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W. C. TOLAND ET AL

2,311,489

PROCESS OF MAKING SHEET MATERIAL

Filed Feb. 5, 1942

Fig. 1.

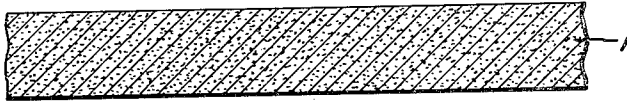


Fig. 2.

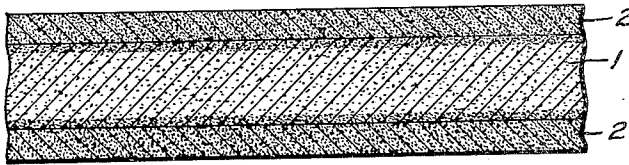


Fig. 3.

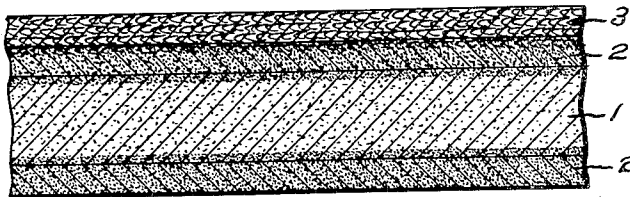
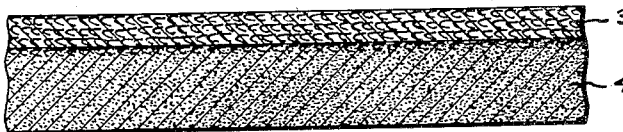


Fig. 4.



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PROCESS OF MAKING SHEET MATERIAL

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9 Claims. (Cl. 117-62)

This invention relates to sheet materials and more especially to coated paper sheet materials, and is a continuation in part of our copending application Ser. No. 306,141, filed November 26, 1939.

An object of the invention is to improve coated sheet materials and to provide a method of making a lithographic paper sheet material which combines water-repellent character with flexibility and toughness. Another object of the invention is to provide a method of incorporating moisture in sheet materials which rely for their water-repellent character upon urea formaldehyde resin coating substances. The invention also aims to provide a simple, cheap and efficient method of making a paper printing element.

The nature of the invention and its objects will be more fully understood from the following description of the drawing and discussion relating thereto.

In the accompanying drawing:

Fig. 1 is an enlarged cross sectional view illustrating a step in the formation of a sheet material in accordance with the method of the invention;

Fig. 2 is an enlarged cross sectional view illustrating another step in the method referred to;

Fig. 3 is an enlarged cross sectional view illustrating still another step in the method noted; and

Fig. 4 is an enlarged cross sectional view illustrating a modification of the invention.

In carrying out the method of the invention, we provide a paper element 1 which may, for example, comprise a tough kraft paper containing a binder such as polyvinyl alcohol intimately incorporated throughout the fibers thereof. The polyvinyl alcohol is of a water-receptive character and tends to prevent the fibers of the paper from being pulled apart.

In place of the kraft paper noted, other papers such as parchment and fiberboard may be utilized. It may be further desired to use rosin as a sizing agent, and especially in amounts appreciably greater than those amounts of rosin commonly employed in conventional paper-making, and the rosin size may be utilized in conjunction with polyvinyl alcohol. Also gelatin, as well as other colloids, may be used in place of the polyvinyl alcohol.

The paper 1 is provided with waterproofing or water-repellent layers 2 (Fig. 2), which lightly impregnate and substantially waterproof the paper 1, to an extent such that it will resist

stretching and shrinking when used as a lithographic printing member and exposed to water.

The water-repellent layers are preferably obtained from aqueous mixtures of resin materials of the type which, upon being coated on a suitable surface, at first is wettable by water and then later sets to a water-insoluble and water-repellent state. Examples of suspensions or solutions of resin material of this general character are water dispersions of urea formaldehyde resin containing free formaldehyde, sometimes referred to as urea formaldehyde resin glues, as "Plaskon," "Casco," and the like.

It is well known that an impregnation of paper by water-proofing or water-repellent resin materials tends to displace moisture in paper and to develop brittleness. The step of incorporating sizing in the paper, as above noted, prevents excess impregnation of the paper by the urea formaldehyde resin layers 2, reduces displacement of moisture from the paper, and maintains a portion of the paper in which moisture may be received and held. It has also been found that application of the resin while either in solution or in suspension in water provides for a small amount of this water being absorbed in the paper. This tends further to insure maintenance of small amounts of moisture in the paper at this point in the process.

The resin "Plaskon" is a water-dispersed urea formaldehyde resin glue containing a hardening agent and other ingredients which combine to provide a product having a pronounced slow-drying character so that a coating obtained therefrom will not set into a thoroughly water-insoluble state until a period of several hours or longer has elapsed. During this drying period the coating has affinity for aqueous mixtures. If covered over by an aqueous mixture, the resin coating will as it dries adhere to the aqueous mixture and become relatively firmly bonded thereto. In a later fully dried state, the coating refuses to adhere properly to an aqueous mixture and a satisfactory bond cannot be achieved.

However, a coating of the resin "Plaskon" does, in a relatively short time, become partially dried to a point at which it is no longer tacky. Such preliminary drying is especially useful in connection with coating a web of paper and allows the web of paper to be wound upon itself shortly after it has been coated without sticking. This is advantageous for carrying out subsequent coating operations. The preliminary drying of the resin layers may be facilitated by the use of heat, and the resin coated paper may, for example, be

passed through a drying chamber. Other drying means may also be resorted to.

The water-repellent material 2, when in a partially dried state as noted, is subjected to a calendering operation, which makes use of heat and pressure in the manner generally referred to in papermaking as "calender stacking." This procedure is carried out by passing the paper between smooth steel rolls under high pressure at a time when the water-repellent material has become partially dried and will not stick to the rolls.

It is pointed out that upon applying to the paper element 1 an aqueous mixture of resin material 2, certain changes take place. Moisture in the aqueous resin mixture may tend to strike into the paper and cause it to swell a slight amount. Also, tiny particles of undissolved urea formaldehyde resin may be present. Either the swelling noted or the presence of particles may present high and low points in the coated surface of the water-repellent material. These high and low points are objectionable in connection with lithographic printing since they may cause scumming.

The calendering operation just above noted is especially directed to flattening out any such projections or high points in the surface of the coated resin material on the paper, which reduces any possibility of scumming occurring in this way. Still other advantages are obtained by the calender stacking operation. The urea formaldehyde material is forced partway into the paper and becomes more firmly bonded to the paper fibers. Also, when thus intimately incorporated with paper fibers, the urea formaldehyde resin coating is less brittle since the paper tends to function, to a limited extent, as a reinforcing agent.

The paper element 1, carrying the water-repellent resin layers 2, in a partially dried and calendered state, is thereafter covered at one side with a coating 3 obtained from an aqueous suspension of a printing material, as for example polyvinyl alcohol. The polyvinyl alcohol may also include a filler such as a clay or other finely divided material.

The coating 3 and the layers 2 are then allowed to dry together in some suitable manner, as for example by hanging the paper in festoons in a drying chamber in the presence of heat and moisture. During this period, the coating 3 becomes intimately incorporated with and firmly bonded to the urea formaldehyde resin layer on which it is disposed.

The coating 3 may comprise other vinyl compounds, and various other aqueous suspensions of colloidal materials such as gelatin, glue, gum arabic, albumin, and other resin suspensions which are suitable for forming a lithographic water-receptive surface.

It should be understood that the vinyl printing coating 3, after it has dried or become bonded to a resin layer 2, has a moisture-receptive character and is well adapted to function as the water-receptive non-printing portions of a lithographic printing plate, as has been more fully described and claimed in our Patent No. 2,230,981, issued to us February 4, 1941.

During the above recited steps of drying the resin-coated paper, calendering the paper, coating the paper with alcohol, and then again drying, a certain amount of moisture is lost from the paper, and this tends to result in an appreciable brittleness developing in the paper.

In accordance with the invention, we replace small amounts of moisture in the paper while it is covered with the water-repellent resin layers 2, thereby to return to the paper its normal flexibility and generally to improve its character for use as a printing element.

It has been found that while coatings obtained from urea formaldehyde resins will effectively repel water and prevent any amount of water from getting into the paper, such as would cause stretching or shrinking of the paper, they are nevertheless permeable by relatively small amounts of moisture which are of significance in papermaking.

The invention makes use of this permeable character of a urea formaldehyde resin and includes the steps of passing small amounts of moisture through the resin layers 2, into the paper or into those portions of the paper which will accept moisture, as has been provided for by the sizing agents above described. In a paper which includes the water-receptive sizing polyvinyl alcohol, specified as one desirable sizing agent of the invention, moisture becomes stored up directly in the sizing as well as in areas of paper fibers which are protected by the sizing. The moisture thus replaced is effective in substantially reducing brittleness and generally improving the character of the paper.

An important aspect of the invention is the method of applying an aqueous suspension or dispersion of a colloid printing material over a waterproof coating or surface while the waterproof coating is in a partially dry state, and before it has become water-insoluble. The waterproof coating, while in this intermediate stage, develops no repellent character for the colloidal printing material and permits the printing material to become intimately incorporated with it. Thereafter allowing the resin glue or other waterproofing material to set while in contact with the printing material results in a relatively strong bond between the two, strong enough to withstand the pull exerted by a lithographic printing press.

Also of importance is the method of utilizing a waterproofing agent which in addition to having the character noted sets relatively slowly, and even, after having passed through a tacky state to a point where it may be readily wound upon itself from a web without sticking, will continue to accept an aqueous suspension of a colloid and allow the bonding action to take place. Similarly the calender stacking operation greatly benefits the coated printing element.

The procedure of passing small amounts of moisture through permeable resin coatings constitutes an important feature of the invention and may be carried out in several ways. Preferably the paper is placed in a conditioning chamber in the presence of moist atmosphere during an extended period of time, as for example two or three weeks.

Passage of moisture may be accelerated by utilizing pressure exerted on moist atmosphere surrounding paper to be seasoned. Passing of moisture into the paper may also be accelerated by holding the paper in water, or by running water over the surface of the paper.

It is intended that the waterproofed and coated paper of the invention may be utilized for other purposes than that of serving as a lithographic printing plate. For example, the paper may be coated with a light-sensitive emulsion and utilized as a photographic negative or as

make-ready paper, or special wrapping paper, or for other purposes.

A modification of the invention consists in making a sheet material 4 of a urea formaldehyde resin such as "Plaskon," and then applying a coating 3 of vinyl compound in the manner already described in connection with applying the coating 3 on layers of "Plaskon" impregnated in paper.

It will be seen that we have set forth a method of applying coating materials to paper by which small amounts of moisture are provided for in the finally coated product, to insure substantial flexibility. In addition, we have combined a printing coating with an impregnated paper which will not stretch or shrink when exposed to water, and which is sufficiently flexible to be clamped to a lithographic printing press. Methods for bringing together two dissimilar types of coatings so that they may become strongly bonded together have been set forth, and generally a simple, cheap and efficient method of making a paper sheet material has been indicated.

While we have shown a preferred method of the invention, it should be understood that various changes and modifications may be resorted to, in keeping with the spirit of the invention as defined by the appended claims.

We claim:

1. Process of making a sheet material which comprises applying, to a supporting web, a water-dispersed resin which sets to a water-wettable partially dried state and hardens to a water-repellent fully dried state, then applying over the resin, while in a water-wettable partially dried state, an aqueous suspension of a colloid and then drying the resin glue to a water-repellent state while the colloid is in contact therewith.

2. Process of making a sheet material which comprises applying, to a supporting web, a urea formaldehyde resin glue of the type which sets into a water-wettable state while in a partially dried condition and which subsequently hardens into a water-repellent state when in a fully dried condition, then applying on the urea formaldehyde, while in a water-wettable state, an aqueous suspension of polyvinyl alcohol, and then allowing the urea formaldehyde and polyvinyl alcohol to dry together.

3. Process of making a paper planographic printing plate base which comprises applying at either side of a web of paper coatings of a water-dispersed urea formaldehyde condensation product which first sets into a water-wettable non-tacky partially dried state and hardens to a water-repellent fully dried state, applying an aqueous mixture which includes polyvinyl alcohol to at least one of the coatings at a point at which the said coating is in a partially dried state, and allowing the urea formaldehyde condensation product to harden into a fully dried state while the polyvinyl alcohol is in contact therewith.

4. The process of making a paper planographic printing plate base which comprises applying, at either side of a web of paper, a water-dispersed urea formaldehyde resin, said urea formaldehyde resin including a hardening agent and being further characterized by the property of setting into an intermediate water-wettable non-tacky partially dried state and a final water-repellent fully dried state, allowing the urea formaldehyde resin to set into a non-tacky partially dried state,

winding the web of paper, while in a water-wettable non-tacky state, into a roll, then unwinding the paper and applying a suspension of polyvinyl alcohol to one of the coatings while the coating continues to remain in a water-wettable state, and drying the urea formaldehyde resin to a water-repellent state while the polyvinyl alcohol is in contact therewith.

5. Process of making a paper planographic printing plate base which comprises applying at either side of a web of paper coatings of a water-dispersed urea formaldehyde condensation product of the type which sets to a water-wettable non-tacky, partially dried state and hardens to a water-repellent fully dried state, allowing the urea formaldehyde coatings to set into a non-tacky partially dried state, winding the web of paper upon itself into a roll while in a partially dried non-tacky state, passing the web of paper while in a partially dried condition between calender rolls, applying an aqueous mixture which includes polyvinyl alcohol to at least one of the coatings while the coating continues to remain in a partially dried water-wettable state, and allowing the urea formaldehyde coatings to harden into a fully dried state while the polyvinyl alcohol is in contact therewith.

6. The process of making a sheet material which comprises providing a support which includes a resin, said resin containing a hardening agent capable of converting the resin into a water-repellent state, then applying over said resin, before it is completely dry, a suspension of a colloid, then converting said resin to a water-repellent state while said colloid is in contact therewith.

7. The process of making a water-resistant paper element which comprises coating paper with a water-dispersed urea formaldehyde resin glue containing an agent adapted to harden the glue slowly to a water-insoluble state, applying a water-receptive coating of polyvinyl alcohol to the paper while the urea formaldehyde glue is in a partially dry state, and then drying the polyvinyl alcohol coating and the glue coating simultaneously to allow the two to set in strongly bonded relation with respect to one another.

8. The process of making a water-repellent paper printing element which comprises coating paper with an aqueous dispersion of a urea formaldehyde resin glue, applying to the coated paper an aqueous suspension of a water-receptive polyvinyl alcohol, and then drying to bond the polyvinyl alcohol to the urea formaldehyde resin glue.

9. Process of making a sheet material which comprises applying at either side of a supporting web a resin, said resin including a hardening agent and being further characterized by the property of setting into an intermediate water-wettable, non-tacky, partially dried state, and of hardening into a water-repellent fully dried state, allowing the resin to set into a non-tacky partially dried state, winding the web into a roll while the resin coating applied to the web is in a water-wettable non-tacky state, then unwinding the web and applying a coating of a water-wettable colloid to one of the resin coatings while the latter continues to remain in a water-wettable state, and drying the resin coatings to a water-repellent state while the water-wettable colloid is in contact therewith.

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