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FOLDING CARTON BLANK

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No Drawing. Continuation of application Ser. No. 554,232, Mar. 14, 1966, which is a division of application Ser. No. 457,221, May 19, 1965, and a continuation-in-part of applications Ser. No. 261,053, Feb. 26, 1963, and Ser. No. 446,372, Apr. 7, 1965. This application Apr. 29, 1968, Ser. No. 725,220

The portion of the term of the patent subsequent to Sept. 12, 1984, has been disclaimed

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U.S. Cl. 117—44 1 Claim

ABSTRACT OF THE DISCLOSURE

Folding cartons having a superior grease, moisture, water, and gas transmission barrier property, as well as printability, product flavor retentivity, sifting loss resistance, external odor product contamination resistance, and insect and fungal product attack resistance, by virtue of the disposition of an edge sealing material on the carton free edges with the aid of a vacuum.

This application is a continuation of U.S. application Ser. No. 554,232, filed Mar. 14, 1966, now abandoned, a division of U.S. application Ser. No. 457,221, filed May 19, 1965, now abandoned, and a continuation-in-part of U.S. application Ser. No. 261,053, filed Feb. 26, 1963, now U.S. Patent No. 3,187,480, and U.S. application Ser. No. 446,372, filed Apr. 7, 1965, and now abandoned.

This invention relates to packaging with paperboard in the form of folding cartons, carton lids, folders, trays, cards, and the like. More particularly, it relates to the packaging of products having a grease content or being moisture-sensitive to a substantial degree.

Products having a relatively high grease content or being subject to moisture loss or gain, particularly shelf-type foodstuff products such as cake and pie crust mixes, breakfast cereals, and the like, are now commonly marketed in waxed glassine or plastic bags or liners inserted into a paperboard container upon which advertising and instructive information is printed. The waxed glassine or, for example, polyethylene bags are filled, sealed or crimped, and introduced into the container by the packager. In this type of packaging, the waxed glassine or polyethylene bags provide the barrier which keeps the grease of the product in (where it cannot provide a path for the spoilage or contamination of the product or the containers) or the moisture of the atmosphere or product out or in, respectively, and the containers provide protection against grosser injury to the product resulting from either normal or improper handling.

It is known that the bag-in-the-box variety of packaging, especially for foodstuffs, is not entirely satisfactory. The bags are difficult to fill, seal, and insert into the containers and the consumer has difficulty both in opening and re-closing this type of package, particularly where inadequacy in the re-closing can adversely affect the life of the product.

It is also known that new advances in the art of laminating or otherwise bringing together paperboard and protective agents or barrier coatings such as paraffin waxes, microcrystalline waxes, waxes blended with polymers, vinyl co-polymer blended waxes, polyvinylidene chloride, and polyolefins have resulted in improved grease and moisture barrier characteristics for the paperboard.

In consequence, in some instances, products can be packaged safely and attractively in containers made of the augmented paperboard and without recourse to waxed glassine or plastic bags. See, for instance, U.S. Patents Nos. 2,999,758 and 3,015,596.

Heretofore, however, there does not appear to have been developed a paperboard-based packaging material, design, or method which results in a single unit folding carton or the like having substantially equal utility for grease-bearing or exuding products and water-absorbing or water-emitting products and creating no additional problems. It has been proposed to place a barrier coating of plastic or the like on the inner wall of a paperboard folding carton to abut a greasy product and to contain the grease, but this leaves the outer wall of the carton and the edges thereof without the requisite resistance to grease penetration, moisture vapor transfer, or water absorption. It has been proposed to place a barrier coating on the outer wall of a paperboard folding carton for a water-absorbent product and to exclude moisture or water, but this leaves the inner wall of the carton and the edges thereof susceptible to attack by any fats or greases normally in the product and leads to difficulties in achieving and maintaining attractive printing or decoration of the outer wall. It has been proposed to place barrier coatings on both the inner and outer walls of paperboard folding cartons, but this tends to diminish or obviate the economic advantage sought by the initial resort to paperboard as the carton material. Or, it results in a packaging material inferior in performance to the bag-in-the-box combination.

Some of the objects of the present invention are to secure a paperboard-based packaging material, design, and method productive of a single unit folding carton or its equivalent having a superior grease, moisture or water, and gas transmission barrier property and other characteristics such as printability, product flavor retentivity, sifting loss resistance, external odor product contamination resistance, and insect and fungal product attack resistance. Other objects will become evident to those skilled in the art from the following disclosure.

Broadly, the present invention encompasses a process made up of the steps of (a) barrier coating at least one surface of a paperboard web or sheet; (b) die cutting flat folding carton blanks having free edges from the barrier coated web or sheet; (c) tightly compressing a stack of a plurality of the flat folding carton blanks; (d) submerging the compressed stack in a bath of free edge sealing material for a pre-determined dwell time; (e) removing the compressed stack from the bath; (f) forming folding cartons, wherein a barrier coated paperboard web or sheet surface is disposed interiorly, from the flat folding carton blanks; (g) filling the formed folding cartons with a product characterized by at least one of the conditions selected from the group consisting of grease-bearing, moisture-sensitivity, and gas sensitivity; and (h) closing the filled carton. Preferably, the paperboard web or sheet or, more generally, substrate is previously prepared for printing, as by being clay coated in accordance with conventional procedures, on that surface which is not to be barrier coated in accordance with the present invention or on top of one of the barrier coated surfaces. Also, it is preferable, not to say most convenient, to accompany the die cutting step with a blank scoring step. Again, it has been found preferable to have the bath hot and agitated during the stack submersion, so as to promote the penetration and the sealing of the free edges by the sealing material. A sealed free edge drying period is also desirable. Then too, the step of printing the blanks on their non-barrier coated surfaces with indicia of advertising and instruction before the cartons are formed and the

use of adhesives or heat sealing to assist in the carton closing is preferred.

Among the grease, moisture, and gas barrier coatings found useful in the practice of the present invention are, and these are cited from a broad grouping only for example, low, medium, and high density polyethylene, polyvinylidene chloride, aluminum foil, grease-proof paper, glassine, alone or in combination with each other or laminating-promoting agents. These materials were laid down in thicknesses of from about 0.0001" to 0.0015" on paperboards having thicknesses of from about 0.013" to 0.24" and made commercially available by International Paper Company under the trademarks "Mosscoat," "Snobrite," "IPB," and "IPX." These boards are all clay coated for printing purposes and made from bleached sulfate pulp or other mixed virgin pulps, but they vary in density.

Among the folding carton blank designs having particular utility in accordance with the present invention are the blanks having in common the structural feature of free edges, i.e., exterior edges nowhere impinging upon or impinged upon by other edges of the same blank.

The apparatus for submerging a stack of flat folding carton blanks like those just referred to in the edge sealing bath need involve, in a bench model, nothing more than metal, expanded metal, or even plywood platens, preferably cut to conform along their peripheries with the outlines of the blanks they are to hold; mechanical, pneumatic, or hydraulic clamping means to hold the platens in place and tightly compress the stack so as to prevent seepage of the edge sealing material between the flat surfaces of the folding carton blanks; a tank for the edge sealing material; means such as a chain hoist to lower the stack into the bath and raise it out of the bath; and, preferably, a bath heating unit and a bath agitation unit, e.g., a stirrer or an ultrasonic vibrator. Production models can, of course, be further refined.

At least two classes of edge sealing materials can be employed in achieving the results of this invention. One class includes those agents which are inert to and do not react with the individual cellulose fibers exposed along the free edges of the paperboard carton blanks and the neighboring fibers, but, rather, have the capability of filling the interstices or voids between such fibers. A hydrogenated castor oil such as Archer-Daniels-Midland Company's Hydrofoil Glycerides #200 or Baker Oil Company's "Castorwax" falls into this class. The other class includes those agents which react with the individual cellulose fibers contacted and an example of such an agent is the water-soluble fluorochemical chromium complex otherwise described as the chromium (Cr III) complex of N-ethyl-N-heptadecylfluoro-octane sulfonyl glycine and sold by the 3M Company under the designations FC–805 Paper Chemical and "Scotchgard."

Just how effective a combination of the foregoing process steps and substrates, barrier coating, folding carton blank designs, and free edge sealing materials can be is both unexpected and surprising. For example, a barrier coated stock was produced by conventional laminating means which comprised 25 lb. opaque glassine/1.5 mil polyethylene/0.015" "IPB" paperboard. About 150 carton blanks having free edges were cut from such stock and stacked. Then, the stack was compressed under about 20 lbs. per sq. in. pressure between two platens and lowered into a bath of FC–805 Paper Chemical. The temperature of the bath was about 75° F. and it was continuously agitated during the submersion of the stock in the bath. The submersion lasted approximately 10 seconds. The stack was then withdrawn from the bath and the free edges of the blanks were permitted to dry for 24 hours at room temperature and 44% relative humidity. Next, cartons were formed from some of the blanks and the cartons were filled with an apple raisin cake mix, marketed by a well-known manufacturer under the "Duncan Hines" imprint, into which a red dye had been introduced. Thereafter, the filled cartons were placed in an oven, held at a temperature of 110° F. for 3.25 weeks and, thereby, subject to a shelf-life of about 13 weeks. At the end of the oven treatment, no incursion of the red dye along the edges of the cartons or on their surfaces was visible to the naked eye, though, by way of contrast, varying, but serious, degrees of such incursions—denoting edge-wicking of the grease content of the cake mix by the paperboard of the cartons—was noted in sample cartons similar in design and manufacture except for the exclusion of the barrier coating or the edge sealing or both. Additional tests, the same or closely similar in all particulars, except that "Castorwax" was used in place of the FC–805 Paper Chemical and the immersion therein took place in a bath held at about 320° F. with a dwell time of about 3.5 minutes, have been conducted with generally comparable results.

There is very reason to believe that the foregoing presents or suggests solutions to problems arising in other areas of the packaging field. The packaging of fluids such as milk and dairy products derived therefrom, frozen goods such as meats, soaps, and detergents, and lubricated metal parts can be advanced by one or more of the several aspects of this invention.

One modification of or variation on the above-discussed process of edge treating carton blanks and the like which has been found to be particularly advantageous is the utilization of a vacuum above the edge treatment bath immediately prior to the immersion of carton blanks in the bath and during at least part of such immersion, and, in some cases, immediately after the immersion has ended.

Thus, for instance, when the bath is comprised of polyfluoroalkyl phosphates, isopropanol, and water (in a weight ratio of about 1:1:1), it is desirable to apply the vacuum prior to immersion, maintain the vacuum for about 25% of the dwell time of the blanks in the bath, and, then, gradually release the vacuum in such a way as to assure that the blanks are still subjected to a slight negative pressure as they are withdrawn from the bath. The same procedure is to be followed when the edge treating material is a perfluorooctanol-sulfonyl glycine solution or the like. In such instances, wherein the edge treating materials coat individual cellulosic fibers at the blank edges and react with the celluose, bringing the blanks out of the bath while they are still under a vacuum and then releasing the vacuum removes excess material, and obviates the need to use an air knife for the same purpose, without adversely affecting the quality of the edge treatment.

By contrast, where the edge treating material is a hydrogenated castor oil or a paraffin wax or a similar material applied in the molten state, the preferred procedure is to create a vacuum above the bath of edge treating material prior to the immersion of the carton blanks therein, to maintain the vacuum for about 25% of the immersion dwell time, and then to release the vacuum immediately. In such instances, wherein the edge treating materials fill up the interstices between fibers and the like at the edges of the blanks, the vacuum applied creates a positive pressure in the blanks and the air in the interstices acting under such pressure overcomes the interfacial tension at the cut edges of the blanks (which consist of cellulose fibers, binders, etc.) and escapes, leaving partial vacuums in such interstices. Thereafter, when the vacuum is released prior to the withdrawal of the blanks from the bath, the resulting atmospheric pressure on the bath is positive relative to the vacuums in such interstices and tends to drive the edge treating material of the bath into the interstices notwithstanding the interfacial tension.

It will be understood by those skilled in the art that the nature of the edge treating material will generally dictate how the vacuum over the bath is to be regulated in a particular case and that, in some instances, equivalent results will be achieved by either means of using the vacuum described above or by a combination of the two.

But the advantages of using a vacuum cannot be gainsaid.

For example, in two tests run for comparison purposes, 50 pieces, measuring 2" x 5" each, of solid bleached sulfate paperboard having a thickness of 0.018" and coated on both sides with 1½ mils of polypropylene (Hercules Resin No. 6130) where clamped tightly into a stack. The torque wrench used to tighten the nuts of the clamping device measured ½ lb.-in. of torque. Then, a 200 ml. solution of a polyfluoroalkyl phosphate, 99% isopropanol, and distilled water, wherein the ingredients each constitute about one-third by weight, was placed in a 600 ml. beaker.

Next, in the first test run, the beaker was placed in a standard laboratory vacuum dessicator, the lid thereof was placed thereon slightly ajar, and the vacuum pump was started. Thereafter, as quickly as possible, one of the clamped stacks was placed in the beaker inside the dessicator, the dessicator was fully closed, and a stopwatch started. After 15 seconds, the vacuum had built up to about 14" of water. The air in the clamped pieces of paperboard was escaping rapidly and even violently and the solution was actively bubbling. Then, the vacuum was released, the clamped pieces of the paperboard were left immersed in the solution in the beaker for another 45 seconds, and, following such 45 seconds, the clamped pieces of paperboard were withdrawn from the solution and allowed to stand for three minutes. After the expiration of the three minutes, the clamp was opened, the pieces of paperboard were inspected, and it was noted that the edge treating solution had uniformly penetrated about ½" in from the edges of the pieces.

In the second test run, the procedure of the first test run was repeated, except that no vacuum was employed and the entire run took place at atmospheric pressure. Upon inspection of the pieces of paperboard subjected to the second test, it was found that the edge treating solution had uniformly penetrated about 1/64" in from the edges of the pieces.

What is claimed is:

1. A folding carton blank cut from paperboard and having an edge sealing material capable of penetrating paperboard and selected from the group consisting of water-soluble fluorochemical complexes, paraffin wax, and hydrogenated castor oil disposed solely on one of its edges, the edge sealing material having a penetration into the blank along said one of its edges of more than about 1/64 inch and up to about ½ inch where the paperboard is solid bleached sulfate paperboard having a thickness of about 0.018 inch.

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