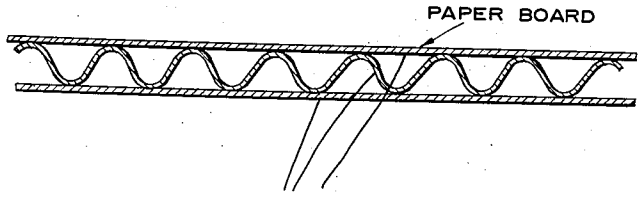
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PAPERBOARD AND METHOD OF MANUFACTURE

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IMPREGNATED
WITH 26% to 37%
OF COMPOSITION
CONTAINING BY WEIGHT
70 to 95 PARTS MINERAL WAX AND
5 to 30 PARTS PETROLEUM
POLYMER RESIN

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PAPERBOARD AND METHOD OF MANUFACTURE

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This invention relates to paperboard and its method of manufacture and is particularly directed to corrugated board which is fabricated in the form of a box blank and then impregnated.

Heretofore, wherever foods have been packaged in containers and packed with ice, hydrocooled, subjected to cold storage, or frozen, it has been necessary to use wooden boxes. Previous attempts to substitute corrugated board boxes for use under such conditions of high humidity or in the presence of water have not been feasible. Where such paperboard boxes have been introduced at a cost sufficiently reasonable to be competitive with wooden boxes, they have lacked the stacking strength necessary for commercial storage and shipment. Wherever paperboard boxes have been constructed so as to be sufficiently stronge to withstand these conditions, their price has been prohibitive.

Previous attempts to produce corrugated paper boxes have been directed primarily to the treatment of the components of the corrugated board before their assembly and accordingly, before fabrication of the blanks from which the boxes are to be erected. In accordance with the present invention, the solution has been achieved by impregnation of the blanks after they have been fabricated and in fact, even after they have received any printed matter intended for the finished product. In accordance with the present invention, the fabricated blanks are impregnated by immersion, as distinguished from coating, and the amount of impregnant is controlled by subjecting the impregnated blank to a subsequent heat treatment during which any excessive impregnant is removed.

Boxes produced from such blanks possess a number of advantages over wooden boxes of the types previously employed from the standpoints of price, insulating properties, uniformity of refrigeration of the contents, moisture retention, and stacking facility.

It is among the objects of this invention to provide an article of manufacture comprising a paperboard base impregnated with a composition containing from 70 to 95 parts by weight of mineral wax and from 5 to 30 parts by weight of a petroleum polymer having an A.S.T.M. ring and ball softening point above 158° F., said composition constituting from 26 to 37% of the total weight of the impregnated sheet material. The base is preferably a blank composed of corrugated board which will ultimately be erected to form a corrugated box. The mineral wax is preferably paraffin and the composition preferably contains from 75 to 90 parts by weight of the wax and from 10 to 25 parts by weight of the resin.

The invention also contemplates a method of increasing the strength of a corrugated paper blank comprising immersing the blank in a composition containing from 70 to 95 parts by weight of a mineral wax and from 5 to 30 parts by weight of a petroleum polymer resin having an A.S.T.M. ring and ball softening point above 158° F. for a period exceeding 15 seconds at a temperature of from 180° to 250° F., removing the blank from the composition and subjecting the blank to an elevated temperature of from 250° to 350° F. to facilitate removal of excessive amounts of the composition. The blank is preferably immersed until the composition represents more than 26% of its total weight and the blank is then preferably subjected to the elevated temperature until the composition represents between 26 and 37% of its total weight.

The single figure shown in the drawing depicts in fragmentary form an article conforming to the present invention.

It has been found in accordance with the present invention that paperboard and particularly corrugated paperboard will have a number of its physical properties vastly improved by impregnating it with a composition containing from 70 to 95 parts by weight of a mineral wax such as paraffin wax and from 5 to 30 parts by weight of a petroleum polymer resin having an A.S.T.M. ring and ball softening point above 158° F., such as the resin disclosed in the patent to Ward, Canadian No. 531,202, dated October 2, 1956. Somewhat improved results are achieved where the composition contains from 75 to 90 parts by weight of the wax and from 10 to 25 parts by weight of the resin, the best results among the many tests conducted having been achieved with a composition containing approximately 80 parts by weight of the wax and approximately 20 parts by weight of the resin.

The selected proportions of the wax and resin are mixed by melting them together in a tank at temperatures ranging from 180° to 250° F., preferably between 210° and 220° F. Then the corrugated board, or other fibrous materials, will be completely immersed in this bath for at least 15 seconds and for periods of up to 5 minutes to produce adequate impregnation. It has been found that from 26 to 37% of the total weight of the impregnated blank should be represented by the impregnant. Accordingly, this immersion is continued long enough for the paper material to become impregnated to a degree that at least 26% of its total weight will be represented by the impregnant.

Then the impregnated product is removed from the bath and introduced into a heating chamber wherein a temperature of from 250° to 350° F. is maintained. The blanks are passed through this chamber, preferably in a vertical position to remove impregnant exceeding approximately 37% by weight of the total product. The movement of the blanks through the conveyor can be achieved with commercial conveyor equipment of various types. The temperature will be maintained in the chamber by the circulation of hot air which may be blown downwardly over the blanks to cause the excess impregnant to be removed and returned to the immersion tank or tanks. Removal of the excess impregnant can be assisted by vibration as well.

This heat treatment at elevated temperature to remove excessive impregnant has been found to require from 3 to 5 minutes for corrugated board having a Mullen strength of 200 lbs. per square inch.

Box blanks produced from corrugated board having a 200 lb. per square inch Mullen strength have shown vast improvement in their top to bottom compression tests by virtue of the present invention. At a temperature of 73° and relative humidity of 65%, the top to bottom compression strength of an untreated specimen increased from 40.5 lbs. per square inch to 60 lbs. per square inch, an increase of approximately 48%. At a temperature of 73° F. and a relative humidity of 100%, the increase was even more marked, from 17.3 lbs. per square inch to 33.5 lbs. per square inch. At 33° F. and

a relative humidity of 100%, the top to bottom compression strength increased from 17.9 lbs. per square inch to 38 lbs. per square inch. Under freezing conditions, its top to bottom compression strength rose from 26.1 lbs. per square inch to 53.1 lbs. per square inch by virtue of the treatment contemplated by the present invention.

Analogous results were produced in connection with corrugated board having a Mullen strength of 275 lbs. per square inch. At a temperature of 73° F. and at a relative humidity of 65%, an untreated blank produced a top to bottom compression strength of only 54 lbs. per square inch as compared with 80 lbs. per square inch in the case of a blank treated in accordance with the present invention. At 73° F. and 100% relative humidity, the increase was from 19.2 lbs. per square inch to 39.6 lbs. per square inch. At 33° F. and 100% relative humidity, the increase was from 19.6 lbs. per square inch to 44 lbs. per square inch. Under frozen conditions, the increase was from 47.9 lbs. per square inch to 96.8 lbs. per square inch.

Corrugated board having a 350 lb. per square inch Mullen strength produced comparable results. At 73° F. and 65% relative humidity the top to bottom compression strength increased from 70 lbs. per square inch to 108 lbs. per square inch. At 73° F. and 100% relative humidity the increase was from 24 lbs. per square inch to 56 lbs. per square inch. At 33° F. and 100% relative humidity, the increase was from 26 lbs. per square inch to 76.9 lbs. per square inch. And under freezing conditions, the increase was from 63 lbs. per square inch to 120 lbs. per square inch.

Each of the foregoing results was achieved by the use of from 70 to 95 parts by weight of the mineral wax and from 5 to 30 parts by weight of the resin. As previously stated, somewhat improved results occurred where the parts by weight of the wax were 75 to 90 and the parts by weight of the resin from 10 to 25. The very best results recorded occurred with 80 parts by weight of the wax and 20 parts by weight of the resin.

Whereas the invention is applicable to a variety of products, it is principally concerned with corrugated board fabricated in the form of box blanks and then impregnated so as to assume such stacking strength and other physical characteristics as will equal and in some respects surpass the properties of wooden boxes under

humid or wet conditions. Such variations are contemplated as fall within the scope of the appended claims.

We claim:

1. An article of manufacture comprising a paperboard base impregnated with a composition containing from 70 to 95 parts by weight of mineral wax and from 5 to 30 parts by weight of a petroleum polymer resin having an A.S.T.M. ring and ball softening point above 158° F., said composition constituting from 26 to 37% of the total weight of the impregnated sheet material.

2. An article of manufacture as set forth in claim 1 wherein said base is a blank composed of corrugated board containing mutually spaced elements.

3. An article of manufacture as set forth in claim 1 wherein said mineral wax is principally paraffin.

4. An article of manufacture as set forth in claim 1 wherein said composition contains from 75 to 90 parts by weight of said wax and from 10 to 25 parts by weight of said resin.

5. A method of increasing the strength of a corrugated paper blank comprising immersing said blank in a composition containing from 70 to 95 parts by weight of mineral wax and from 5 to 30 parts by weight of a petroleum polymer resin having an A.S.T.M. ring and ball softening point above 158° F. for a period sufficient to incorporate at least 26% of said composition in said blank at a temperature of from 180° to 250° F., removing said blank from said composition and subjecting said blank to an elevated temperature of from 250° to 350° F. to facilitate removal of excessive amounts of said composition until said composition represents between 26% and 37% of the total weight of the impregnated blank.

6. A method as set forth in claim 5 wherein said blank is immersed in said composition for a period between fifteen seconds and five minutes.

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