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COOLING ENVELOPE WITH BREAKABLE DIAPHRAGM

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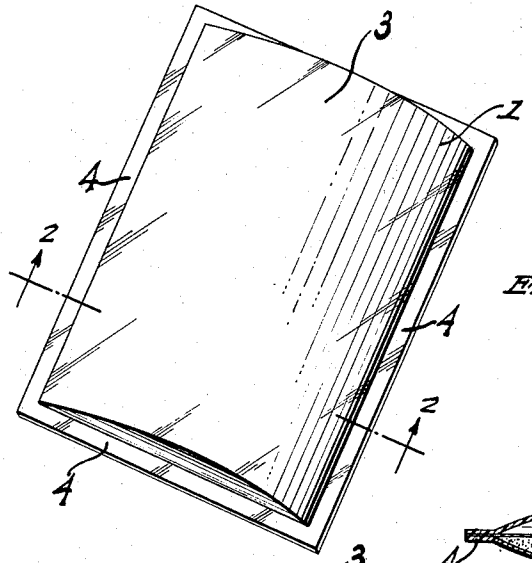


FIG. 1.

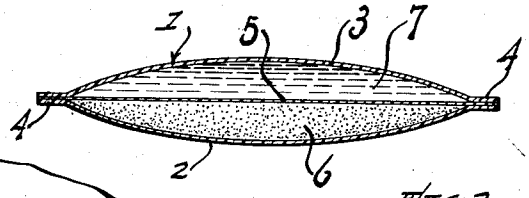


FIG. 2.

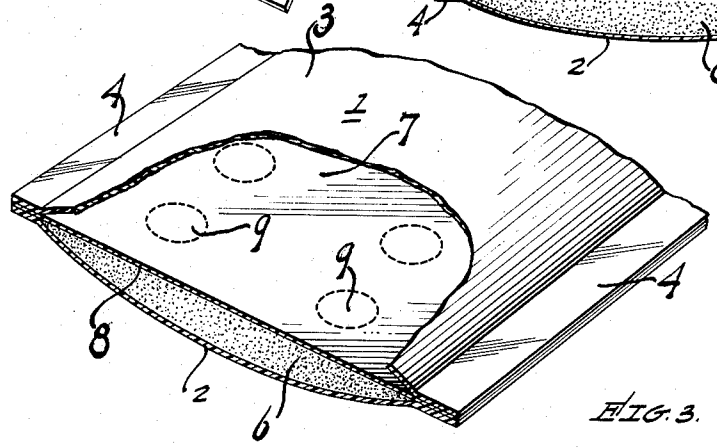
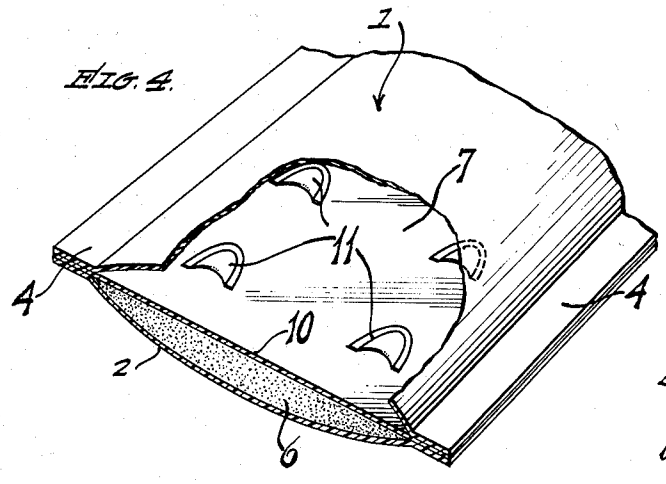


FIG. 3.

FIG. 4.



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3,095,291
COOLING ENVELOPE WITH BREAKABLE DIAPHRAGM

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This invention relates to a cooling envelope with breakable diaphragm, and is an improvement on my co-pending application, Serial No. 26,348, filed May 2, 1960, for a "Cooling Pack With Releasable Constriction," now Patent No. 3,058,313. This invention is also an improvement on my patents numbered 2,882,692; 2,898,744, and 2,916,886.

This present improvement relates more particularly to a cooling envelope in which a crystalline or granular form of cooling reagent is inclosed in one side of a bag or envelope, and a liquid such as water is inclosed in another side of the same bag; the liquid and the dry reagent being separated by a diaphragm which is breakable or severable by hand in order to comingle the liquid and the dry reagent in the outer envelope.

An object of my invention is to provide a cooling envelope which consists of an outer envelope or bag or container, preferably formed of flexible sheet plastic (such as polyethylene), and where the outer envelope or bag is relatively difficult to tear or break, due to the thickness or toughness of the plastic sheet from which the outer envelope is formed. The outer envelope is divided into two compartments by a transverse diaphragm, also formed of flexible thin sheet plastic material, the diaphragm being breakable or severable by hand simply by either striking the envelope a blow with the hand, or performing a tearing action with the fingers, thus causing the diaphragm to break or shatter and permitting comingling of the liquid and the dry reagent.

Another object of my invention is to provide a novel cooling envelope of the character stated, in which the breakable diaphragm in the envelope is so formed that it will readily break or tear, such as creating weak spots or areas throughout the diaphragm, or forming liquid containing pockets in the diaphragm, or providing a plastic diaphragm which is structurally weakened before it is introduced as a diaphragm into the outer envelope.

Other objects, advantages and features of invention may appear from the accompanying drawing, the subjoined detailed description and the appended claims.

In the drawing:

FIGURE 1 is a perspective view of my cooling envelope with breakable diaphragm.

FIGURE 2 is a sectional view taken on line 2—2 of FIG. 1.

FIGURE 3 is a transverse sectional view of a cooling envelope of a modified form of diaphragm.

FIGURE 4 is a transverse sectional view of still another type of cooling envelope showing another form of transverse diaphragm.

It is well known in the chemical art that certain chemicals absorb heat when water is added to them, this heat being obtained from adjacent bodies or areas by means of conduction, convection or radiation, or all three. The chemical reaction does not occur until the water mingles with the dry chemical, and in this instance the dry chemical consists of ammonia nitrate (NH_4NO_3). The ammonia nitrate is only one example, since there are other chemical reagents which will perform a like function. Another such product is ammonia chloride (NH_4Cl).

In constructing the cooling envelope the outer bag **1** is formed of a lower sheet **2** and an upper sheet **3**. These sheets are each formed of a suitable flexible sheet plastic,

such as polyethylene, or vinyl, or polyurethanes, or the like. The outer envelope **1** is hermetically sealed along all four outer edges by the usual heat sealing method, and these sealed outer edges are indicated at **4**. The sealed edges **4** provide a complete and effective seal so that neither water nor dry reagent can escape along or through these edges. A separating diaphragm **5** is also formed of a thin flexible sheet plastic material, such as polyethylene, vinyl, etc., and extends entirely across the envelope **1** and is sealed between the sealed edges **4**. The diaphragm **5** is placed in position before the edges **4** are sealed, so that the sealing operation will hold the diaphragm **5** in position, as well as simultaneously seal the outer envelope **1** along its peripheral edges. One end of the envelope **1** is left open until the compartments **6** and **7** formed by the diaphragm **5** are filled, one with a dry reagent, such as ammonia nitrate, and the other with water. After these compartments have been filled with the water or the reagent, the fourth side is then sealed and the entire envelope is completely inclosed and no liquid or reagent can leak therefrom. The outer sheets of flexible plastic material **2** and **3** are relatively tough and strong and will not break or shatter under ordinary usage or handling. To comingle the water and the ammonia nitrate it is, therefore, necessary to break or tear the transverse diaphragm wall **5**. The wall **5** may be formed of a very thin plastic sheet and, therefore, relatively fragile and easily broken or torn, or the polyethylene sheet (if this is used) may be weakened with the addition of a plasticizer. This plasticizer may be poly isobutylene. The poly isobutylene may be added to the plastic within a solid chunk form, for example, 5% by volume of poly isobutylene may be added to the polyethylene before it is formed as a sheet. When this is done the entire sheet is weakened and, therefore, readily broken by means of a blow or torn with the fingers.

Also, if desired, the central transverse diaphragm **8** may be formed with weak spots or areas, that is, a plasticizer may be sprayed or sprinkled onto the sheet of polyethylene to form weakened areas or spots **9**. The spots or areas of the polyethylene sheet can be weakened by spraying or sprinkling mineral oil or poly isobutylene on the polyethylene sheet. After the liquid plasticizer has been sprinkled or sprayed onto the polyethylene sheet it is allowed to dry, and thereafter the sheet will have weakened spots or areas therein which will readily break or tear under stress.

To insure that the transverse diaphragm will break or shatter, I may provide a structure as shown in FIG. 4, in which the transverse diaphragm **10** is formed with a plurality of pockets **11** which are open at one end. These pockets are in the compartment which contains the water and are, consequently, filled with the water during the time that the cooling envelope is not in use. When it is desired to shatter or break the diaphragm **10**, a blow can be struck on the water side of the outer envelope **1** and these pockets will momentarily retain a quantity of water after a blow is delivered, and this will transmit the force of the blow more effectively to the limited area within the pockets **11**, thus causing the diaphragm to shatter, tear, or otherwise break.

In Operation

The cooling envelope is formed by placing two sheets of flexible plastic material, one upon the other; these two sheets being separated by a transverse diaphragm, also formed of flexible sheet material. The flexible diaphragm, such as **5**, **8** or **10**, is held in position under the sealed edges **4** of the envelope **1**, and the peripheral edges of the envelope are thus hermetically sealed. One end of the envelope remains open until one compartment **6** has been filled with granules of ammonia nitrate, and the

other compartment **7** has been filled with water. The fourth or open end of the envelope **1** is then heat sealed in the same manner as the other peripheral edges, and the entire envelope is now completely and hermetically sealed. The transverse diaphragms **5**, **8** or **10** may be weakened structurally by several means, either by adding a plasticizer when forming the sheet, or weakening areas of the sheet by means of a plasticizer, or by forming water receiving pockets within the diaphragm, and thus when a blow or other shattering force is applied to the envelope from the outside the diaphragm separating the compartments **6** and **7** will be broken, permitting the intermingling of the water and the dry cooling reagent, thus providing a cooling package or envelope.

To further amplify the term plasticizer as used in this application, the term as here used means a softener or plasticizer-extender. This softener, therefore, is a relatively nonvolatile diluent which can be substituted for a portion of the true plasticizer in the plastic, and will materially effect the mechanical properties of the plastic film for the purpose of weakening the center diaphragms **5**, **8** or **10**, as previously described. The term plasticizer as used herein may also be known as a secondary plasticizer. They are also considered as extenders.

For the various types of solvents or plasticizers which are used in connection with various plastics, and which will give the required physical effect of the plastic sheet, attention is directed to Table 15.3, pages 904 to 927 of the book "Technology of Solvents and Plasticizers," by Doolittle, published by John Wiley & Sons, Inc., New York; Library of Congress Catalog Card Number 54–9035.

Regarding specific solvents for polyethylene to weaken a film, aromatic solvents can be used, such as esters, ketones and ethers. Among the petroleum oils which are applicable, the type known as transformer oils can be used.

Having described by invention, I claim:

1. A cooling envelope containing a cooling reagent with breakable diaphragm comprising an outer envelope, consisting of an upper and a lower sheet, said sheets being superimposed and all of the engaging edges of the sheets being hermetically sealed, said upper and lower sheets being formed of thin flexible plastic sheet material, a diaphragm arranged between the upper and lower sheets and dividing the envelope into two compartments, said diaphragm being formed of a thin flexible plastic sheet material, said diaphragm being structurally weaker than the upper and lower sheets whereby said diaphragm will rupture under impact before the upper and lower sheets, said diaphragm being structurally weakened by addition of a solvent plasticizer thereto, said plasticizer being added in a plurality of discrete spots.

2. A cooling envelope containing a cooling reagent with breakable diaphragm comprising an outer envelope, consisting of an upper and lower sheet rectangular in shape, said sheets being superimposed and all of the engaging edges of the sheets being hermetically sealed, said sheets being formed of a thin flexible sheet plastic material, a diaphragm extending transversely across the outer envelope and arranged between the upper and lower sheets and dividing the envelope into two compartments, one of said compartments containing a cooling reagent and the other compartment containing water, said diaphragm being formed of a thin flexible sheet material and being structurally weaker than the upper and lower sheets by addition of a solvent plasticizer in the sheet material of the diaphragm, whereby said diaphragm will rupture under impact before the upper and lower sheets, said plasticizer being added in a plurality of discrete spots.

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