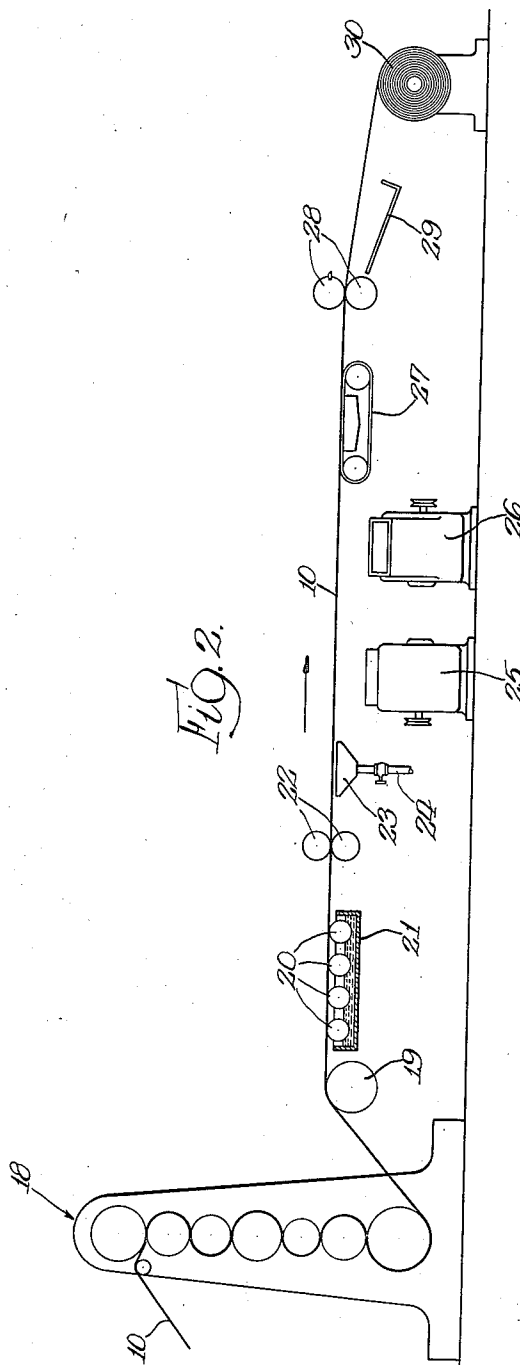
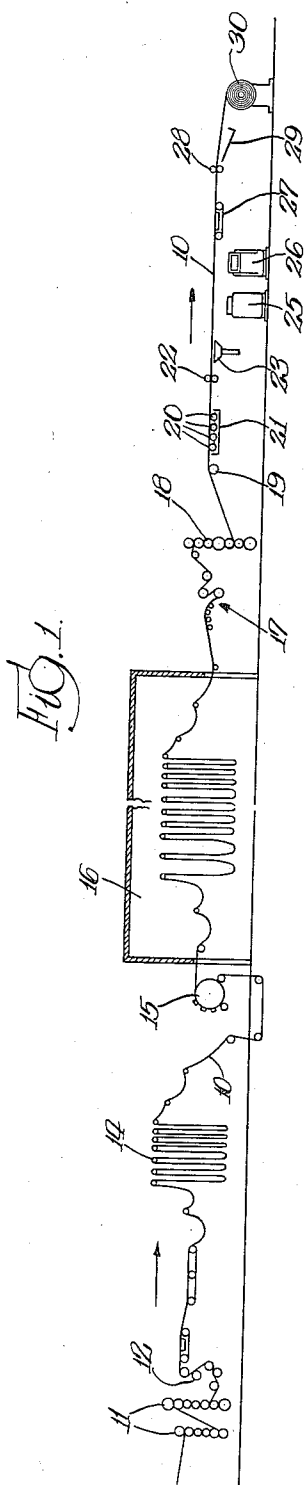


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CALENDER FINISHED PAPER BOARD PRODUCT AND PROCESS AND MEANS FOR  
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## CALENDER FINISHED PAPER BOARD PRODUCT AND PROCESS AND MEANS FOR PRODUCTION OR TREATMENT THEREOF

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This invention relates to calender finished products comprising coated and uncoated paper board, and to processes and means for use in production or treatment of such finished products.

The paper board in a calender finished product is formed or provided with a top liner or facing ply of relatively good paper; the remaining portion of the board, or the intermediate plies thereof, being composed of relatively inferior paper material, which may be produced from old newspaper stock or other coarse cheap pulp. The smoothly finished front surface of the product may be that of the paper liner, or of the paper liner treated or lightly coated with material to promote glossiness of the finish, or of a distinct film of coating material applied to the paper liner. Calender finished paper board, in the sense of this specification, therefore includes ordinary calendered paper board; similar products formed with a facing ply of comparatively fine stock and highly finished by extended calendering; the so-called "patent coated" paper board which is finished with a glaze-like surface by extended calendering and treatment during calendering with a fine spray of thin coating solution, or by calendering, treatment and supercalendering; and coated board produced by coating the face of ordinary calendered paper board with a paper coating solution, drying the coated board, and finishing the dried coated board by supercalendering, usually with a glossy or lustrous finish. In the production of coated paper board of the type last mentioned, the coating solution commonly employed is a composition containing clay or the like, which when dried and finished by supercalendering forms an enamel-like surface. Such coated paper board, herein referred to as "clay coated," is used extensively for the manufacture of merchandising cartons the labels of which are printed on the fine printing surface provided by the film of coating material.

Paper board, especially in thick and medium-thick grades, is substantially reduced in thickness by calendering. A product subjected to severe calendering to impart a high surface finish will be rendered thinner than one of the same weight or containing the same amount of stock per square yard which is finished with only moderate calendering. Differently finished products in coated and uncoated paper board may therefore have different weights in sheets of the same size and thickness, so that more stock may be required to obtain a specified thick-

ness in one product than in another. Such products as patent coated and finished clay coated paper board are generally relatively heavier than ordinary calendered paper board of the same thickness. Finished clay coated paper board, on account of the extra weight of its film of coating material, as well as on account of the degree of supercalendering which it undergoes in some instances, will ordinarily outweigh patent coated board of the same thickness. Though the differences in weights of the respective products may be slight or seemingly trivial, they will show up upon comparing substantial amounts of the respective products; since there will be more square feet of board in a ton of a relatively lighter product than in a ton of a relatively heavier product of the same thickness.

Both stiffness and lightness are desirable properties in paper board. The lighter the product of a given thickness, the more of it can be made from a given amount of stock, and the more of it will be contained in a ton furnished by the manufacturer to the customer. A product relatively stiff for its thickness is usually to be preferred to thicker or heavier board of the same stiffness or rigidity, other conditions being equal.

An object of the present invention is to obtain, in a calender finished product comprising coated or uncoated paper board, an increment of additional thickness, or increased rigidity of the paper board, or both, without increasing the amount of stock in the paper board, and without diminishing the degree of calendering for the production of such finished product. Further objects or advantages of the invention will hereinafter appear.

According to the invention, the calender finished paper board, coated or uncoated, after it has undergone the calendering for the finishing of its front surface, is treated to impart additional rigidity or thickness or both to the paper board, or to obtain in connection therewith one or more of the other advantages hereinafter mentioned, by wetting or dampening the paper board by application of or introduction of moisture to or through the back of the board. In carrying out the invention, the board may be treated as it is withdrawn from the calendering machine by which it is finished, or, if the finished product has been reeled or gathered in a roll, it may be treated as it is withdrawn from the reel or roll. Water or other suitable liquid (which may be a treating solution to impart a desired property to the paper board) may be applied substantially uniformly to the back of the

board by wet rolls or by spraying or other suitable means, with appropriate regulation of the amount of water or liquid going into the paper board, which should be sufficient to render the coarse paper material in the board substantially damp, or to cause substantial impregnation of said material with the applied liquid by absorption thereof in said material. The preferred mode of dampening is by contacting the back of the board successively with a series of metal-surfaced rolls bearing films of water or treating liquid, the amount of water or liquid introduced into the paper board being controlled by the number of wet rolls. A more refined control may be obtained, if necessary or desirable, by associating with each of the wet rolls an adjustable squeeze roll coating therewith to regulate the thickness of the film of liquid carried by such roll into contact with the paper board. In treating finished coated paper board having a clay coating, which coating and finish thereof would not be impaired or objectionably affected by temporary wetting, the board may be rendered substantially damp or even quite wet throughout; while in the case of a product whose front surface or finish thereof would be impaired or objectionably affected by moisture, the dampening operation may be controlled to avoid penetration of moisture to such finished surface, or to avoid substantial moistening of the top liner of the paper board or absorption therein of sufficient moisture to impair the smooth finish of its front surface. In this connection, attention may be called to the fact that the plies of the paper board composed of coarse paper material will quickly absorb moisture, whereas the top liner, being formed from more finely beaten stock and of closer formation or texture, will be less quickly moisture absorbent; so that it is practicable to regulate the wetting operation to cause substantial dampening of the coarse paper plies in the paper board without material or objectionable moistening of the top liner.

After the wetting or dampening operation, the dampened paper board is suitably dried by rapid drying or partially by rapid drying. Rapid drying may be accomplished by blowing air across the back of the paper board, but preferably by first exposing the back of the paper board to a blast of hot air or to contact with heated air and then blowing air in opposite directions or alternately in opposite directions against and across the back of the board. It is not intended to imply that the board is completely dried, for it is desirable to retain a small amount of moisture in the paper board. In general the paper board will be dried to an appropriate degree of dryness for gathering the board in a roll or in piles of cut sheets. During the drying, the paper board is drawn out and maintained as taut as practicable, to resist tendency to buckle.

By the dampening of the paper board and ensuing drying, a desirable increase in rigidity is imparted to the paper board, which may be attributed to the swelling of the fibres in the coarse paper material. The material being in a compressed state, the swelling of the fibres by action of moisture will cause them to pack still more closely together, with resultant rigidifying effect in the dried product. So also the swelling of the fibres as they absorb moisture will tend to swell the paper board as a whole. Assuming sufficient absorption of moisture in the paper board to cause appreciable swelling of the paper

board, the product after drying will be fluffier or lighter for its thickness than when it was delivered from the calender finishing operation, and therefore of fluffier or lighter quality than similarly finished paper board of the same thickness as conventionally produced by operations concluded by the calender finishing. By the effect of the dampening operation, a substantial increase in the thickness of the calender finished paper board may be obtained, especially in thick and medium-thick grades of paper board. In the case of supercalendered clay coated paper board of 16 points thickness as delivered from the supercalendering rolls, I have found it practicable to obtain, as an effect of swelling of the board by moisture, an increase in thickness up to 20 points by gauge measurement.

From the foregoing it will be seen that the invention offers opportunity of obtaining relatively stiffer and lighter products in calender finished paper board having an unimpaired fine printing surface, and of production of such products as patent coated and finished clay coated paper board in sheets comparing favorably as to lightness of weight with one another and with ordinary calendered paper board of the same thickness. In general the invention offers opportunity for manufacture of calender finished products comprising coated and uncoated paper board from less stock per square yard than has formerly been required, with resultant economy in large scale production.

Attention is invited to another important aspect of this invention in connection with the manufacture of coated paper board by coating the paper board with a coating solution, drying the coated paper board while it hangs in festoons or folds from supporting poles, and supercalendering the dried coated board. As an effect of hanging the coated paper board from the supporting poles, there are produced what are known as "pole marks," which in the finished product are neither discolorations nor deformations but are visible effects somewhat suggestive of water marks. There are also produced what are known as "check marks" appearing at the back of the board, these being suggestive of minor disturbances in the coarse paper material. An advantage of the present invention is that the dampening or wetting of the paper board tends to promote removal or substantial diminution of such pole marks and check marks. For this object it is desirable to render the paper board quite wet, which is practicable in the case of clay coated paper board without objectionably affecting the smoothness of the finished surface of its coating.

The invention further offers opportunity in connection with the manufacture of calender finished coated and uncoated paper board to practice auxiliary processes whereby to impart a desired property or characteristic to the paper board. Thus it is contemplated that the dampening of the board as hereinbefore described may be accomplished with the use of an aqueous or other suitable treating solution to impart a water-proofing or grease proofing quality or other property to the paper board by substantial impregnation with solution containing appropriate ingredients. Or in connection with the moistening of the paper board by water there may be a supplemental treatment with grease proofing, water-proofing or other liquid to impart a desired quality or characteristic to the paper material. It is

also contemplated that the board may be treated with a solution containing an ingredient to promote fluffiness.

Again, in the case of a calender finished product the back ply of which is formed from the unattractive looking gray stock obtained from old newspapers, an improvement in the appearance of the back side of the paper board may be obtained by taking advantage of the wet state of the coarse paper material to imprint a design on the back side of the board, by carrying it over a suitable roller to imprint such design. For example the board while in the wet state may be drawn over a roller to impart to the back side of the board an appearance simulating alligator skin or the like.

Reference will now be made to one illustrative practice of the invention in connection with the manufacture of coated paper board by a preferred method; it being understood that the illustrative practice is exemplary and that the following description with references to the drawing, which is diagrammatic, is not to be taken as limiting the invention beyond the terms of the claims.

In the accompanying drawing:

Fig. 1 is a diagram representing a plant for manufacture of coated paper board and embodying means for practicing the present invention.

Fig. 2 is a diagrammatic representation of the portion of said plant which comprises the supercalendering machine and apparatus for treating the finished coated board as it is drawn from the supercalendering machine.

The diagram in Fig. 1 represents a plant of the type disclosed in United States patents to Colbert et al. No. 1,514,439 of November 4, 1924 and No. 1,903,325 of April 4, 1933, wherein paper board is continuously produced from wet stock on a board making machine and subjected to the successive operations for production of the finished coated product without reeling the board between successive stages of manufacture. In the drawing the numeral 10 designates the line of paper board coming from the board making machine and undergoing said successive operations. From the drying section of the board making machine (not shown) the paper board runs through the calenders 11 for ironing out the board and smoothly finishing the surface provided by its top paper liner (such surface being the top side of the paper board sheet 10 as shown). The calendered paper board may receive at 12 a preliminary thin coat of coating solution, as in Patent No. 1,903,325, and the board is then conveyed to a suitable hang-up apparatus in which the board is hung up in festoons or folds for drying, as indicated at 14; the hang-up apparatus permitting variable accumulation of hanging folds in its delivery end. From the delivery end of the hang-up apparatus the paper board is withdrawn for a second or main coating operation which is performed by a conventional coating machine 15. The board is drawn around the breast roll of the coating machine 15, with the pre-coated surface of the board exposed to the action of brushes which apply and brush evenly over said surface a coating solution of similar composition and color to that previously applied but somewhat thicker. The coating solution may be a composition containing clay or the like (for example a composition of clay and casein, with or without coloring pigments or aniline coloring matter, and which may contain suit-

able percentages of sizing and other ingredients commonly used in clay type coating solutions). The coated paper board is fed into the drying room 16 in which the board hangs in festoons or folds for drying, the hang-up apparatus permitting variable accumulation of hanging folds in the delivery end of the drying room. The dried coated board is drawn from the drying room past aligning, tensioning and smoothing appliances 17 to and through the supercalendering machine 18, or through such portion of the stack of supercalendering rolls as may be required for ironing out the board and imparting the desired finish to its clay coating.

As represented in the drawing, the finished coated board is drawn from the supercalendering machine over a guide roll 19 and then over a series of wet rolls 20 contacting with the under side or back of the board, whereby the paper board or coarse paper material thereof is substantially dampened as hereinbefore described. A pan containing water or treating solution in which the wet rolls are partially submerged is indicated at 21. The wet rolls may be driven to rotate at a surface speed equal to the speed of travel of the paper board, or at a slightly less or greater speed for varying the amount of water carried by each roll into contact with the paper board. Beyond the wet rolls the board may be engaged by coating slitter disks 22 for trimming the edges of the board or cutting it longitudinally. There may be a pair of coating disks for trimming each side of the board, and one or more intermediate pairs of coating disks for dividing the board longitudinally. An advantage in this connection is that the dampened board cuts easily, offering much less resistance to the slitting operation than in the case of dry paper board. After the dampening of the board, it is subjected to rapid drying action, which may be initiated by passing the board over the open-topped hot air box or chamber 23 to which hot air is supplied by the pipe 24. The back of the board is thus exposed to a blast of hot air, with consequent drying or partial drying effect. It will be understood that as the back ply of paper board becomes dry it will draw moisture from the next ply, so that the effect of exposing the board to hot air will be to check further penetration of moisture in the board. Further rapid drying may be obtained by blowing air against the back of the board or back and forth in opposite directions across the back of the board. In the diagrammatic representation shown, two blowers are indicated at 25 and 26, the blower 25 being arranged to blow air under and across the board from one side, and the blower 26 being arranged to blow air under and across the board from the opposite side. There may be as many blowers as may be required for drying the paper board to an appropriate degree of dryness. Beyond the blowers the board is engaged by a suction conveyor 27 comprising a perforated apron which runs over an open-topped vacuum chamber, whereby the board is locked to the suction apron by atmospheric pressure. The suction conveyor draws the board from the supercalendering machine, and runs at appropriate speed to maintain the board drawn out in taut condition. The suction conveyor may be driven at a speed slightly in excess of the speed of the paper board as it leaves the calendering machine, to take up slack and maintain the board taut. The driving mechanism for the suction conveyor may include a friction clutch which

will slip when the tension of the board exceeds a predetermined value. At 28 are indicated a pair of coating cutter rolls for cutting the board into sheets. The upper roll may have a cutter blade which at every revolution will register with a groove in the lower roll. The cut sheets may be taken off by conveyor means or may drop into the tray 29. If desired the upper roll may be removed and the finished board may be gathered in a roll 30.

It will be understood that the details of the illustrative practice and apparatus may be variously modified to suit different requirements and conditions in the manufacture of calender finished coated and uncoated paper board of various specific types. In carrying out the invention, it is desirable to dampen the paper board by introducing from about 45% to 55% of its weight of moisture, whereby to obtain appreciable swelling of the paper board by moistening action, while avoiding such excess of moisture in the board as to require correspondingly increased drying capacity. However the invention is not intended to be restricted to the use of the proportion of moisture stated nor to any proportions.

I claim as my invention:

1. In the production of a calender finished product comprising coated or uncoated paper board having a smoothly finished facing ply, the process which comprises finishing the board by calendering, dampening the finished board by application of liquid to the back of the board after it has undergone its final calendering, and drying the dampened board.

2. In the production of a calender finished product comprising coated or uncoated paper board having a smoothly finished facing ply, the process which comprises finishing the board by calendering, and, after it has undergone its final calendering, introducing through the back of the board sufficient moisture to render the coarse paper material in the board substantially damp, and drying the dampened board.

3. The process of treating calender finished paper board having a smoothly finished facing ply which comprises dampening the finished paper board by application of liquid to the back side of the board after it has undergone its final calendering, and drying the dampened board.

4. The process of treating calender finished paper board having a smoothly finished facing ply which comprises introducing through the back side of the board sufficient moisture to cause appreciable swelling of the paper board and drying the moistened board, said treatment being after the board has undergone its final calendering.

5. The process of treating calender finished paper board having a smoothly finished facing ply which comprises dampening the coarse paper material of the finished board by application of moisture to the back of the board after it has undergone its final calendering, while avoiding substantial moistening of the finished front surface of the board, and drying the dampened board.

6. The process of treating calender finished paper board having a smoothly finished facing ply which comprises causing appreciable swelling of the finished board by action of moisture, the moisture being introduced through the back side of the board after it has undergone its final calendering, and drying the board by rapid drying action commencing after appreciable swelling and before absorption by said facing ply of suffi-

cient moisture to impair the smooth finish of the front surface of the board.

7. The process of treating calender finished paper board having a smoothly finished facing ply which comprises dampening the finished paper board by application of liquid to its back side after the board has undergone its final calendering, and rapidly drying the dampened board while drawing it taut.

8. The process of treating calender finished paper board having a smoothly finished facing ply which comprises dampening the finished paper board sufficiently to cause appreciable swelling of the board, by introduction of moisture through the back of the board, and rapidly drying the board while drawing it taut, said treatment being after the board has undergone its final calendering.

9. In the process of making coated paper board by coating calendered paper board with coating solution, drying the coated board while hanging it in festoons or folds, and supercalendering the dried coated board, the improvement which comprises dampening the paper board after supercalendering by application of moisture to the back of the board, and drying the dampened board.

10. The process of treating calender finished paper board having a smoothly finished facing ply which comprises impregnating the finished paper board with liquid to impart a desired property to the paper board, the impregnating liquid being introduced by application to the back side of the board, said treatment being after the board has undergone its final calendering.

11. The process of treating calender finished paper board having a smoothly finished facing ply which comprises wetting the back portion of the finished board and drawing it while wet over a roll having a surface formed for imparting a design to the back side of the board, said treatment being after the board has undergone its final calendering.

12. In apparatus for treating paper board, the combination with a calendering machine of moistening and drying apparatus beyond said calendering machine and through which the board is drawn from the calendering machine, said moistening apparatus comprising means for dampening the paper board by application of liquid to its bottom side.

13. In apparatus for treating paper board, the combination with a supercalendering machine, of a series of wet rolls contacting with the bottom side of the board as it is drawn from the calendering machine.

14. In apparatus for treating paper board, the combination with a calendering machine, of a suction conveyor beyond and remote from the calendering machine, by which the board is drawn taut, means for dampening the board delivered from the calendering machine by application of liquid to its back side, means for longitudinally slitting the board while damp, means for drying the dampened board, said dampening, slitting and drying means being in advance of the suction conveyor, and means beyond the suction conveyor for cutting the board transversely.

15. Calender finished paper board having a surface satisfactory for printing and characterized by a higher degree of fluffiness and rigidity than when delivered from the calendering operation by which it was finished.

16. Clay coated paper board finished by supercalendering, having a surface satisfactory for

printing and characterized by a higher degree of fluffiness and rigidity than when delivered from the supercalendering operation.

17. The process of treating calender finished paper board having a smoothly finished facing ply, to obtain fluffing and rigidifying effects, which comprises dampening the finished paper board sufficiently to cause appreciable swelling thereof by application of liquid to the back side of the board after it has undergone its final calendering, while avoiding sufficient absorption of moisture by said facing ply to materially impair the smooth finish of its surface, and drying the dampened board.

18. The treatment of supercalender-finished clay coated paper board, to obtain fluffing and rigidifying effects, which comprises introducing through the back side of the board sufficient moisture to cause appreciable swelling thereof and

drying the moistened board, said treatment being after the board has undergone its final calendering.

19. The treatment of supercalender-finished clay coated paper board which comprises dampening the paper board substantially throughout the thickness of its coarse stock portion by application of liquid to the back side of the board after it has undergone its final calendering, and drying the dampened board.

20. The treatment of supercalender finished coated paper board having a front surface of coating material smoothly finished by the supercalendering which comprises dampening the paper board by application of liquid to its back side after the supercalendering, while avoiding moistening of the coating or the paper surface to which it adheres, and drying the moistened board.

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