METHOD OF PACKAGING COMPRESSIBLE ARTICLES

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Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

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The invention described herein may be manufactured and used by or for the United States Government for governmental purposes without payment to me of any royalty thereon.

This invention relates to a method of packaging non-rigid articles which are compressible and which ordinarily are bulky due to the presence of air in the interstices thereof. It is the object of the invention to provide a method of packaging articles of the above described type which results in a great reduction in the volume of the article so that it can be stored and transported in a minimum space. It is a further object of the invention to provide a method of packaging compressible articles which in addition to reducing the volume of the article also permits the article to be molded into various shapes so as to permit storage thereof in irregular spaces with efficient utilization of space. It is a still further object of the invention to provide a method of packaging capable of attaining the above results which at the same time is simple, cheap and requires a minimum of equipment and apparatus.

Briefly the method consists in placing the article in a bag or non-rigid container made of a gastight plastic film, sealing the container, and then evacuating the container to as low a pressure as possible. The resulting removal of air from the interstices of the article permits the outside air pressure to compress the container and its contents to a minimum volume. If the evacuation is carried out slowly the container and its contents may be molded into a variety of shapes or molded to fit the space in which it is desired to store the article.

A more complete description of the process will be given in connection with the accompanying drawings in which:

Fig. 1 shows typical apparatus for vacuum packaging compressible articles in accordance with the invention.

Fig. 2 shows the general appearance of the article in Fig. 1 after vacuum packaging.

Figs. 3 and 4 show the method of molding the article during evacuation to fit a storage container.

Fig. 5 shows a suitable valve for use in evacuating the container, and

Figs. 6 and 7 show an alternative method of sealing the container after evacuation.

As already stated an article to be vacuum packaged in accordance with the invention must be non-rigid and have a compressibility of the type that entrains a large amount of removable air. Referring to Fig. 2 such an article is placed in container 1 which is then sealed along edge 2. The container 1 must be made of a non-rigid or plastic material so that it can readily conform to the shape of the contained article. The material of which the container is made must also be practically impervious to gases and the necessary seals must be gas tight. A valve and nipple 3, which may be the commercially available type shown in Fig. 5 for example, is provided in the container to permit the connection of a hose 4 between the vacuum pump 5 and the container 1 for evacuation of the latter. A manometer 10 or other suitable pressure indicating device may be connected to the hose 4 to indicate the pressure in the container.

As the air is removed from the container and the inside pressure reduced the atmospheric pressure external thereto compresses the container and its contents. When the pressure in the container has been reduced to substantially zero the valve 3 is closed and the pump disconnected. After substantially complete evacuation the container and its contents are a solid high density mass, as represented in Fig. 2, having a volume much less than that of the article before packaging. The reduction in volume achieved depends of course upon the nature of the article. Bulky non-rigid articles having a fluffy interior structure of low density permit the greatest reduction in volume and may be vacuum packed with great advantage from the standpoint of space saving.

If it is desired to mold the package into a desired shape a form 6 such as shown in Figs. 3 and 4 may be used. The package is placed in the form before evacuation, as shown in Fig. 3, and evacuated while in the form. When completely evacuated the package forms a rigid unyielding mass, however, during evacuation and before the pressure is reduced to a very low level the mass is pliable and may be made to conform to the shape of the form by the application of external force. This force may be applied directly to the mass by the hands or by the use of a suitable implement. In Figs. 3 and 4 the form is shown as rectangular, however it may take any desired configuration. Such forms may be used to advantage to preform a package into an irregular shape so that it may be fitted into a similar irregularly shaped storage space. Slow evacuation is best during the molding process.

In general vinyl plastic film having a thickness of about .012" is a very satisfactory material for the container 1, since it is highly impervious to gases and moisture and is easily sealed. However vinyl plastic film has the disadvantage that it becomes brittle at extremely low temperatures. In cases where the package is to be subjected to low temperatures, polyethylene film has been found suitable since it remains pliable at such temperatures. Polyethylene however does not form as good a barrier against gases and moisture as the vinyl plastic film and therefore when polyethylene is used it has been found advisable to use a composite film consisting of an inner layer of polyethylene, a layer of metal foil and an outer layer of scrim or other protective fabric.

Instead of using a valve of the type shown in Fig. 5 the arrangement shown in Figs. 6 and 7 may be used. The container 1 is fitted with a plastic tube 7 through which a hollow rigid tube 8, attached to hose 4, may be inserted for withdrawing the air from the container. After evacuation is complete the tube 8 is partly withdrawn and the plastic tube 7 sealed as at 9 in Fig. 7. The excess length of tube 7 may then be cut off if desired.

The above described process of vacuum packaging is particularly useful in military survival kits. Such kits for use in cold climates or in the arctic regions contain a sleeping bag as well as certain other articles of clothing for protection against the extreme cold. Such survival kits are usually transported by aircraft either as individual units for the use of the crew of the airplane and to be carried down with each crewman in bailing out, or else in larger units to be dropped to men on the ground. In both cases it is highly important to pack the kits in such a volume as possible since space on an airplane is always at a premium. The sleeping bag is the largest, bulkiest item in the kit and the most difficult to hand pack in a small space. By vacuum packing a sleeping
3. A bag in accordance with the above described process its volume can be reduced from 40 to 50 percent below the minimum volume that can be attained by ordinary methods of packing. One particular instance in which vacuum packaging is highly advantageous is in the case of the survival kit packed in a fighter pilot’s contour seat of the ejectable type. In this case the sleeping bag is pre-molded, as explained in connection with Figs. 3 and 4, to fit the contour of the seat so that in packing it against the seat a very efficient utilization of space is obtained. The mold of course would be shaped in this case to conform to the configuration of the seat. No appreciable impairment of the heat insulating properties of sleeping bags and clothing as a result of vacuum packaging has been found.

I claim:

The method of packaging, reducing the volume of and molding into a desired form a non-rigid article of the type that normally contains throughout its structure a relatively large amount of removable interstitial air, said method comprising the steps of placing said article in a non-rigid, gas impervious container, sealing said container, placing said sealed container in a mold having the shape that it is desired to impart to the package, slowly evacuating said container to substantially zero pressure, and forcing said container into contact with the surface of the mold during evacuation.

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