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DESICCANT PACKAGING

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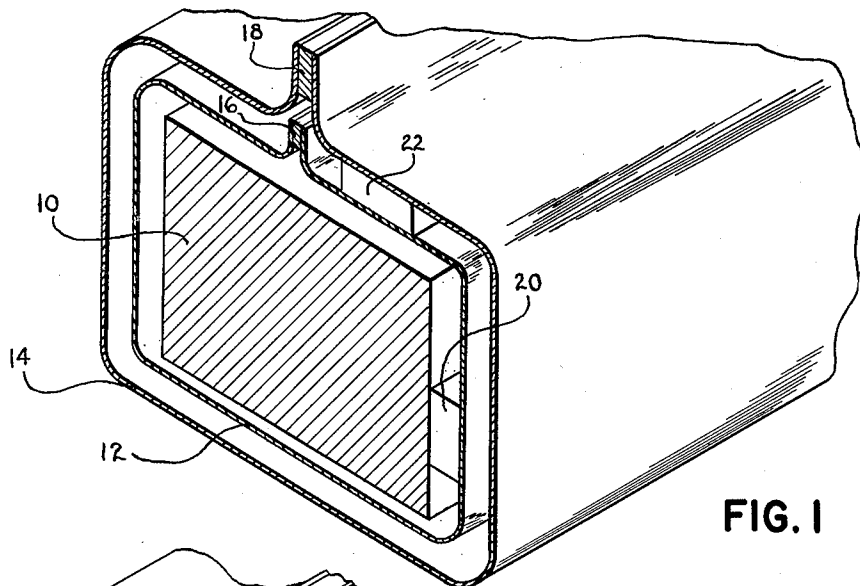


FIG. 1

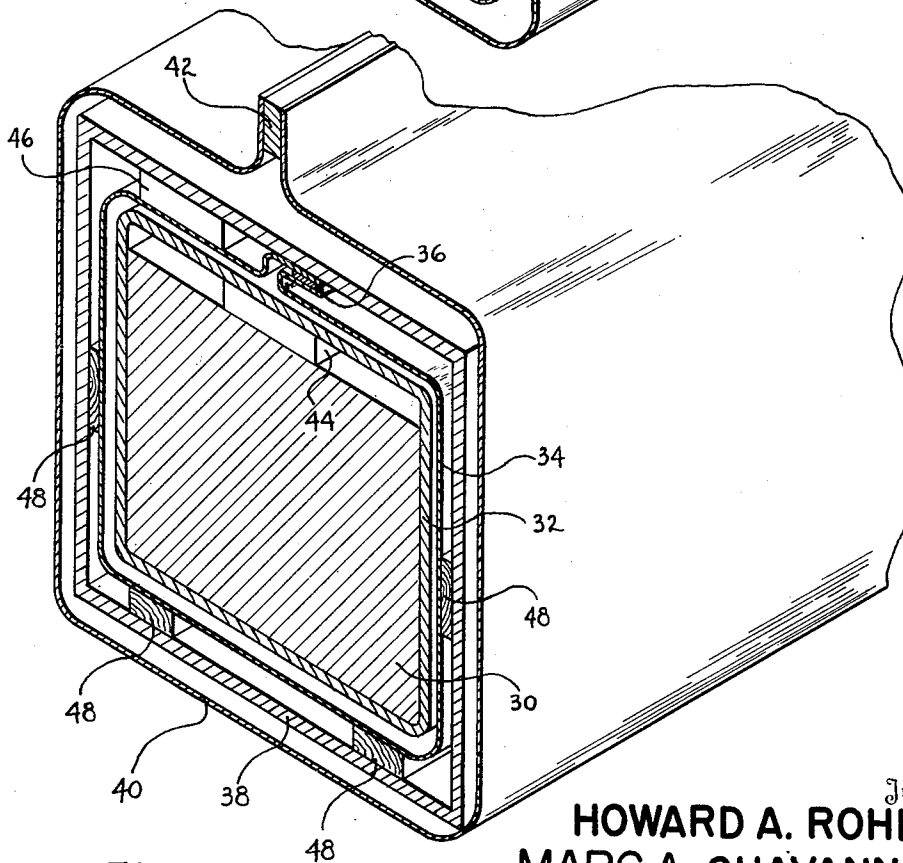


FIG. 2

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DESICCANT PACKAGING

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3 Claims. (Cl. 312—31)

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It is an object of this invention to provide an improved package and an improved method of packaging whereby goods or material may be stored for long periods with complete protection against the ingress of moisture either in the form of water or its vapor.

It is a further object of this invention to provide a package which may be easily inspected to determine the extent of moisture penetration, and which may be easily resealed after such inspection.

The above and other objects will be made clear from the following detailed description, taken in connection with the annexed drawings in which:

Figure 1 is a perspective view partly in section of one form of improved package, and

Fig. 2 is a view similar to Fig. 1, of an alternative form of package.

It is well known that there is no such thing as absolutely impervious material, and there is therefore no known package, the walls of which absolutely will not transmit any moisture vapor. Heretofore it has been common practice to seal such objects as airplane engines, gun mounts, and other highly finished parts in a wrapper or envelope, the material of which offers good resistance to the passage of moisture vapor, and to seal within the package a suitable desiccant such, for example, as silica-gel, calcium chloride, or activated carbon. The machine parts are protected against moisture until the desiccant has become saturated. Various means are used to provide visual indication of saturation of the desiccant. These usually involve mixing with the desiccant a suitable anhydrous acid or alkali, together with an anhydrous indicator. As moisture accumulates in the desiccant the acid or alkali is activated to affect the indicator, whereby to bring about a change of color, providing a visual indication that the saturation point has been reached.

The materials used for forming packages for this purpose are necessarily rugged and opaque, and it is therefore impossible to observe the indicator through such material. Theoretically, a window structure could be devised which would permit inspection. The provision of a window, however, decreases the total resistance of the package to moisture vapor penetration, and moreover, contributes an area of mechanical weakness which is detrimental in handling and shipping the packages.

The fundamental principle of this invention lies in providing a duplex package in which a desiccant is completely sealed, along with the

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machine parts, in an ordinary type of wrapper or envelope. A second wrapper is sealed completely around the first wrapper, and a second body of desiccant is placed between the wrappers. Super-

5 ficially this appears to be a mere multiplication of parts. In practice, however, it results in protecting the interior of the inner wrapper from ingress of moisture vapor and of preventing such ingress for tremendous periods of time.

10 The best sheet materials available for this purpose have a moisture vapor transmission rate slightly under .025 gram of water per hundred square inches per twenty-four hours at 100 de-

15 grees Fahrenheit, and with a relative humidity on the "wet" side of 95 per cent. This may seem low, but when it is considered that the total area of the package may easily exceed four thousand times 100 square inches, it is clear that moisture

20 penetration at the total rate of 100 grams every twenty-four hours is a serious factor. Under present practice any reasonable quantity of desiccant may become saturated within about two months; therefore within this time the package

25 must be opened, the desiccant inspected, and perhaps replaced. If for any reason (and there are many reasons) the moisture transmission rate increases, there is the distinct possibility that the desiccant will become saturated prior to the regular inspection date, whereupon damage to the machine parts will ensue.

30 In the interests of brevity, materials of the character referred to above, which have excellent, but not, of course, perfect resistance to moisture vapor penetration, are characterized herein as "unavoidably pervious" materials. An example of such a material which is common in the industry comprises a lamination of heat sealable vinyl resin with an intermediate layer of metallic foil, and an outer layer of scrim. Numerous other materials having the characteristics noted above may, of course, be used.

35 The provision of both an outer and an inner envelope, and of a desiccant between the envelopes lowers the relative humidity of the air between the envelopes to a point at which the rate of penetration of moisture vapor through the inner envelope is so small as to become negligible.

40 The actual rate of moisture vapor penetration per unit of area per unit of time behaves somewhat in the manner of heat conduction expressed in the same area and time units. That is, for a given area and time, the total quantity transmitted depends, in the case of heat, on the temperature differential between the two sides of the wall being measured, and in the case of moisture

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vapor, upon the differential as between the two sides, not only of temperature, but also of relative humidity. The relationship of transmission as a function of the differentials of temperature and humidity is complex since the moisture content of the air, and the dew point of the mixture, in absolute terms, are functions of temperature and also of absolute, or barometric pressure. The precise mathematical relationship between the transmission rate on the one hand, and the temperature and humidity differentials on the other is one which has not as yet been determined, and which probably will not be worked out for many years to come. Qualitatively, however, there is an abundance of observed data to demonstrate that when the temperature, and especially the humidity, on the "high" side are low in absolute terms, the rate of transmission is negligible. As a matter of fact, in the testing process, it is necessary to establish the humidity differential between the two sides of the test specimen as high as the difference between one or two per cent on the low side and ninety-five to ninety-six per cent on the high side in order to obtain measureable results within 100 hours on a specimen of reasonable size. The decrease in transmission rate with decreasing temperature and humidity on the "high" side is far more severe than a straight line relationship, closely approaching zero per unit of area per unit of time, at low differential, when the high side is low in absolute terms.

In fact, there can be no perceptible penetration of moisture through the inner envelope until several weeks after the desiccant between the envelopes has become saturated. This means first, that a longer interval can be allowed between inspections, and second, that, for such greatly increased periods of time, the above mentioned unpredictable increases in the rate of penetration through the outer envelope, under no circumstances, can bring about the saturation of the desiccant within the inner envelope with consequent damage to the machine parts.

It is still true that from time to time the outer envelope must be opened and the outer desiccant inspected and replaced, but it will not be necessary to open the inner envelope oftener than once in a number of years and then only as a precautionary measure. In short, so far as protection of the contents is concerned, the present invention does not, by doubling the number of walls, merely halve the moisture transmission rate. The number of walls is doubled, but thereby the moisture transmission rate is divided by many times two.

Referring now to Fig. 1, there is shown a commodity 10 surrounded by inner wrapper 12 which in turn is surrounded by an outer wrapper 14. The inner wrapper 12 is hermetically sealed at 16 and the outer wrapper 14 is hermetically sealed at 18. A quantity of desiccant 20 is packaged within the inner wrapper 12 and another package of desiccant 22 is placed between the wrappers 12 and 14.

In Fig. 2 the arrangement is somewhat different. Here, commodity 30 is contained within a relatively rigid carton 32 formed of cardboard, fibre board or, perhaps, corrugated board. A wrapper 34 of substantially impervious material surrounds the carton 32 and is hermetically sealed at 36. A second carton 38 surrounds the carton 32 and its wrapper 34, while a second wrapper 40 surrounds the carton 38 and is hermetically sealed at 42. A body of desiccant 44 is contained

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within the inner carton while a second body of desiccant 46 is contained between the inner surface of the outer carton 38 and the outer surface of the inner wrapper 34. Suitable spacers 48 are provided to separate the inner wrapper 34 from the outer carton 38. This is done to facilitate circulation of air and thus to assure uniformity of humidity conditions throughout the space of inner and outer packages. The packages of desiccant 44 and 46 are treated exactly like packages 20 and 22 discussed above in connection with Fig. 1.

Each of the quantities of desiccant 20 and 22 (Fig. 1) and 44 and 46 (Fig. 2) is packaged in a bag or wrapper formed of material which is relatively pervious to the transmission of water vapor but relatively impervious to the passage of liquid water. The desiccant, therefore, is enabled to function for the purpose of absorbing water vapor but, as the water accumulates in liquid form in the desiccant, the individual bag or wrapper containing the desiccant tends to prevent liquid water coming in contact either with the commodity or with the adjacent package walls.

There are many materials which are relatively pervious to moisture in the form of vapor, but which are relatively impervious to the passage of water in liquid form. For example, most of the vinyl resin films have relatively poor resistance to the passage of moisture vapor, but have excellent resistance to the passage of liquid water. As a practical matter, however, paper of the high wet strength type will usually be best for this service, since such paper if otherwise untreated offers very low resistance to the vapor, but offers high resistance to the passage of the liquid.

It is a fact that the apparent moisture vapor transmission rate of a given packaging film increases enormously if there is any actual liquid water in contact with either surface. This occurs for the reason that any packaging material will have a certain quantity, however small, of soluble material. Liquid water in contact with such wrapping material dissolves a portion of the soluble matter. Osmosis then immediately takes place, bringing about a passage of the liquid itself. It is, therefore, important to avoid, so far as possible, any contact of liquid water with the walls of the package.

Once in place, there is no functional and very little structural difference between a bag and a wrapper. A bag may, therefore, be regarded as a partially preformed and presealed wrapper. For convenience the term "wrapper" is used herein, but such term is intended to include bags.

The packages illustrated in the drawings have been somewhat idealized and in practice there usually will not be the regularity of form illustrated. Moreover, when the packages are very large, the wrapper will be formed by joining a number of sheets by means of hermetic seals or seams, which may be of any suitable type, but which preferably should be made in accordance with the co-pending application of Howard A. Rohdin, Serial No. 561,982, filed November 4, 1944, which has now become abandoned. The use of spacers between the inner and outer package has been illustrated in connection with the carton structure of Fig. 2. It is equally applicable to the wrapper structure of Fig. 1, but in practice, where the object is irregular and no carton support is provided, the spacer idea is somewhat more difficult of application.

What is claimed is:

1. A package comprising: a commodity; an

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unavoidably pervious sheet of material wrapped about said commodity and sealed by substantially impervious seals; a quantity of desiccant material enclosed in said wrapper with said commodity; a second wrapper of unavoidably pervious sheet material surrounding said first wrapper and sealed by substantially impervious seals; and a quantity of desiccant material enclosed between said first and second wrappers each of said quantities of desiccant material being wrapped in a material substantially pervious to moisture vapor and substantially impervious to liquid water.

2. A package comprising: a commodity and a quantity of desiccant material enclosed in a substantially rigid carton; a wrapper of unavoidably pervious sheet material sealed by substantially impervious seals around said carton; a second carton surrounding said first carton and its wrapper; and a second wrapper sealed around said second carton; there being a quantity of desiccant material between said second carton and said first wrapper, each of said quantities of desiccant material being wrapped in a material substantially pervious to moisture vapor and substantially impervious to liquid water.

3. A package comprising: a commodity and a quantity of desiccant material enclosed in a substantially rigid carton; a wrapper of unavoidably pervious sheet material sealed by substantially

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impervious seals around said carton; a second carton surrounding said first carton and its wrapper; and a second wrapper sealed around said second carton; there being a quantity of desiccant material between said second carton and said first wrapper, said second carton being spaced from said first wrapper to provide air circulation therebetween, each of said quantities of desiccant material being wrapped in a material substantially pervious to moisture vapor and substantially impervious to liquid water.

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