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MANUFACTURE OF DECORATIVE LAMINAE

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FIG-1

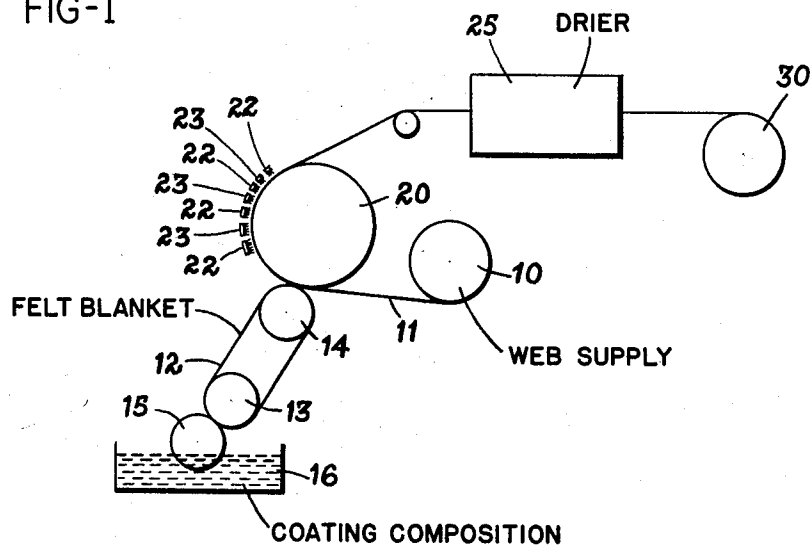


FIG-2

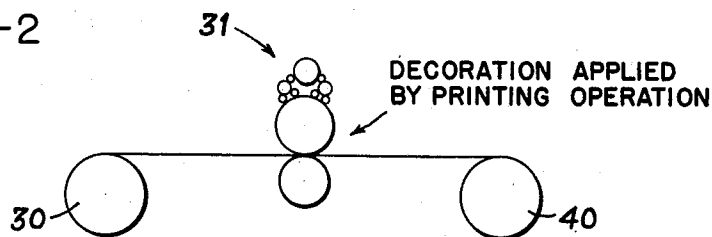
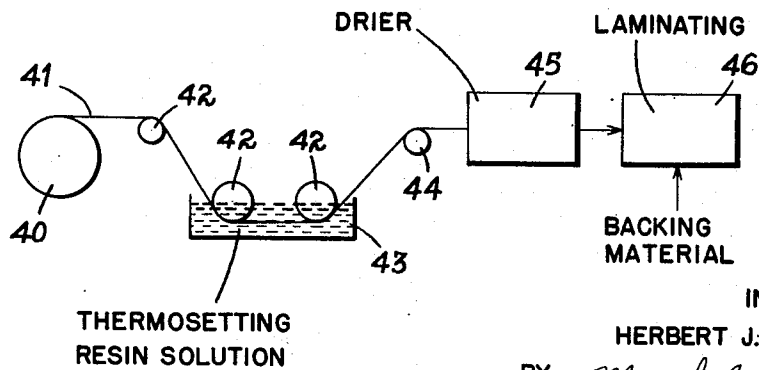


FIG-3



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MANUFACTURE OF DECORATIVE LAMINAE

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6 Claims. (Cl. 117-15)

1

This invention relates to improvements in the manufacture of decorative laminae of the type in which a face sheet of paper bearing a desired self coloring or an ornamental design, such as for instance a wood grain pattern or any pattern that can be etched preferably by intaglio, is secured to a backing consisting either of further paper sheets, of wood or plywood or of materials such as plasterboard, fibreboard, asbestos sheet or the like rigid sheeting material.

Hitherto the production of tinted or colored paper for use as surface or print sheets in such decorative laminae has presented certain difficulties. In the first place, it is not convenient for a paper manufacturer to make less than two tons of a particular shade of paper, whereas, by way of example, only ten hundredweights of any particular shade may be required. The inclusion of a colored pigment, coloring matter, or light reflecting material in the paper pulp necessitates stopping the machine at the conclusion of the operation, thoroughly washing out the machine in order to get rid of the colored fibres and running the machine for some little time after it has been restarted until the correct thickness of paper has been restored. In the second place, the addition of such coloring matter to paper pulp has presented great difficulty with regard to matching the tint. As a means of overcoming this difficulty it has been proposed to tint a white paper base but this has proved a failure as it has not been possible to keep the same shade in different runs.

An object of the present invention is to provide a process of making colored paper adapted for use in the production of decorative laminae in which any selected shade can be produced without thought as to quantity. A further object is to provide a colored paper in which the shade is uniform throughout the surface of the paper and can be matched in later runs.

According to the present invention a process of making a paper for use as a surface or print sheet in the production of decorative laminae comprises applying a layer of white or colored pigmented filler or light reflecting material to a web of paper, smoothing the coated surface such as by brushing to ensure uniform distribution of filler and then impregnating the web of paper with a thermosetting resin.

Other objects and advantages of the invention will be apparent from the following description, the accompanying drawings, and the appended claims.

2

In the drawings—

Fig. 1 is a diagrammatic view showing apparatus suitable for practicing the coating operation in accordance with the invention;

Fig. 2 is a diagrammatic view showing apparatus suitable for practicing the decorating operation in accordance with the invention; and

Fig. 3 is a diagrammatic view showing apparatus suitable for practicing the impregnating operation in accordance with the invention.

The present invention is a continuation-in-part of application Serial No. 94,972, filed May 24, 1949, now abandoned.

Referring to the drawings which illustrate diagrammatically the operations followed in carrying out the invention, Fig. 1 indicates the coating operation which is performed in connection with the coating of the web of paper. The supply of paper is indicated at 10 and may be in the form of a roll such as received from the paper mill, and of suitable characteristics as to weight, size, surface, and other characteristics such as relatively good wet strength and absorptive capacity. The paper web may be either filled or may be substantially free of filler, the filler if such is used being preferably white or neutral in color so that it will not require special treatment in the subsequent coating operation in order to compensate for such initial color.

The paper is unwound from the roll and travels as a web 11 to an application zone which may be formed by means of an endless felt 12 passing over guide rolls 13, 14, with a transfer roll 15 running in a bath 16 of the desired coating composition. Roll 14 guides the felt into contact with the web 11 while the latter passes around a large cylinder or drum 20, suitable driving being provided for the several rolls in the customary manner. Coating material from the bath 16 is picked up on transfer roll 15, transferred to the traveling felt 12, and from it applied to the surface of the web 11, the web then continuing around the drum 20 to a zone where the newly applied coating is smoothed and distributed, in order to obtain uniform distribution thereof. This smoothing operation may be conveniently performed by means of a series of brushes of which one group 22 may be stationary with another group 23 of reciprocating brushes alternating therewith. Satisfactory results have been secured with the first brush made of bristle and the others of badger hair, the successive brushes diminishing in width progressively, with the final brush being quite narrow and very soft to avoid rust which would discolor the delicate pastel

tints. The mounts for the brushes should preferably be made of aluminum or other non-rusting material, and the hairs or bristles are preferably attached or sewn thereto by means of a stainless wire. Preferably drum 20 should be made of or covered with some non-rusting material, also for the purpose of avoiding rust and discoloration. It will be evident that if desired more than one such coating may be applied to the web and smoothed and distributed thereon, after which the web passes into a dryer indicated at 25 where it is converted into a normally dried web.

The coating composition which is applied in the bath 16 is selected to have the desired color characteristics for the particular type of decorative laminae to be produced. The composition consists essentially of a filler or pigment of the desired color to impart either the whiteness or the particular shade or tint required in the finished sheet, together with adhesives and such other materials as may be desirable in obtaining the proper flowability of the composition and the proper retention thereof upon the coated sheet. The application of the pigmented filler as a coating with the resulting concentration thereof primarily on the surface is advantageous in contrast with having the filler distributed internally of the sheet as would be the case if incorporated in the manufacture of the paper web. Examples of fillers which may be utilized essentially for producing a white surface are blanc fixe, baryta clay, carbonate filler, and titanium oxide. Examples of coloring pigments are chrome yellow, chrome green, cadmium yellow, ochras and umbras, cobalt, and other metallic oxides, such materials being selected and incorporated in the proper quantities and in suitable admixture with the white fillers to produce the desired shade or color. Dyes may also be employed to impart or affect the color provided they are not incompatible with the resins subsequently applied.

In addition to, or replacing the pigmented materials in whole or in part, the invention also provides for incorporating light reflecting particles in the coating, including metallic powders such as bronze or aluminum, scale materials such as fish scale and H scale (a form of pearl essence), micas, and the like. Such light reflecting materials may be supplied to the coating composition and applied in the manner described to develop desired surface characteristics in the final product.

The term "coloring material" is used herein in the sense of applying to all such fillers, pigments, dyes and light reflecting particles, etc.

It will be evident that different coating compositions may be prepared in as small quantities as desired, and with considerable accuracy and precision so that the change from one colored pigment to another, and the matching of different runs of the same colored pigment, may be accomplished quite readily and accurately. It is only necessary to change the relatively small quantity of coating composition which remains in the bath 16 and on the transfer rolls and felt, the washing out of one color and the replacement thereof by another being performed easily and quickly. Thus, any desired number of different colored runs of the coated paper may be produced, and in as large or small amounts as desired, from the same stock supply of paper and great flexibility as well as uniformity of colored surface is thus obtained.

Following its drying in oven 25 the coated

sheet of paper is rewound and the rewound roll 30 is then in condition to receive decoration. This is accomplished by performing a printing operation, the web with the colored surface still being soft, flexible and highly receptive to printing. It is passed into a suitable printing press indicated at 31 which may be a rotogravure type of roll or other desired printing mechanism. The printing is performed in a continuous manner upon the traveling web prior to impregnation thereof with resin, to apply a pattern of any suitable design to decorate the colored web as desired. Such decoration leaves the web still absorptive and adapted to be impregnated by the thermosetting resin solution. If desired the decorated web may be wound on the roll 40 or may be impregnated directly with the thermosetting resin material after which the web loses its soft, pliable and receptive character. The web 41 is passed over suitable guide rolls 42 to an immersing bath which contains the thermosetting resin solution. The web travels through the bath and is maintained therein for a sufficient length of time to accomplish substantially complete impregnation with the resin solution. The impregnating material contained in bath 43 is a solution of a thermosetting resin, suitable examples of which are phenol formaldehyde, urea formaldehyde, and the melamine resins. Such resins are usually obtainable in dry powdered form and are converted into solution by dissolving the same in a solvent such as alcohol and water in suitable proportions. A solution of such resinous material for application in accordance with the present invention may contain a solids content of approximately 45-5%.

The selection of the particular resin depends to some extent upon the color desired, the use of phenol formaldehyde resin which has a light brown color being unsatisfactory where the finished surface is to be a light pastel shade, such resin however being quite suitable for use in producing a laminated sheet such as a walnut reproduction. When white or pastel shades or bright colors are desired it is found more desirable to use the urea formaldehyde and the melamine resins. It is also found that it is not necessary that the paper as originally produced have a filler incorporated therein during its manufacture as would normally be considered necessary in order to overcome the tendency for the unfilled sheet to be rendered translucent owing to the impregnation with urea formaldehyde and melamine type resins. Such translucent condition does not ordinarily occur with respect to a sheet which is impregnated with the phenol formaldehyde resin, but even with the other resins, the necessary opacity to overcome translucency may be satisfactorily provided by the incorporation of the filler in the coating operation above described.

Following impregnation the web is removed and travels over guide rolls 44 to a drying oven 45 in which it is suitably dried to a moisture content of approximately 5%, and at a temperature below that which will produce reaction in the thermosetting resin, a suitable temperature being of the order of 60° C. Suitable lengths thereof may be assembled with backing material comprising one or more sheets of paper, wood, or plywood, or material such as plaster-board, fibreboard, asbestos sheet or entirely rigid sheet material, the backing sheets themselves being impregnated with a thermosetting resin. Such resin however need not be the same as that

5

used in the preparation of the decorative surface sheet as described above. The surface sheet is bonded to one or more of the backing sheets by the application of heat and pressure in a laminating operation indicated diagrammatically at 46. For example the assembled sheets may be pressed between platens in a hydraulic press at a pressure of the order of 800-1000 lbs. per square inch and at a temperature of 120° C. for 15 minutes, thereafter being allowed to cool while the pressure is maintained. In order to achieve a polished surface it is desirable to use mirror-polished stainless sheets as cauls, the surface finish being a reproduction of the finish on the cauls. An insoluble, infusible sheet having the properly colored and decorated surface is thus produced.

In addition to the high-pressure laminating process described above, the resin-impregnated web may also be used in conjunction with the low-pressure laminating process employing suitable pressure rollers in place of the press used for the high-pressure process. In the case of the low-pressure system, the resin varnished web need not be cut into suitable lengths as is the rule when the plain colored or decorated sheets are laminated in a press, but the web may be used in the form of a continuous process by bonding the web to suitable backing materials by feeding through pressure rollers. Using the low-pressure system, the paper web can be bonded to such soft base materials as Gypsum board, etc.

Three examples of typical coating compositions follow:

Example 1

6½ kilos of blanc fixe (barium sulphate) containing 25-30% water, i. e. in the paste form as normally supplied to manufacturers of photographic paper, is placed in a mixing vessel and 1 gallon of water added thereto. When the paste is dissolved the necessary dye is added. The dyes are the same as used for tinting the raw paper base and must be fast to urea. The dye is dissolved in approximately 50 c. c. of alcohol before being added very slowly to the blanc fixe solution. Approximately 70 c. c. of pure glycerine well mixed in an equal quantity of alcohol is then added to the blanc fixe solution whilst the latter is being well stirred. The solution is stirred for about 15 minutes. It is found convenient to add both the solution of the dye and the glycerine to the blanc fixe solution through a glass funnel at the end of which is a glass jet attached to the funnel by a piece of rubber tubing. The jet is made by heating a glass tube in a Bunsen flame and then drawing out the tube to provide a narrow throat from which the tube can be severed after making a file cut.

Melted gelatine, prepared by soaking 650 grams of gelatine in 8 gallons of cold water for between 24-36 hours after which time the water is drained off and the gelatine dissolved in an earthenware vessel which is placed in boiling water, is then added to the blanc fixe solution containing both dye and glycerine and the whole then placed in the hot water bath and stirred well for another 15 minutes. The gelatine must be skin gelatine or best quality skin glue. To the said solution is then added 120 c. c. of a 1 in 15 solution of pure chrome alum. The chrome alum is used as a hardening agent for the gelatine. As with the solution of the dye and glycerine, the chrome alum solution must also be added slowly to the blanc fixe with continuous stirring. The glass

6

jet and funnel is utilised for this purpose. When the chrome alum has been thoroughly mixed with the blanc fixe the resultant solution is set aside in a cool room over night.

The next day the composition is placed in a hot water bath and re-melted and thereafter a further 100 grams of gelatine, dissolved in 1000 c. c. of water, is added thereto together with a further 100 c. c. of the chrome alum solution through the aforesaid jet.

To the resultant coating composition and for every 5 gallons thereof, 40 c. c. of milk are next added. The milk is used as an anti-froth and spreading agent and it should have been allowed to stand for some hours and then skimmed carefully before being used.

After thorough mixing, the coating solution is filtered through a very fine gauze sieve, so fine that the composition will only pass through the sieve by working it through with a good size paint brush.

Whilst the weight of coating must vary to some extent with the precise nature of the paper to which it is applied and with the purpose for which the paper is to be used, generally speaking the application of a coating of 12 grams per square metre is likely to prove satisfactory.

During the manufacture of the said coating composition a temperature of approximately 45° C. should be maintained.

During the actual machine coating a temperature of approximately 40° C. should be maintained if possible.

Example 2

25 lbs. of aluminium paste are dispersed in 50 gallons of solvent. 24 gallons of this mixture are then added to 11 gallons of pigmented filler to produce a coating composition which is ready for brush coating on to a web of paper.

Example 3

78 lbs. of H scale (Pearl essence) are added to 140 gallons of thinner. 14 gallons of this mixture are then mixed with 1 gallon of pigmented filler and then the whole well mixed and then brush coated on to a web of paper.

The success of the process of the invention hereinbefore described is thought to reside in the fact that an aqueous non-film-forming coating composition of a relatively special nature is applied to the web of paper by specific mechanical means. When the said mechanical means and the requisite coating composition and the procedure for applying the coating composition to the web of paper are operated in unison, then there is provided a technique for producing certain end effects which have never been achieved before. The principal objectives obtained may be summarised as follows:

1. Treatment of the paper by a mechanical means plus a special coating composition applied in a specific way facilitates the production of decorative high pressure laminates.

2. The high pressure paper treated in accordance with the invention permits the proper saturation of the laminating materials, the efficiency of such saturation not being materially reduced by the treatment.

3. The invention provides means of introducing colours and other materials which permit the reflection, diffraction and refraction of light in the basic colours. Such effects cannot be combined in the paper beater in which pulp for the high pressure laminates was originally made.

4. The combination of mechanical means and novel coating compositions has the added advantage that the flexibility of the paper is not impaired, thus permitting the decoration to be done in continuous rolls and re-rolled. When the paper is being re-rolled it is not only flexible but there is no material that will cause the fibres of the paper to stick together and mar the surface to which decoration has ultimately to be applied.

The essential ingredients displayed by a coating composition as detailed in Example 1 above may be enumerated as follows:

1. An adhesive binder material which will not interfere with penetration but will still allow the design to be printed—an example being hide glue.

2. A colour material of which there is a wide selection including dyes and pigments.

3. One or more solvents of which there are any number—examples being water and alcohol.

4. An anti-foaming agent—an example of which is skimmed milk.

5. A preservative of which there is a wide selection—an example being phenol.

In a coating composition of this type an anti-foaming agent is essential in order to ensure that the coating composition will work properly with the mechanical means described.

Generally speaking the components of the coating composition must in all cases be of such a nature that they will not greatly reduce the absorption quality of the paper, or leave a surface of such a nature that is unsuitable after receiving a decoration. It is a fact that the nature of high pressure laminating papers necessarily makes them of a fairly coarse grain and of high absorption. The difficulty of attempting to print any type of uniform decoration upon a paper having a high degree of absorption is manifest, particularly if it is desired to apply multi-coloured designs. On the other hand high pressure laminating papers treated in accordance with the present invention may be printed satisfactorily.

Decorative laminae produced in accordance with the invention have a widespread application in industry. For example, they are particularly suitable for use in hospital wards, ship-building, cinemas, interiors of buildings, furniture, etc. on account of the ease of cleaning and hygienic properties.

While the process herein described constitutes preferred embodiments of the invention, it is to be understood that the invention is not limited to this precise process, and that changes may be made therein without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. The process of making a paper adapted for use as a surface print sheet in the production of decorative laminae and of obtaining predetermined color characteristics therein from a supply web consisting of a highly absorbent sheet of soft, saturable paper of uniform color characteristics which comprises the steps of applying to one side only of said web an aqueous non-film-forming coating composition containing an adhesive and a coloring material adapted to penetrate and remain primarily in the surface zone of said web, smoothing and spreading said applied coating composition while still workable uniformly over said surface of said sheet with a brushing action resulting in the production of

a substantially uniformly coated surface of the desired color upon said one side of said web leaving said coated web soft and flexible and receptive to printing, and applying a decorative surface to the coated side of said web by a printing operation and retaining high receptivity of said web for subsequent impregnation and saturation by a thermo-setting resin suitable for laminating said sheet to backing sheets to form a decorative surface thereon.

2. The process of making a decorative laminated product incorporating a surface print sheet of paper and of obtaining predetermined color characteristics in said sheet from a supply web consisting of a highly absorbent sheet of soft, saturable paper of uniform and neutral color characteristics which comprises the steps of applying to one side only of said web an aqueous non-film-forming coating composition containing an adhesive and a coloring material and forming a uniform coated surface of the desired color on said one side of said web by a brushing action leaving the opposite side substantially untreated and the treated surface of said web still absorbent and suitable to receive printing, drying said coated web to form a web which is soft and flexible and suitable for receiving surface decoration, applying a surface decoration to said coated web surface by a printing operation, said web retaining high receptivity for subsequent resin impregnation, and thereafter impregnating and saturating said coated web with an unpigmented thermosetting resin capable of effecting lamination of said surface sheet with backing sheets to form a decorative surface thereon.

3. The process of making a decorative laminated product incorporating a surface print sheet for overlying a backing which contains a thermo-setting resin comprising the steps of applying to one side only of a supply web of soft, saturable paper of uniform substantially neutral characteristics as to color and highly absorptive properties for resin solution an aqueous non-film-forming coating composition containing an adhesive and coloring material of predetermined selected color imparting properties in the form of a relatively thick suspension with resulting concentration of said coloring material primarily on the surface of the sheet leaving the opposite side of said sheet substantially untreated, brushing said coated surface of said sheet to smooth and distribute said applied coating uniformly over the surface of said sheet, drying said coated web leaving said coated web surface soft and flexible and receptive to printing, decorating said coated web surface by a printing operation leaving said web still receptive to resin impregnation, and thereafter treating said web with a thermosetting resin composition to substantially completely impregnate and saturate said web for subsequent lamination with said resin containing backing.

4. The process of making a decorative laminated product incorporating a surface print sheet for overlying a backing which contains a thermosetting resin comprising the steps of applying to a supply web of soft, saturable paper of uniform substantially neutral characteristics as to color and highly absorptive properties for resin solution an aqueous non-film-forming coating composition containing an adhesive and coloring pigment of predetermined selected color imparting properties in the form of a relatively thick suspension with resulting concentration of said pigmented coating material primarily on the surface of the sheet, brushing said coated surface of said

sheet to smooth and distribute said applied coating pigment uniformly over the surface of said sheet, drying said coated web providing a smooth surfaced soft, flexible and relatively yieldable sheet, decorating said coated surface of said web with a pattern leaving said web still adequately receptive to subsequent impregnation by a solution of thermosetting resin for effecting lamination with said backing, and thereafter impregnating and saturating said web with a laminating resin adapted to be thermally set.

5. A process as defined in claim 1 in which said supply web of paper as produced is substantially free of filler, and an opacity-imparting filler is incorporated in said coating composition and present upon the coated surface of said sheet to overcome the tendency of the impregnated sheet to become translucent.

6. The process as defined in claim 4 in which the brushing is effected through an alternating hard and soft brushing action.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,508,720	Perry -----	Sept. 16, 1924
1,825,877	Loetscher -----	Oct. 6, 1931
1,997,358	Cochrane -----	Apr. 9, 1935
2,069,648	Denner -----	Feb. 2, 1937
2,084,081	Faber -----	June 15, 1937
2,292,118	Guhl -----	Aug. 4, 1942