and 5 mm, in which the stated measurements extend above the plane of the sealed surface. However, it should be noted that different heights can also be utilized. The inserts **16** are designed to be inserted into the slots **14** of the tray mold **10** with the pointed end **18** extending outwardly from the slot **14**.

As shown in FIG. **6**, a film structure **20** to be tested can be of varying types of films used in product packaging such as bases structures of PET, Nylon, PP, each of which can exhibit a coextrusion or laminate of sealant and/or combination of other structures or materials to aide in overall performance of the final material. The film structure **20** is secured to the tray **10** or product package **12** by sealing.

The film testing tool **22** includes the tray mold **10** and at least one insert **16**. The testing tool **22** is utilized to test a film structure's resistance to puncturing. Specifically, the pointed end **18** of the insert **16** is used to test the film structure's ability to resist being punctured thus causing a leak in the product package **12**. Preferably, the inserts **16** are inserted into the tray mold slots **14** with the pointed end **18** upward to simulate a solid item in the product package **12** such as a cracker. The film testing tool **22** allows for consistency in puncture testing across different film structures **20**.

In operation and in reference to FIG. **7**, the tray mold **10** with one or more inserts **16** therein is placed into the product package **12**. One film structure **20** is sealed to the product package **12** to observe the film structure's ability to resist

puncturing. For example, in-line sealing equipment that a manufacturer already has in its facility, such as the Mini Mondini available from G. Mondini of Cologne Italy, can be used on a manufacturing line to seal the various film structures **20** to packages **12**. However, other off-line or in-line methods can also be used to secure the film structure **20** to the product package **12**.

After the film structure is sealed to the product package **12**, the film structure can be visually analyzed to determine if the film structure **20** has been punctured and, if so, the puncture severity. The film structure **20** can also be sent to a lab for analysis under a microscope to observe how deep/severe the punctures are.

The puncture testing tool **22** allows for the puncture testing of a variety of film structures **20** in a consistent, comparative, replicable and cost-effective way using sealing equipment that the product package manufacturer already has in its facility.

Since the location of the solid items within the product package **12** can vary, providing multiple slots **14** in the tray mold **10** can provide an opportunity to evaluate potential punctures based on location. For example, the film structure **20** may be less taut in one location as compared to another. Since there may be more than one solid item in the product package **12**, providing multiple inserts **16** can provide an opportunity to evaluate greater than one solid item puncturing through the film structure **20**.

Various features and advantages of the invention are set forth in the following claims.

What is claimed is:

1. A film puncture testing tool for testing resistance to puncturing of a film structure for a product package, said film puncture testing tool comprising:

a mold insertable into a product package and including a slot; and

an insert positioned in the slot in an orientation extending outwardly of the slot to simulate an object in the product package.

2. The film puncture testing tool of claim **1** wherein the mold fills the product package.

3. The film puncture testing tool of claim **1** wherein the insert has a pointed end.

4. The film puncture testing tool of claim **1** and further including a plurality of slots.

5. The film puncture testing tool of claim **4** wherein the plurality of slots have varying depths.

6. The film puncture testing tool of claim **4** wherein the plurality of slots have the same depth.

7. The film puncture testing tool of claim **1** and including a plurality of inserts.

8. The film puncture testing tool of claim **7** wherein the plurality of inserts are of differing dimensions.

9. A film puncture testing tool for testing resistance to puncturing of a film structure for a product package, said film puncture testing tool comprising:

a mold insertable into a product package; and

an insert extending outwardly from the mold so that a film structure to be tested can be sealed to the product package over the mold and the insert.

10. The film puncture testing tool of claim **9** and further including a plurality of inserts.

11. A film puncture testing tool for testing resistance to puncturing of a film structure for a product package, said film puncture testing tool comprising:

a mold insertable into a product package, the mold having a plurality of slots; and

a plurality of inserts, each positionable in a slot in an orientation extending outwardly of the mold.

12. The film puncture testing tool of claim **11** wherein the plurality of inserts are the same size.

13. The film puncture testing tool of claim **11** wherein the plurality of inserts are of differing sizes.

14. A method for testing the resistance of a film structure on product package to puncturing, said method including the steps:

inserting a mold having a slot into a product package;

inserting an insert into the slot, the insert extending outwardly from the mold; and

covering the mold and the insert with a film structure to be tested.

15. The method of claim **14** wherein the mold includes a plurality of slots.

16. The method of claim **15** wherein in the inserting step, a plurality of inserts are inserted into the plurality of slots.

17. The method of claim **14** wherein in the covering step, the film structure is sealed to the product package.

18. A method for testing the resistance of a film structure on product package to puncturing, said method including the steps:

inserting a mold into a product package, the mold having a portion adapted to simulate an object in the product package; and

covering the mold and the insert with a film structure to be tested.

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