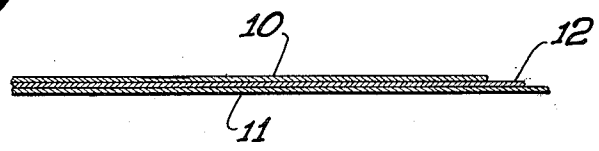
Feb. 27, 1945. D. RAY 2,370,419

GAS-PROOF CONTAINER

Filed Jan. 21, 1942

Fig. 1.



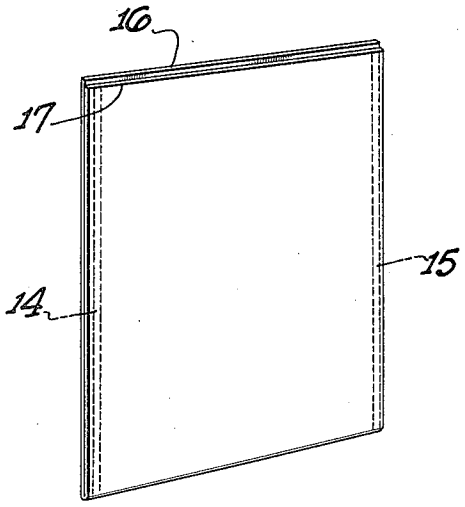


Fig. 2.

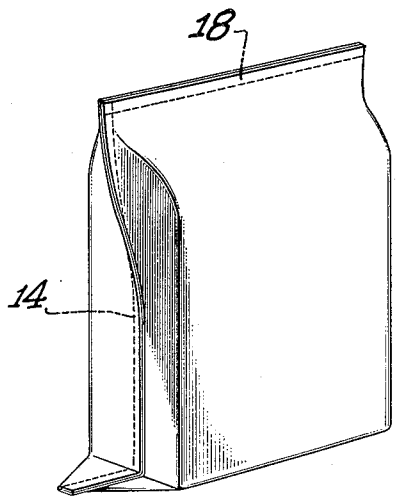


Fig. 3.

DON RAY,
INVENTOR.

BY C. C. Lee & Co.

ATTORNEY.

Patented Feb. 27, 1945 2,370,419

UNITED STATES PATENT OFFICE

2,370,419

GASPROOF CONTAINER

Don Ray, Beverly Hills, Calif.

Application January 21, 1942, Serial No. 427,665

4 Claims. (Cl. 229—3.5)

The present invention pertains to improvements in packaging and is particularly directed to the provision of sealed packages which are virtually gas-tight and to containers for use in the production of such packages, said containers and packages being particularly well adapted for use on food stuffs, emergency rations, medical supplies and other commodities or articles which it is desired to maintain free from contamination with poison gases such as mustard gas and the like. Moreover, the present invention is directed towards packages and containers which resist insect infestation and are capable of resisting changes in atmospheric pressure such as are encountered in transporting packages by air, and various conditions of heat and humidity, thereby permitting the contents to be maintained in suitable condition even though the packages are subjected to extreme conditions.

Emergency rations used by the armed forces of the United States should be able to withstand rough handling, should resist destruction by insect pests, should be resistant to rapid and extreme changes in temperature and humidity, and be capable of passing through zones contaminated with poison gases without impairing the edibility of such rations. In addition, the packages should be capable of being transported by air without having such packages rupture due to the reduction in atmospheric pressure at high altitudes. The containers must maintain their strength and hermetically sealed state under these various conditions. Moreover, the containers must be light in weight and preferably non-metallic.

These and other stringent requirements have not been met in the past and the present invention is directed to a package and container for use therefor which fufills all of the requisites imposed upon the package by reason of the conditions to which it is subject or may be subjected, as well as reasons of economy, light weight, and the like.

It is an object of the present invention, therefore to disclose and provide a light weight, non-metallic container which is particularly well adapted for use on food stuffs, surgical supplies, emergency rations and other articles which it is desired to maintain in their original condition.

A further object of the invention is to disclose and provide a container or package which is virtually moisture and gas tight and which may be heated or boiled, if necessary, without losing its original hermetic state.

A further object of the invention is to disclose a non-metallic, light weight, flexible and stretchable container which is virtually gas and moisture-vapor tight.

Other objects, uses, advantages and modifications of the invention will become apparent to those skilled in the art from the following detailed description. Exemplary forms of the invention are shown on the appended drawing, in which: Fig. 1 schematically illustrates an enlarged section through a sheet of material which may be used in making containers; Fig. 2 is a perspective representation of one form of bag in an unfilled condition; Fig. 3 is a perspective of a filled and sealed bag, before the ends of the bag are folded to fit into a box.

Heretofore, Cellophane has been extensively used as a wrapping material or in the formation of bags and other containers. Cellophane, however, is not vapor tight and becomes brittle at low temperatures. By "low temperatures," reference is made to temperatures below freezing and temperatures on the order of say below 0° F. Such temperatures are often encountered, particularly at the high altitudes through which bombers and transport planes need fly. Moreover, Cellophane is readily attacked by insects which appear to eat the Cellophane, thereby exposing the contents to the action of gases, moisture and the like. In addition, Cellophane loses strength very rapidly in the presence of moisture.

There are numerous thermoplastic materials available in sheet form, such as Pliofilm, which is a rubber halide composition, Koroseal, which is a polymerized vinyl halide, and others. These substances in general are unsatisfactory in that they contain volatile solvents and plasticizers which have a tendency to contaminate the contents of containers made therefrom with unsuitable odors and flavors. Moreover, sheets of these various compositions are not gas tight and not resistant to the passage of moisture vapors therethrough; the physical characteristics of the sheet material undergoes many changes when the material is subjected to low temperatures of below 0° F.

The present invention contemplates a container made of sheet material, such material being stretchable and flexible and composed in whole or in part of a synthetic linear polyamide, said polyamide being the reaction product of a linear polymer-forming composition selected from the class consisting of (*a*) monoaminomonocarboxylic acids, and (*b*) mixtures of diamine with dibasic carboxylic acid, sold under the name nylon (made by E. I. du Pont de Nemours & Co. Inc.). Extensive tests have shown that nylon in the form

of thin sheets or film of 0.002 inch to 0.01 inch in thickness, is strong, resists puncturing, is non-absorptive, resists the passage of moisture vapors therethrough, is proof to oxygen and carbon dioxide, not attacked by insects, transparent and thermoadhesive, that is, capable of bonding to itself and other thermoplastic substances upon the application of heat. In order to impart extreme resistance to the passage of mustard gas and similar poison gases, it has been found desirable to incorporate in the sheet material forming the bag or container a layer of polyvinyl alcohol composition, polyvinyl alcohol compositions being substantially impervious to oils, greases and poison gases. In order to impart strength and durability to containers which are to be subjected to extreme hardship, the sheet material may include an outer protective layer of nylon or other thermoplastic material.

In adapting the present invention to the packaging of emergency rations, food stuffs, etc., sheet nylon (or other composite sheet material which is both flexible and streachable) is preferably formed into bags in any of the well known manners of making bags from fibrous material such as paper, the only difference being that areas of the overlapping sheet or sheets adjacent the edge portions thereof are heat sealed. By "heat sealing," reference is made to the step of applying heat and pressure so as to cause the thermoplastic material to fuse or bond together.

Bags made in this manner may be filled with the commodity to be packaged and the open end of the bag is then folded and heat sealed. The final sealing of the bag or container may be carried out in a vacuum or in accordance with the method described in my co-pending application Serial No. 402,392. When packaged in the last mentioned manner, the container is pressed against its contents by the action of atmospheric pressure thereon so that when the package is later brought into an atmosphere of low pressure (as in a plane at high altitude), the container is not ruptured by the existence of a great difference in pressure within and without the container. It is to be remembered that the final heat-sealing step may take place at different degrees of vacuum and by the use of the word "vacuum," reference is made to any subatmospheric pressure ambient the container during the heat-sealing step. Even though the packages are not sealed at a subatmospheric pressure, they will not rupture when subsequently exposed to reduced atmospheric pressure due to the flexibility and stretchability of the sheet material from which the container is made.

In the event the sheet material from which the container or bag is made includes polyvinyl alcohol composition, it is desirable that such polyvinyl alcohol composition be provided with a heat-sealing inner surface portion at least adjacent that area of such inner surface which is heat-sealed during the final heat-sealing or closing operation. Moreover, it is desirable that the polyvinyl alcohol composition is protected by an outer layer which is moisture resistant. In the preferred form of package, particularly adapted to resist contamination of the contents with mustard gas, the sheet material from which the bag or container is made preferably includes a polyvinyl alcohol composition, the inner surface of such container being provided with a heat-sealing layer or surface portion (made of nylon, Pliofilm, methacrylate resin, or the like) and an outer layer of nylon. Fig. 1 schematically shows a section through such sheet material, the outer layer of linear polyamide being indicated at 10, the inner layer of heat-sealing material being indicated at 11, and the polyvinvyl composition at 12. These various layers are preferably integrally bonded together so as to form a substantially inseparable sheet. Moreover, the softening or heat-sealing temperature of the inner heat-sealing surface portion should be lower than that of the outer layer of nylon so that during the heat-sealing operation the outer portion or layer is not unduly softened, the inner layer receiving sufficient heat to form a thorough hermetic seal. In the event all of the layers of such composite sheet were to have the same softening temperature, the outer layers would receive an excessive amount of heat and a thorough seal would not be obtained. Nylon films may be obtained from the manufacturers, such films having softening or heat-sealing temperatures ranging from 200° F. to about 600° F. Nylon films are therefore well adapted for use both as internal and external layers of such composite sheet material, the inner layer being composed of nylon having a softening or heat-sealing temperature of about say 250° F. whereas the external film or layer may have a softening temperature on the order of 450° F. The polyvinyl alcohol composition, although resistant to penetration by poison gases, oils, greases and the like, becomes brittle when heated and is subject to softening in the presence of moisture and therefore the preferred multi-ply construction permits the utilization of the gas-resistant properties of polyvinyl alcohol compositions without destroying the moisture-resisting characteristics of the container.

When a dual composition sheet is used for the bags or containers, the component materials may be fused or welded together. For example, a continuous strip of nylon in thin sheet form, together with a thin sheet of polyvinyl alcohol composition in superimposed relation thereto may be passed through heated rolls capable of exerting sufficient pressure and heating the sheets to a sufficiently high temperature to cause bonding to take place. Two or three components may be combined in a similar manner. Fig. 2 shows one form of bag made from sheet material of the character described. In this form a sheet of the material is folded upon itself (with the heat-sealing layer in contact with itself) and the side edges heat-sealed together as along areas indicated by dotted lines at 14 and 15. The upper edge 16 may extend slightly beyond edge 17 to facilitate the later opening of the bag. Fig. 3 illustrates the bag after it is filled and upper edge areas heat-sealed together as indicated at 18. Such filling and sealing is preferably accomplished under vacuum. The corner areas of the bag are then folded in the event the bag is placed in a carton or box. It is to be understood that bags may be made in other manners.

In an alternative mode of operation, one surface of a strip of material such as nylon, may be sprayed with solvent (or solution or dispersion of thermoplastic material in a solvent) so as to form a thin film on such surface. Most of the solvent can then by evaporated so as to leave a thin film of thermoplastic on such surface. A strip of other material (such as Pliofilm, polyvinyl alcohol composition, etc.) can then be placed upon the coated surface and the two sheets then passed between heated pressure rolls to weld the sheets or strips together into an inseparable un-

A third component can be applied in a similar manner. The use of dispersions of incompletely polymerized thermoplastics in a solvent (from which the thermoplastic may gel out upon evaporation of the solvent) is highly desirable since minor heat treatment with heated pressure rolls matures the thermoplastic and causes it to effectively fuse or weld the layers together.

It is to be noted that the container of this invention is free from rigid or non-stretchable layers. Bags of nylon may be used in packaging many food stuffs, among them frozen foods such as frozen vegetables. If the containers of nylon are hermetically sealed (either at atmospheric pressure or subatmospheric pressure), such containers may be boiled with their contents and frozen vegetables may thus be cooked in their own natural moisture and juices, thereby retaining all of the natural flavor thereof. During cooking, the nylon may stretch to accommodate for the increased pressure in the container. A more rapid cooking is attained. Various commodities such as coffee, condiments, cereals, pharmaceuticals, etc. may be packaged with great advantage in containers made of or including nylon.

The term "polyvinyl alcohol" as used herein is understood to include those products in which some of the alcohol groups are esterified or otherwise reacted, certain of the hydroxyl groups remaining so as to cause the material to be capable of solution, in part at least, in hot water. Polyvinyl alcohol compositions are generally produced by hydrolysis of polyvinyl acetate. Incomplete hydrolysis of polyvinyl acetate or other materials from which these compositions are formed, or further partial reaction of the polyvinyl alcohol with other materials such as formaldehyde, appears to characterize the gas-proof compositions contemplated by the present invention. It is to be understood that substituted polyvinyl alcohols such as polymethylvinyl alcohol, may also be used.

The term "nylon" as employed herein refers to the product made by E. I. du Pont de Nemours & Co. Inc. and appears to be of the nature of a polymerized protein. Its mode of manufacture and chemical composition are not clearly disclosed in the literature but the product itself is available from the manufacturer.

I claim:

1. A non-metallic, light weight container for food stuffs, medical supplies, emergency rations and similar articles, adapted to resist contamination of its contents by poison gases, said container being flexible and stretchable and having a heat-sealing inner surface portion, a thin layer of polyvinyl alcohol composition, and an outer layer of a synthetic linear polyamide, said polyamide being the reaction product of a linear polymer-forming composition selected from the class consisting of (*a*) monoaminomonocarboxylic acids, and (*b*) mixtures of diamine with dibasic carboxylic acid, said layers and portions forming a substantially inseparable sheet, the softening temperature of the inner heat-sealing surface portion being lower than that of the outer nylon layer.

2. A sealed package for food stuffs and other articles, said package being adapted to yield to changes in atmospheric pressure without rupture, which consists of: a flexible, stretchable container, said container being hermetically sealed and including as a component part thereof a layer of polyvinyl alcohol composition and a layer of a sheet composed of a synthetic linear polyamide, said polyamide being the reaction product of a linear polymer-forming composition selected from the class consisting of (*a*) monoaminomonocarboxylic acids, and (*b*) mixtures of diamine with dibasic carboxylic acid, said layers forming a substantially inseparable sheet.

3. A sealed package for food stuffs and other articles, said package being adapted to yield to changes in atmospheric pressure without rupture, which comprises: a flexible, stretchable container consisting of sheet material including a heat-sealing inner surface portion, a thin layer of polyvinyl alcohol composition, and an outer layer of thin sheet material of a synthetic linear polyamide, said polyamide being the reaction product of a linear polymer-forming composition selected from the class consisting of (*a*) monoaminomonocarboxylic acids, and (*b*) mixtures of diamine with dibasic carboxylic acid, said outer polyamide layer being adapted to impart strength and insect-resisting characteristics to the container, said layers and portions forming a substantially inseparable sheet.

4. A non-metallic, light weight container for food stuffs, medical supplies, emergency rations and similar articles, consisting of an inner layer of polyvinyl alcohol composition and an outer layer of a sheet composed of a synthetic linear polyamide, said polyamide being the reaction product of a linear polymer-forming composition selected from the class consisting of (*a*) monoaminomonocarboxylic acids, and (*b*) mixtures of diamine with dibasic carboxylic acid, said layers being bonded to form a substantially inseparable sheet, edges of said sheet being heat sealed to form a container, said container being flexible and stretchable and adapted to yield to changes in atmospheric pressure without rupture.

DON RAY.