

- [54] **PACKAGE AND METHOD OF MAKING**
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- [21] Appl. No.: **331,701**

Related U.S. Application Data

- [63] Continuation of Ser. No. 83,891, Oct. 16, 1970, abandoned.
- [52] **U.S. Cl.**..... **206/471, 161/130**
- [51] **Int. Cl.**..... **B65d 73/00, B32b 3/30**
- [58] **Field of Search**..... **206/80 A, 78 B, 471; 161/130**

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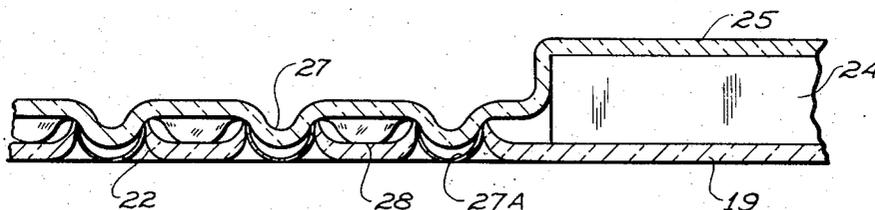
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[57] **ABSTRACT**

A skin package with a plastic base sheet and a method of making it, the base sheet has projections and recesses therebetween. A heat-softened cover sheet is forced down over a product and brought into engagement with the base sheet by establishing a pressure differential. The projections are partially collapsed inwardly to form concavities and portions of the cover sheet enter into tight intimate contact with the concavities.

The base sheet is formed by establishing a pressure differential while the sheet is heat softened and on a perforated platen of a skin packaging machine. There the base sheet is inverted so that those portions of the sheet which have been drawn into the perforations provide the projections.

12 Claims, 7 Drawing Figures



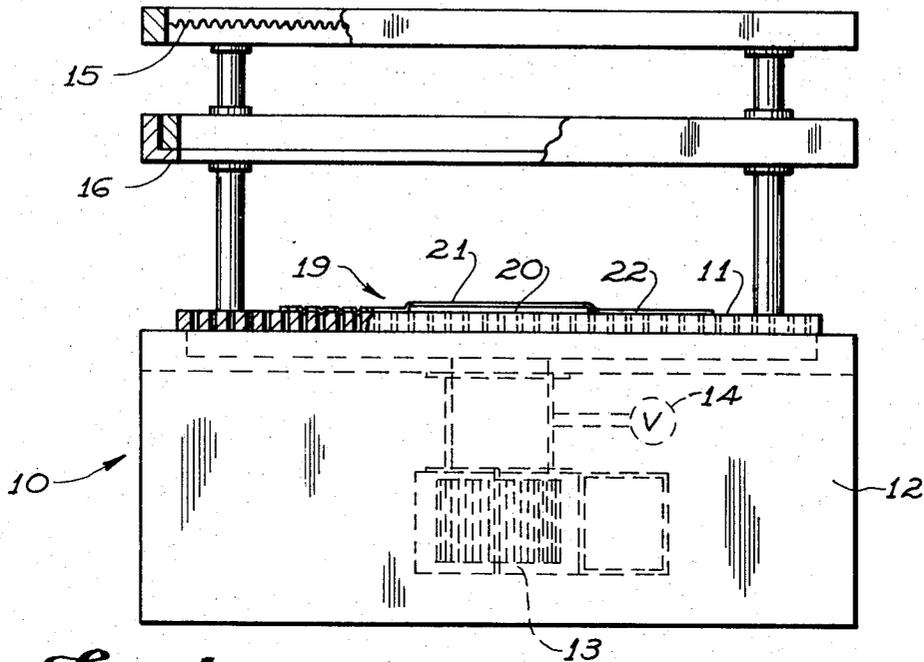


Fig. 1

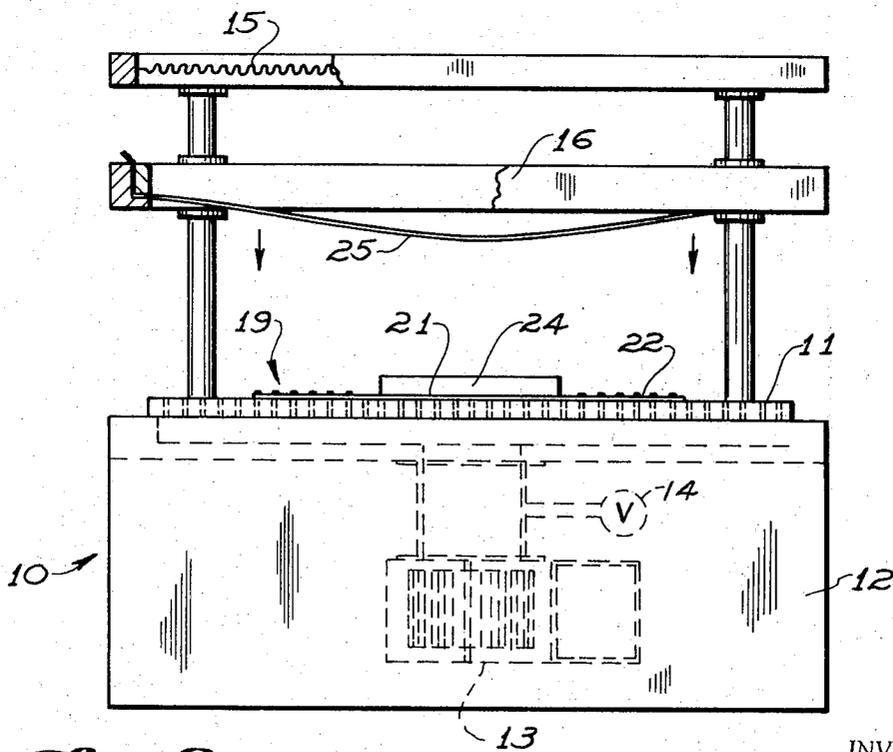


Fig. 2

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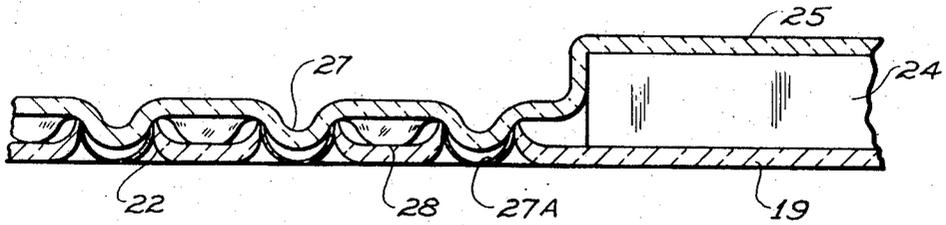


Fig. 3

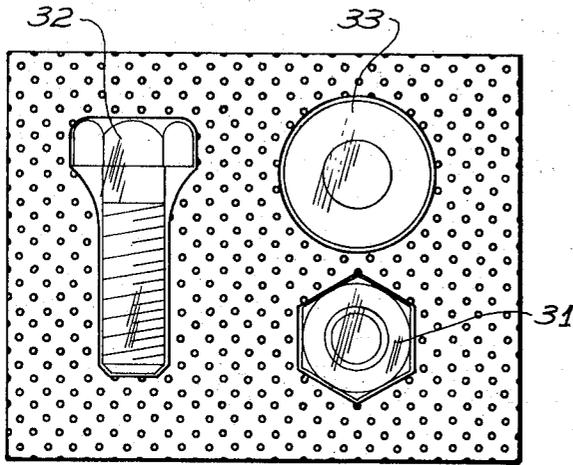


Fig. 4

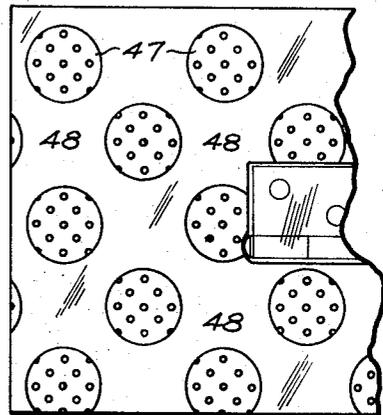


Fig. 7

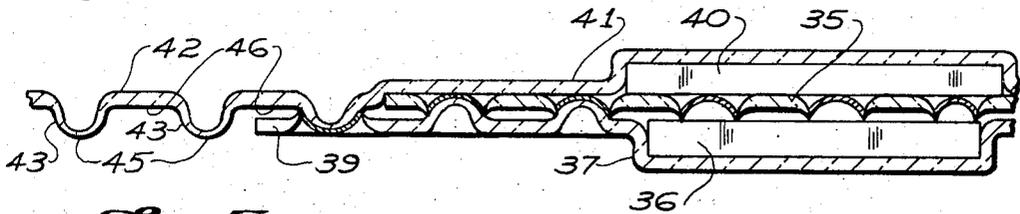


Fig. 5

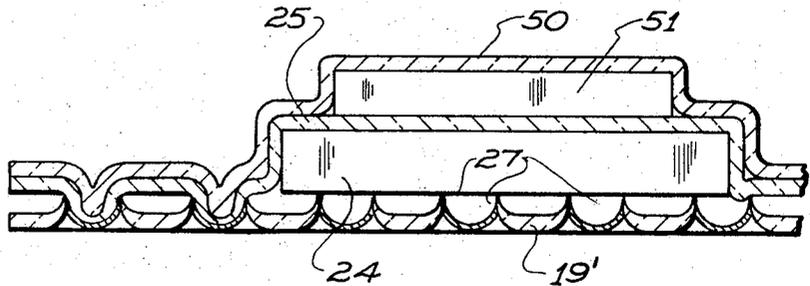


Fig. 6

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PACKAGE AND METHOD OF MAKING

This is a continuation of application Ser. No. 83,891, filed Oct. 26, 1970, now abandoned.

BACKGROUND OF THE INVENTION**1. Field of the Invention**

This invention relates to a method of securing a body between two imperforate sheets and more particularly in its preferred form to a method of skin packaging and a skin package formed by the method.

2. Prior Art

So-called skin packages have now become well known in the art. With the typical skin package, a permeable base sheet is provided. With one form of skin packaging, a surface of the base sheet has been coated with an adhesive and the adhesive then perforated to provide a permeable layer.

This sheet is positioned over a vacuum chamber with the adhesive side up. The product to be packaged is positioned on the adhesive-treated surface. A film of thermoplastic material is then heat softened and brought down over the product and the sheet. The vacuum chamber is operated to establish a pressure differential such that the thermosoftened sheet is forced down over the product into an intimate, bonded contact with the adhesive surface of the base sheet.

In other forms of skin packaging, adhesive is not applied to the base sheet, but rather a treated film which will become adhesively secured to the base sheet is utilized. When the film is heat softened and forced into contact with the sheet through pressure differential, it bonds to the sheet around the product being packaged.

There have been proposals for providing selected imperforate areas in the base sheet. For example, when packaging a soft product, it has been proposed to provide a protective ring around the product and position the product on an imperforate area. When the plastic film is forced down against the base sheet, it adheres around the protective ring but is not drawn down into the ring and against the soft product. While there have been such proposals, formation of the package has nonetheless relied upon the permeability of the base sheet.

SUMMARY OF THE PRESENT INVENTION

The present invention is directed to a novel and improved process and package in which an imperforate plastic base sheet is used in skin packaging. The finished package is all plastic, having a number of advantages, many of which will be described.

It has been discovered that with an imperforate base sheet having projections and recesses therebetween, a skin package can be achieved with an otherwise more or less conventional process. The product is positioned on the formed sheet and a pressure differential is established. The heat softened film is brought down over the sheet. Air entrapped between the film and the sheet escapes through recesses between the projections as the established pressure differential forces the film into tight intimate contact with the substrate. It is believed that the escaping, flowing air serves to maintain the film and base sheet in spaced relationship while, at the same time, assisting in permitting the establishment of an appropriate pressure differential.

With the present invention, the base sheet is formed so that it has a series of projections and recesses therebetween. Preferably, the forming of the base sheet is

achieved by thermoforming. This thermoforming of the base sheet can be accomplished with a standard skin packaging machine set up in a manner akin to the manner utilized when blister packages are formed. Specifically, a mold may be formed with air holes drilled through it. A plastic sheet is placed over the mold and heat softened. A pressure differential is then established to draw the plastic sheet against the mold and to cause it to achieve the contour of the mold.

In its simplest and preferred form, a "dimpled" base sheet is formed by placing a plastic film on the platen of a skin packaging machine. The film is heat softened and vacuum is applied so that the platen itself serves as the mold. After formation, the base sheet is inverted and used as a base sheet for forming a skin package.

In addition to the many characteristics which make the packages made in accordance with this invention superior packages for many applications, there are considerable economic advantages over conventional skin packages. These include:

1. The plastic film used as the base film is less expensive than permeable card stock conventionally employed. It especially has economic advantages over coated and perforated card stock commonly used in making skin packages;
2. Any good-quality polyethylene film, or similar plastic material, can be employed. Specially-treated films are not required for this package. Thus, the plastic film used for both the base and the covering of the package is less expensive than the base and the film used in conventional packages; and,
3. Inventory requirements are reduced since the same material is used for both the base and the covering sheets.

As previously suggested, the package has a number of advantages over prior packages. One advantage is achieved when the base film is used in its simplest form; that is, the desired form where the film is simply formed by using the platen of a conventional skin packaging machine. This one advantage is that the projecting dimples on the base sheet tend to retain circular and spherical products in place. That is, the dimples inhibit rolling when circular products are positioned on the base sheet for packaging.

Another advantage of all forms of the invention is that, unlike card stock, the flexible base sheet conforms to the platen before pressure is applied. Thus, the base sheet does not tend to be drawn out of shape when the vacuum system is placed in operation.

In many applications, it is desirable that the base sheet not be dimpled across its entire surface. For example, if one wishes to be able to see the part clearly from either side of the package, it may be desirable to have a flat, non-dimpled area in the base sheet. This is conveniently accomplished by placing flat inserts at various locations on the platen before the base sheet is formed. When heat-softened film is forced down against the platen, a small pocket is formed at each insert location. Preferably, these flat metal inserts will be magnetic so that they will remain where positioned on the platen and a series of identical base sheets can be formed.

If metal inserts are made to the contour of parts to be packaged, the formation of a base sheet for such applications as a kit for repair parts is greatly facilitated. The person placing the parts on the base sheet before the

package is formed can make sure that a part of the contour of each formed pocket is placed in each pocket. Thus, formation of a complete kit and inspection to be sure that a given kit is complete, is greatly facilitated.

If an insert, such as a thin metal sheet having evenly spaced holes, for example about one-half inch in diameter, is used other advantages can be achieved. When a base sheet is formed over such an insert, it will have a series of circular dimpled areas of one-half inch diameter. These provide selective areas of cover film to base sheet adherence and also provide cushioning over a part for protection of the part. Obviously, an insert with spaced one-half inch holes is only by way of example. Such an insert between a base sheet and the platen can take any of many varied forms.

Another advantage of the present invention is that multiple-layered skin packages can be formed. After a first product has been skin packaged in place, one may simply place a second product on top of the first and then apply another layer of film. This second layer of covering film will adhere to the first, because the first has taken on a dimpled contour of the base sheet in that area where they are bonded together.

Another manner of making multiple parts packages is to use a small base sheet and package a first part with a covering film that extends beyond the small base sheet. The covering film is then trimmed to dimensions slightly larger than the base sheet and the package inverted for packaging of a second part.

The band of film from the first package projecting beyond the base sheet becomes a base sheet for a second covering film once the package is inverted. This can be repeated any number of times, with the package becoming slightly larger in width and height as well as thickness each time a part is added.

In another form of the invention, if the insert extends to an edge of the base sheet, and in fact is again used on top of the base sheet after it has been formed and inverted, the base sheet and film can be adhered together around three edges. This leaves the fourth edge open to provide an inexpensive, but functional envelope.

Another advantage of skin packages made in accordance with this invention is the finished package is quite flexible. Accordingly, a package containing a number of parts can be rolled and, for example, inserted in a mailing tube for shipment or storage.

The same technique and equipment can be used to form blister packages. One simply places inserts on the platen to the shape of the blisters which are to be formed and then thermoforms plastic sheet material, as distinguished from film, onto the platen. The formed blisters can be easily closed with a skin packaging technique or by bonding a suitable closure to them.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims taken in conjunction with the accompanying drawings.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of a skin packaging machine with portions thereof broken away and with a base sheet positioned to be formed;

FIG. 2 is a similar schematic view of a skin packaging machine with portions thereof broken away and showing a formed base sheet positioned for forming a pack-

age, a product in place, and a covering film held by a drape frame;

FIG. 3 is an enlarged fragmentary sectional view of the finished package;

FIG. 4 is a plan view of a package;

FIG. 5 is an enlarged fragmentary sectional view of one form of multiple parts package where the parts are packaged sequentially rather than simultaneously;

FIG. 6 is an enlarged, fragmentary view of another form of package with multiple parts that have been sequentially packaged; and,

FIG. 7 is a fragmentary plan view of a package in which projections have been formed in spaced selected areas.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings and to FIGS. 1 and 2 in particular, a skin packaging machine is shown schematically at 10. Since the skin packaging machine itself is conventional, it is shown only schematically. A suitable, commercially-available skin packaging machine for performing the process and making the package of this invention is a Model 200 series vacuum packaging machine sold under the trademarks AMPAK and PORT-A-VAC by American Packaging Corporation of Hudson, Ohio.

The packaging machine 10 includes a platen 11. The platen 11 typically is a perforated sheet of steel having uniformly disposed perforations. Typically, the perforations may be of the order of one thirty-second inch in diameter and they will be spaced of the order of one-eighth inch from center to center. There will be of the order of 75 holes per square inch.

The machine 10 includes a vacuum chamber 12 below the platen 11. The vacuum chamber 12 is evacuated by a suitable vacuum source such as a vacuum pump 13. An oven is above the platen 11 and is represented by a schematic showing at 15 of a heater element.

The commercial machine is slightly modified in that a bleed line and bleed valve 14 are provided. The valve is adjusted to draw air through the line as well as through the platen 11 when it is desired to reduce the platen vacuum.

A drape frame is shown at 16. The drape frame holds a covering film adjacent the heat 15 until the film is heat softened. The drape frame is then lowered to position the film for formation of a package.

Referring now to FIG. 1, a sheet of plastic film to be formed into a base sheet is shown at 19. An insert 20 is mounted on the platen so that an area 21 will be free of dimples in the finished base sheet 19. As has been suggested previously, in its simplest form, the insert 20 is not employed. Conversely, where desired, a series of inserts 20 may be used but for clarity of illustration, only one is shown in FIG. 1. Similarly, for clarity of illustration, the thickness of the insert 20 and of the plastic film 19 is greatly exaggerated in the drawings.

When the base sheet is formed, the drape frame need not contain a film. The oven, represented by the heater 15, is energized to thermosoften the base film 19. The vacuum pump 13 is then operated to draw the film tightly down against the insert 20 and the platen 11. A smooth pocket is formed over the insert 21. The vacuum draws portions of the film 19 in a dimpled area 22 into the holes in the platen. The vacuum preferably is

not sufficiently high to cause the film to rupture as it is forced into the platen apertures. For this purpose, the vacuum may be adjusted by adjusting the bleed valve 14.

When film in the dimpled area 22 is drawn against the platen, a series of projections or dimples are formed by the portions drawn into the platen perforations. The spaces between these dimples or projections are smooth surfaces where the film has been drawn against the platen. These smooth surfaces form recesses between the projections.

After the base sheet has been formed in the manner shown and described in connection with FIG. 1, it is stripped from the platen and inverted so that the projections extend upwardly as depicted in FIG. 2. A body 24, which may be a part or other object such as a washer, is positioned on the pocket 21 of the inverted base sheet 19.

A covering film 25 is positioned in the drape frame and adjacent the heater 15 for thermosoftening. After the covering film 25 has been thermosoftened, the drape frame 16 is lowered to a position near the platen 11. The vacuum pump 13 is then operated to establish a pressure differential. Since the base film 19 is imperforate, the vacuum pump 13 serves to establish a volume of reduced pressure between the base film 19 and the covering film 25 by withdrawing air from around the perimeter of the base film 19.

It should also be noted that many plastic films are not truly imperforate. Moreover, the small projections may rupture when burned but the holes thus formed are small and do not adversely affect the formation of the novel package. As used here, the term "imperforate" as applied to the substrate or base sheet 19, is intended to mean sufficiently imperforate to a flow of air at the pressure differentials which are established in skin packaging when a vacuum system is operating so that the package is formed primarily by withdrawing air from around the perimeter of the base sheet rather than through it.

Establishment of the described volume of reduced pressure between the base and covering films 19, 25 establishes a pressure differential on the covering film 25. This forces the heat softened covering film 25 down over the body 24 and against the base film 19. As the covering film 25 approaches the base film, entrapped air moves radially outwardly from the center of the package in all directions. This establishes a flow of air around the projections and through the recesses defined by the projections in the base film 19. This flow of air apparently keeps the two films apart until the air is exhausted adequately to achieve a tight physical contact and a mechanical bond, i.e., a mating or nesting of film portions with like contours in intimate contact, in the dimpled area 22.

By appropriate selection of films and temperature control, the mechanical bond can be enhanced by a physical bonding to produce a hermetically sealed package. If the bond is only mechanical, obviously the package is readily openable by simply separating the films near the perimeter and pulling. With a physical bond or so-called heat seal, caused by heat softening and forcing the two films together, complete hermetic protection is obtainable.

As an example of how to obtain a bond which is primarily, if not exclusively, only mechanical, it has been found that one may use polyethylene film of 4 to 10

mils thickness for both the base and covering film or sheets. When the package is formed, the temperature and length of time vacuum is applied is relatively short.

Where a physical bond as well as a mechanical bond is used, it has been found that a simple elevation in covering film temperature of a few degrees and maintaining vacuum for longer times will accomplish the desired result.

The temperatures and vacuum time durations vary according to films being used. One simply increases the heat and vacuum cycles if a mechanical bond is being obtained and a physical bond is desired and vice versa.

Referring now to FIG. 3, an enlarged fragmentary sectional view is shown of a package. There the plastic thickness is greatly exaggerated for clarity. An examination of FIG. 3 will show that after package formation, dimple top 27A has become concave and the covering film 25 has been drawn down snugly over the product and, in addition, into tight intimate physical contact with and into the dimples 27. The cover sheet remains spaced from the recesses 28 between the dimples.

In FIG. 4, a sample parts kit package has been shown at 30. For simplicity of illustration, the parts kit has been shown as a nut and bolt 31, 32 and a washer 33. A hex-shaped insert was used to provide a pocket for the nut 31, a T-shaped insert for the bolt 32, and a circular insert for the washer 33.

It can be seen that the balance of the package around each of these three parts is dimpled and the covering film has been brought into tight contact and connection with the base sheet.

In FIG. 5, a base sheet 35 was first formed. A product 36 was then packaged to the base sheet by a first covering sheet 37. The first covering sheet 37 extends perimetally outwardly from the base sheet 35 and dimples have been formed in a perimetral portion 39. The package was then inverted and this perimetral portion 39 became the base sheet for a second part 40 and a second covering sheet 41. The second covering sheet 41 includes a perimetral part 42 which may serve as the base sheet for a third part if that is desired. Thus, one may simply invert the package of FIG. 5, place yet another part on top of the first base sheet 37 and form a package by drawing another covering sheet, this time into engagement with the perimetral base part 42.

The projections in the perimetral base part 42 are dome shaped. That is, each projection includes a frustoconical side wall 43 and a convex top 45. By contrast, the tops of other projections in the drawings are accurately shown as convex. The reason is that the initially concave projections become concave at the time when pressure is applied to connect a cover sheet to a base sheet.

It will also be seen that the walls of the projections 42 taper from a relatively thick base adjacent recesses 46 to the apex of the top 45.

In FIG. 6 a second covering sheet 50 secures a second part 51 to a package like the package of FIG. 3 but for a small difference in the base sheet 19'. The difference is that no insert was used in forming the base sheet 19' and the projections are under the object 24. The projections are shown without tops as may occur in their formation. The package of FIG. 6 was formed simply by positioning the second product 51 on the package of FIG. 3 while it is on the platen 11 and then establishing a pressure differential to draw the thermosoftened second cover sheet 50 into place.

In FIG. 7, the projections are arranged in groups 47. The groups 47 are surrounded by flat areas 48. The covering sheet is drawn into tight intimate contact with the flat areas 48 of the base sheet.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made by way of example and that numerous changes in the details of construction and the combination and arrangement of parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A package comprising first and second substantially imperforate thermoplastic sheets extending into contact in regions around an object interposed between said sheets, said first sheet having formations thermoformed from the material of the sheet, extending out of the plane of the sheet toward and into contact with the other sheet in regions around said object, and at least some of said projections of the first sheet being partially collapsed to form a generally cylindrical upstanding wall portion merging into a concavity, and said second sheet having thermoformed portions extending into firm intimate contact with the extending and partially collapsed portions of the projections of said first sheet to provide a firm connection between said sheets in regions around said object.

2. A package as set forth in claim 1 wherein the connection between said sheets includes a heat seal in a peripheral region about said object.

3. A package as set forth in claim 1 wherein the said sheets are thermoplastically bonded in a continuous path around said object, forming an hermetic seal.

4. A package comprising first and second substantially imperforate sheets extending into contact in regions around an object interposed between said sheets, each of said sheets having formations thermoformed from the material of the sheet and extending out of the plane of their respective sheet toward and into mating supporting contact with thermoformed formations on the other sheet in regions around said object to secure said sheets together in regions around said object, each of said sheets having a substantially uniform thickness in regions between said thermoformed formations, said thermoformed formations of at least said first sheet having portions of a lesser thickness than their respective adjacent sheet regions and extending toward the second sheet, the tips of at least some of said projections of the first sheet being collapsed and at least some of said thermoformed formations on said second sheet extend into firm intimate contact with the extending and the collapsed portions of the projections of said first sheet to provide a firm connection between said sheets.

5. A package as set forth in claim 4 wherein the connection between said sheets includes a heat seal in a peripheral region about said object.

6. A package as set forth in claim 4 wherein the said sheets are thermoplastically bonded in a continuous path around said object, forming an hermetic seal.

7. A skin package comprising:

- a. a base sheet formed of plastic film material;
- b. a first cover sheet of plastic film material;
- c. a first object interposed between said base and first cover sheets;

d. said base sheet having a plurality of projections extending toward and into intimate engagement with said first cover sheet in an area around said first object such that said first cover sheet and said projections are in tight intimate contact and said base and first cover sheets are secured together around said first object;

e. said first cover sheet having portions extending perimetrically of said base sheet and projections are formed in said first cover sheet portions, said first cover sheet projections extending oppositely from the direction of said base sheet projections; and

f. a second object is secured to said base sheet by a second cover sheet overlying said second object and in tight intimate engagement with said first cover sheet projections.

8. A package comprising:

a. base sheet of substantially imperforate plastic film material;

b. an object positioned on said base sheet;

c. a cover sheet of plastic film material overlying said object and overlying portions of said base sheet around said object;

d. a plurality of projections formed on said base sheet extending toward and into intimate engagement with said cover sheet and arranged in groups in an area around said object, with smooth areas free of projections surrounding each of said groups of projections;

e. at least some of said projections each defining a depression which is concave away from said cover sheet; and;

f. said cover sheet having portions which extend at least partially inwardly of at least some of said depressions.

9. A package comprising:

a. a base sheet of substantially imperforate material;

b. a first object positioned on one side of said base sheet;

c. a first cover sheet overlying said first object and portions of said base sheet;

d. a second object positioned on the other side of said base sheet;

e. a second cover sheet overlying said second object and portions of said base sheet;

f. both of said cover sheets having portions which extend perimetrically of said base sheet;

g. said base sheet having a plurality of projections formed thereon extending toward and into intimate engagement with at least one of said cover sheets in an area around its associated object;

h. at least some of said projections defining a depression which is concave away from said one cover sheet;

i. said one cover sheet having portions which extend at least partially inwardly of at least some of said depressions;

j. the perimetrically extending portions of one of said cover sheets having a plurality of projections formed thereon extending toward and into intimate engagement with at least some of the perimetrically extending portions of the other of said cover sheets;

k. at least some of said last-mentioned projections defining depressions that are concave away from said

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perimetrically extending portions of said other cover sheet; and,

l. said perimetrically extending portions of said other cover sheet having portions which extend at least partially inwardly of said last-mentioned depressions.

10. A package comprising:

a. a base sheet of substantially imperforate material;

b. a first cover sheet overlying said base sheet;

c. a first object interposed between said first cover sheet and said base sheet;

d. said base sheet having a plurality of projections formed thereon extending toward and into intimate engagement with said first cover sheet in an area around said first object;

e. at least some said projections defining a depression which is concave away from said first cover sheet;

f. said first cover sheet having portions which extend at least partially inwardly of some of said depressions;

g. a second cover sheet overlying one of said sheets encompassing said first object;

h. a second object interposed between said second cover sheet and said one sheet; and,

i. said second cover sheet having portions which substantially conform to the configuration of said one sheet in at least some of said regions of intimate en-

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gagement between said sheets encompassing said first object.

11. The package of claim 10 wherein said second cover sheet overlies said first cover sheet, and said second cover sheet portions have portions which extend at least partially inwardly of the dimples formed in said first cover sheet where said first cover sheet extends inwardly of said depressions.

12. The package of claim 10 wherein:

a. said second cover sheet overlies said base sheet;

b. both of said cover sheets have portions which extend perimetrically of said base sheet;

c. the perimetrically extending portions of one of said cover sheets having a plurality of projections formed thereon extending toward and into intimate engagement with at least some of the perimetrically extending portions of the other of said cover sheets;

d. at least some of said last-mentioned projections defining a depression which is concave away from said perimetrically extending portions of said other cover sheet; and

e. said perimetrically extending portions of said other cover sheet having portions which extend at least partially inwardly of said depressions.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3861529

Dated January 21, 1975

Inventor(s) Eugene W. Coleman

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 47, "heat" should be -- heater --;

Column 5, line 50, "convex" should be -- concave --;
line 51, "concave" (first occurrence) should
be -- convex --.

Signed and sealed this 1st day of July 1975.

(SEAL)

Attest:

RUTH C. MASON
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents
and Trademarks