# United States Patent

**Baker**

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[54] **AIR PERMEABLE CONTAINER**


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[52] **U.S. Cl.** .....**229/16 R,** 206/67.2, 229/DIG. 14, 55/384

[51] **Int. Cl.** .....**B65d 5/00**

[58] **Field of Search** .206/67.2 R; 229/DIG. 14, 16 R; 55/364, 384, 524, 518 X



[56] **References Cited**

UNITED STATES PATENTS

1,871,418 8/1932 McKee .....55/384



*Primary Examiner*—Davis T. Moorhead

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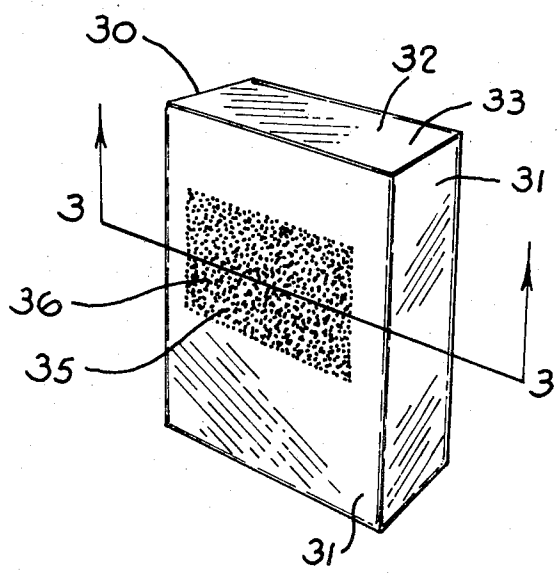
[57] **ABSTRACT**

Tightly sealed containers are formed from blanks made of a substrate permeable to gas with a coating of a material substantially impermeable to gas applied to at least one surface of the blank. Selected areas of the coated surface of the blank are treated with a perforating material to form perforations through the coating but not the substrate in these areas, thereby permitting penetration of gas into and out of the container. By control of the size of the area perforated and the number and size of the perforations, the rate at which gas may enter and leave the container may be controlled.


**4 Claims, 5 Drawing Figures**



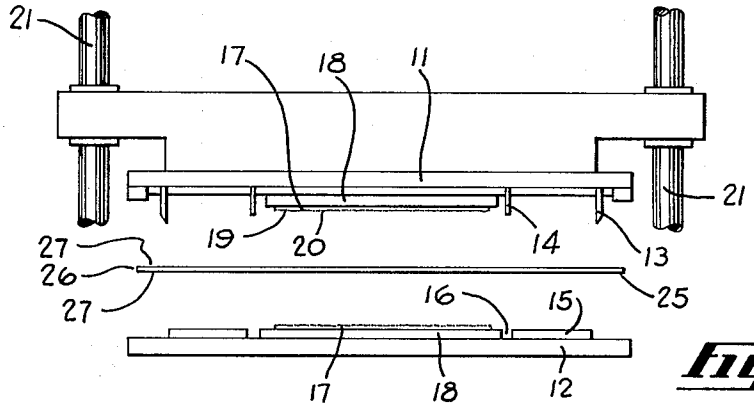



fig-1

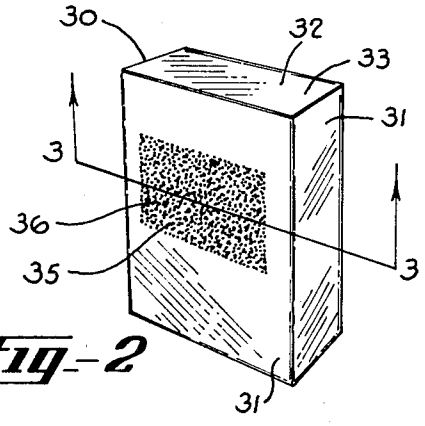



fig-2

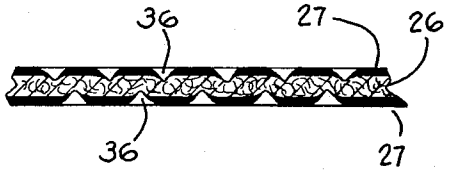



fig-3

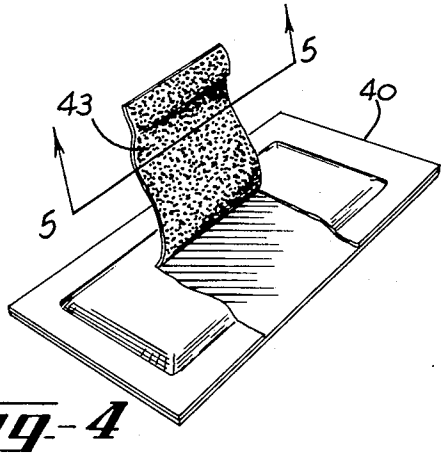



fig-4

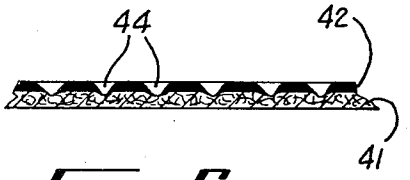



fig-5

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# AIR PERMEABLE CONTAINER

## BACKGROUND OF THE INVENTION

Containers formed from blanks made of paperboard or similar materials completely coated on one or both surfaces with polyethylene, or other heat sealable coatings have many advantages over containers formed from uncoated blanks. Such coatings permit heat sealing of the container closures to give excellent seals without application of additional adhesive and also improve the appearance and "feel" of the containers to users. In addition, such coatings make a tightly sealed container substantially impenetrable to gas.

In certain packaging applications it has been found that the heat sealability and the improved appearance and "feel" to users are desirable but the substantial impermeability of these coatings to gas weighs strongly against their use. An example is in the pharmaceutical industry which frequently packages bandages, syringes, surgeon's kits and many other items in containers which are then sterilized by the packager and delivered to hospitals with the contents in sterile condition capable of being used without resterilization. The containers must be tightly sealed to prevent contamination by bacteria or other means during shipment and storage but the container must also permit air and sterilizing gas to pass into and out of the tightly sealed container during sterilization.

Applicant's invention provides an expeditious and economical way in which such coated blanks may be used for such packaging.

In other instances it is desirable to control the rate at which gas may enter and leave a container. An example is in the packaging of grapes in lugs for storage. Grapes bear spores and bacteria which normally cause deterioration if stored for extended periods of time. This deterioration may be prevented by periodic treatments with sulfur dioxide gas which inhibits attack by the spores and bacteria.

One method to do this is to include packets of sodium bisulfite in the grape lugs. As water vapor from the grapes penetrates into the packets sulfur dioxide is released and passes through the packet walls to surround the grapes. By use of packets made in accordance with applicant's invention, the rate at which water vapor enters the packet and sulfur dioxide is released can be controlled to provide an atmosphere containing the requisite amount of sulfur dioxide over extended periods of time, whereas if packets are made of uncoated paper or paperboard the sulfur dioxide release is very rapid and will provide only short term protection. Also, packets made of coated paper or paperboard without perforations through the coating will release sulfur dioxide so slowly as to be useless.

## SUMMARY AND OBJECTS OF THE INVENTION

An object of this invention is to provide a tightly sealed container formed from a blank comprising a substrate permeable to gas completely coated on one or both sides with a coating substantially impermeable to gas which may be used in applications requiring the container to permit gas to pass into and out of the container.

A further object is to provide a tightly sealed container in which the rate at which gas may enter and leave the container can be controlled.



The container comprises a substrate permeable to gas, such as paper or paperboard completely coated on one or both surfaces with a heat sealable coating substantially impermeable to gas. Selected areas of the container have small perforations extending through the coating but not through the substrate, permitting gas to enter and leave the container. Proper selection of the size of the perforated area and the number and size of the perforations permits control of the rate at which gas may enter and leave the container.

## BRIEF DESCRIPTION OF THE DRAWINGS

Other objects of this invention will become apparent from the following description and accompanying drawings wherein:

FIG. 1 is an elevational view of a conventional cutting and creasing press modified to produce blanks to be formed into containers embodying this invention;

FIG. 2 is a perspective view of a container embodying the invention;

FIG. 3 is an enlarged partial section along the line 3 — 3 in FIG. 2, viewed in the direction of the arrows;

FIG. 4 is a perspective view of a modified container embodying the invention; and

FIG. 5 is an enlarged partial section along the line 5 — 5 in FIG. 4, viewed in the direction of the arrows.

## DESCRIPTION OF THE PREFERRED EMBODIMENTS

Containers embodying this invention are formed from blanks comprising a substrate of paper, paperboard or similar material which is permeable to gas but not permeable to solids. A continuous coating is applied to one or both surfaces of the substrate by conventional means. Coatings are normally of the heat sealable type such as polyethylene, but the invention is applicable to any continuous coating which is substantially impermeable to gas.

Blanks may be formed from coated roll or sheet stock by conventional cutting and creasing presses modified to provide perforating means which will contact and perforate the coatings during blank formation. FIG. 1 illustrates a platen type cutting and creasing press which has been modified to perforate coatings on both surfaces of a substrate during blank formation.

The press comprises a die **11** and a counterdie **12**. Die **11** is slidably mounted on vertical bars **21** for vertical movement. Knives **13** are mounted in a conventional manner on die **11** to cut through the blank forming material upon descent of the die to cut out the entire exterior outline of the blank. Scoring rules **14** are mounted on die **11** to provide the means to score the blanks as required. Blocks **15** are mounted on counterdie **12** forming recesses **16** therebetween opposed to the aforementioned scoring rules.

Sheets of perforating material **17** are mounted on die **11** and counterdie **12** directly opposite each other. Spacers **18** normally of wood are used to position the perforating sheets so that upon descent of the die the perforating sheets will contact the blank forming material with the proper force to perforate the coatings but not the substrate. Spacers **18** and sheets **17** may be mounted on die **11** and counterdie **12** by adhesive means. Depending on the type and thickness of the coating and the size and number of abrasive particles as

well as the size of the area to be perforated, pressures of 500 to 10,000 psi have proven satisfactory.

The sheets of perforating material **17** may comprise a cloth backing **19** to which particles of aluminum oxide grit **20** are bonded by polyurethane. Other perforating materials such as silicon dioxide, garnet, silicon carbide, flint, emery or tungsten carbide may be used. Size and number of particles will depend on the degree of gas penetration desired.

To form a blank embodying this invention a sheet of blank forming material **25**, is inserted in the press. The material comprises a paperboard substrate **26** coated in this instance with a continuous substantially gas impermeable, heat sealable coating **27** of polyethylene on both surfaces. As the die descends, knives **13** cut out the blank to proper shape and the scoring rules **14** impress the required scores into the blank by compressing the blank material into recesses **16** in counterdie **12**. As the die reaches its maximum descent, grit particles **20** mounted on abrasive sheets **17** contact and penetrate the coatings **27** on each side of the substrate **26**. Because of the resiliency of the blank material and the sheet cloth backing **19**, these particles do not penetrate through substrate **26**. The blank is then removed from the press and may be formed into the container of FIG. **2** by any conventional means which will provide tightly sealed end closures.

The container **30** illustrated in FIG. **2** comprises four side panels **31**, a conventional glue flap, not shown, and tightly sealed end closures **32**. To form the carton, the glue flap is adhered to the opposite side panel **31** to form a tubular structure. The tubular structure is then opened, one end closure tightly sealed, the contents inserted and the other end closure tightly sealed. Each end closure may be formed by four closure flaps attached respectively to the side panels (only the outer closure flap **33** is shown). The end closure may be formed by activation of the heat sealable coating and subsequently pressing the flaps together to effect a tight seal. Since the end closure and the sealing thereof comprise no part of this invention they will not be described in detail herein. One satisfactory method for sealing such closures is that described in U.S. Pat. No. 3,389,645 to Winters et al., assigned to the assignee of this invention and entitled Apparatus and Method for Folding and Sealing Cartons. A container formed by this method from a polyethylene coated blank is tightly sealed and substantially impermeable to gas except in the perforated area.

Area **35** of the carton corresponds to the area of the blank originally contacted by grit particles **20** of abrasive sheet **17**. As shown in FIG. **3** perforations **36** extend through coating **27** in this area on both the interior and exterior surfaces of the container but do not penetrate through the substrate **26**. If the carton blank material to be used is coated on only one side, the sheet of perforating material mounted on counterdie **12** is removed and replaced with an additional spacer of equal thickness.

A typical use of a container embodying this invention is the packaging of presterilized pharmaceutical supplies, for example, surgeon's kits. The container is erected into squared configuration in a conventional manner and the surgeon's kit is inserted therein. Thereafter the ends are tightly heat sealed to form the completed package. The package is then permeable to air through the perforations in the coating but is impermeable to bacteria and other solids since the paperboard substrate acts as a filter.

Packages are then placed in a sterilizing chamber and the air in the chamber is evacuated to a partial vacuum of about 29 inches of mercury removing most of the air from the chamber and the packages. The chamber and packages are then filled with a sterilizing gas, such as ethylene dioxide, which is retained within the chamber and packages long enough to complete sterilization. The chamber and packages are then flushed with sterile air and the packages are removed. Contents of the package are then sterile and will remain so during shipment and delivery.

FIGS. **4** and **5** illustrate a second embodiment of the invention. Container or packet **40** is formed from a substrate of paper **41** permeable to gas, coated on one surface with a heat sealable coating **42** substantially impermeable to gas. Area **43** comprises perforations **44** extending through the coating but not through the substrate. Container or packet **40** may be formed by cutting two pieces of coated paper with appropriate perforated areas to the proper size, placing the contents to be packaged on one piece, with the coated side of the paper facing the interior of the packet, placing the second piece thereon also with the coated side facing inwardly, and heat sealing around the entire periphery of the packet to form a tight seal.

Of course, paper coated on both sides may also be used, but in such event the coatings **42** must both be perforated in area **43**. Proper selection of the size of area **43** and the size and number of perforations **44** will permit gas to enter and leave the packet at a predetermined rate. Such packets are useful as aforementioned in the packaging of grapes for storage.

Table **1** illustrates air transmission rates through 0.017 inch thick solid bleached sulfate paperboard coated on both sides with one mil. of polyethylene which has been perforated with various abrasives at a pressure of 3,000 lbs. per square inch. The air transmission rate listed is in terms of cubic centimeters of air per minute per square inch of perforated area at a differential pressure of 1 inch of mercury. Screen size indicates particles of perforating material are retained on the screen size shown but pass through the next larger screen, and such sizes are in holes per square inch of screen area.

TABLE 1

| Perforating Material | Screen Size | Perforations Per In.$^2$ | Air Transmission Rate |
|---|---|---|---|
| Aluminum Oxide | 120 | 100 | 1.2 |
| " " | 80 | 225 | 6 |
| " " | 60 | 400 | 11 |
| " " | 50 | 350 | 11 |
| Tungsten Carbide | Medium | 330 | 9 |
| " " | Coarse | 200 | 28 |
| Unperforated | | | 0 |

As can be seen from the table, by proper selection of abrasive particle size and area to be perforated, provision can be made for any reasonable rate of gas transmission desired. For instance, for a package with a total gas transmission rate of 200 c.c. per minute at a pres-

sure differential of one inch of mercury, one might select any of the following combinations of particle size and area perforated: Coarse tungsten carbide, area 7.1 sq. in.; 50 screen aluminum oxide, area 18.2 sq. in.; 80 screen aluminum oxide, area 33.3 sq. in.; or several others. For a very low total gas transmission rate of, for example, 5 c.c. per minute, one might select 120 screen aluminum oxide, area 4.2 sq. in.; or 80 screen aluminum oxide, area 0.83 sq. in.

Thus, by use of applicant's invention one may obtain the benefits of coatings of the types previously mentioned in packaging applications where use of such coatings would normally be precluded. Further, the rate at which gas may pass into and out of containers may be predetermined by proper selection of the size of the perforated area and the number and size of the perforations.

I claim:

1. In a container, adapted to be tightly sealed, made from a material comprising a substrate permeable to gas having a continuous coating on at least one surface thereof of a heat sealable material substantially impervious to gas, the improvement which comprises perforations numbering between about 50 and 500 per square inch extending through said coating but not through said substrate in selected areas of said container.

2. The invention of claim 1 wherein said heat sealable material is polyethylene.

3. The invention of claim 1 wherein both surfaces of said substrate are coated with a coating substantially impermeable to gas and perforations in said selected area extend through both coatings.

4. The invention of claim 1 in which the size of the selected areas and the number and size of the perforations are determined so as to provide a predetermined rate of gas transmission into and out of the container at a given pressure differential between the interior and exterior of the container.

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