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PROCESS FOR PREPARING AN EMBOSSED LAMINATE

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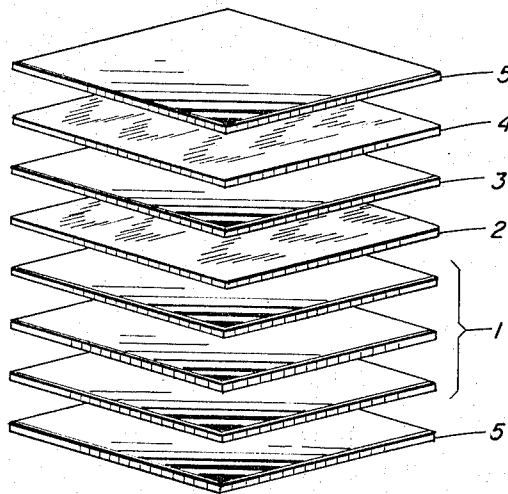


FIG-1

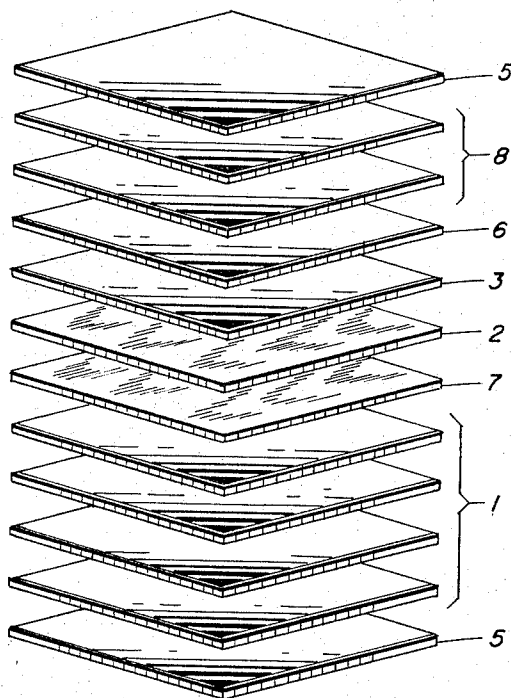


FIG-2

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PROCESS FOR PREPARING AN EMBOSSED LAMINATE

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Continuation-in-part of application Ser. No. 423,945, Jan. 7, 1965. This application Nov. 16, 1966, Ser. No. 604,507

13 Claims. (Cl. 156—219)

This application is a continuation-in-part of our earlier application having the Ser. No. 423,945, filed Jan. 7, 1965.

This invention relates to a process for producing decorative laminates which have surfaces on which an embossed design is positioned. Still further, this invention relates to a process for producing an embossed decorative laminate in which a decorative sheet is used as the medium through which the overall appearance of the laminate is developed coupled with a utilization of a raised printed design sheet. Still further, this invention relates to a process for producing an embossed decorative laminate in which a printed design sheet is used in association with a raised printed design which is compatible with that contained on the printed design sheet and, as a preferred embodiment, the use of a raised printed design which is substantially in register with the design on the print sheet. Still further, this invention relates to embossed decorative laminates in which embedments of a plurality of small hard particulates are contained in the raised printed design.

One of the objects of the present invention is to produce a decorative laminate having a decorative surface on which there is imposed intricately embossed designed surfaces. A further object of the present invention is to produce an embossed design decorative laminate in which the design on the print sheet is modified so as to impart a truly embossed surface which is not only apparent to the eye but is observable to the touch. These and other objects of the present invention will be discussed in greater detail hereinbelow.

The decorative laminate art has been developed over a substantial plurality of years and these laminates may be produced with a glossy or a satin finish. In each of these two categories the surface generally has no embossing but instead the surfaces are substantially smooth and uniplanar. The vogue in the decorative laminate industry varies from time to time and in varying geographic locations. This is particularly true in the area of printed designs where a print sheet such as one having the appearance of a wood grain is printed from a photograph of an actual piece of wood and the reproduced print looks exactly as the actual wood had looked. However, when a non-textured appearance is imparted to such a print sheet in a laminate, one frequently gets the impression that it is a laminate and it is not real wood. These laminates are exceedingly durable and in fact require significantly less maintenance from the standpoint of cleaning than do the real wooden articles. However, for those who want a piece of furniture or a wall panel with a truly wooden appearing surface, namely, one that has all of the characteristics of a truly wooden surface, a certain measure of texturing needs to be accomplished in order to achieve this end. This objective can be achieved by the process of the present invention.

In the general manufacture of decorative laminates, it is conventional to prepare an assembly of a plurality of core sheets. This is to be found illustrated in the U.S. Patent No. 3,050,434 which is incorporated herein by reference. The core sheets are conventionally prepared by impregnating a web of kraft paper with a phenolic resin. After drying, but while still in a thermosetting condition,

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the resin impregnated web is cut to the desired size and superimposed in stacked relationship in an assembly. The number of sheets utilized may be varied significantly depending on the choice of thickness of the ultimate laminate to be produced. Ordinarily, these core sheets will number between about 3 and 9. Immediately above the core sheet assembly there is positioned a decorative sheet having a solid color or having thereon a suitable design which when practicing the present invention will need to be compatible with the embossing design which will be discussed hereinbelow. When the concept of compatibility is considered, one must think in terms of the print sheet having been prepared from the same roller that the embossed design is prepared or from a different roller which does not conflict with the design of the print sheet except that in the embossed design sheet, the design is raised so that certain areas of the print are significant in thickness and heavy whereas certain of the areas of the design are nonexistent on the embossing sheet. Still further, as a preferred embodiment, it is necessary, in completing the assembly, that the embossed design be positioned so as to be substantially in register with the design in the print sheet. In this preferred embodiment, some slight departures from exact register can be tolerated and in fact are even sometimes desired since the presence of such an off-register embossed sheet will scarcely be detectable by the human eye.

Superimposed above the decorative sheet and particularly when it is a print sheet one may optionally position an overlay sheet. The overlay sheet is a thin sheet of fine paper which has been impregnated with a noble thermosetting resin such as a melamine formaldehyde resin or other triazine resins, urea-formaldehyde resins, thiourea-formaldehyde resins, un-saturated polyester resins, and the like. In selecting the noble resin for the overlay sheet, it is generally preferred to utilize the same resin or substantially the same quality of resin which has been used to impregnate the print sheet. In preparing the print sheet, it should be observed that one may impregnate the unprinted paper first and after drying, print the design on the sheet. Alternatively, one could print the design on the unimpregnated print sheet paper followed by impregnation of the printed sheet.

Whether the overlay sheet is used or not, there is then positioned a release sheet. The release sheet may be any one of a plurality of commercially available materials such as non-adherable paper or non-adherable aluminum foil. The non-adherable papers such as parchment paper of which a plurality are available commercially, may be used. Also suitable, are papers coated, treated or impregnated with polyethylene, polypropylene or the polyfluorocarbons such as polytetrafluoroethylene. Silicone oil treated papers may also be used and are available commercially. Papers coated with sodium alginate are suitable for this purpose and are also available commercially. Papers treated with thermoset resins such as the aminoplast resins referred to hereinabove, which after treatment in a thermosetting state are substantially completely cured. These resin treated paper are satisfactory for this purpose and are known in the art. Still further, paper treated with fully cured thermoset silicone resins are also suitable. One of the preferred release sheets is a commercially available aluminum foil onto the back of which is mounted a thin sheet of paper. In using such a release sheet, the metal surface of the sheet would be placed face down on the print sheet or overlay sheet with the paper side away from the laminate assembly.

The positioning of the embossed design is not critical and may, in fact, be printed on the paper side of the release sheet. If desired, the embossed design may be printed on a different piece of paper which is superimposed above the release sheet. Still further, the embossed design

may be applied directly to the reverse side of the print sheet before or after the first printing of the design has been applied to the print sheet. In this latter approach, certain additional steps are required which will be discussed hereinbelow in the discussion of the drawings. A still further approach resides in the use of a separate sheet onto which has been printed the embossed design which separate sheet is then positioned below the print sheet with the embossed design either in contact with the print sheet or on the side of the separate sheet which is away from the print sheet.

The concept of the present invention is applicable to the production of decorative laminates in which the decorative sheet is simply a solid color such as a pastel and, more specifically, white, yellow, pink, green, blue, or the like. When the solid color decorative laminates are utilized, there is generally no need for the use of an overlay sheet, although one may still use such an overlay sheet advantageously. On the other hand, when the decorative sheet is a printed design sheet, it is generally desirable to make use of an overlay sheet in order to provide additional protection to the print so as to avoid any deterioration of the design as a result of attrition due to wear.

A further preferred embodiment of the present invention is to make use of small hard particulates which are forced to adhere to a printed design thereby producing a raised printed design substantially immediately after the printed design has been printed on the ultimate raised printed design sheet and before the printed design ink has had an opportunity to solidify and harden. These small hard particulates may be any one of a substantial plurality of available materials such as sand, ground glass, sugar, salt, finely divided thermoset resinous materials, and the like, among a host of other comparable granular particulates. In order to achieve the adherence of these small hard particulates in the printed design so as to produce a raised printed design, one may print the printed design on the selected sheet such as in one embodiment, the aluminum release paper, and after having accomplished the printing for instance in a silk screen printing process, the thus printed design sheet is passed through a zone containing the hard particulates, wherein the particulates contact the print and become automatically bonded to the unsolidified printed design followed by the drying of the printed design to a hard thermoset state thereby producing one form of a raised printed design. If desired, one may bond to the reverse side of the printed design sheet a layer of polyethylene coated paper in order to give more body and strength to the printed design sheet. This latter embodiment, namely, the bonding of the polyethylene coated paper to the printed design sheet is applicable when the printed design is on an aluminum release paper, but would not be utilized in that instance when the printed design is so positioned as to become permanently a part of the ultimately embossed laminate.

Reference is made to the drawing in which FIGURES 1 and 2 illustrate two alternative approaches for accomplishing the process of the present invention. In FIGURE 1, the sheets 1 are the core material, namely phenolic resin impregnated kraft paper. The printed sheet 2 carried a suitable design such as a wood grain which is or will be compatible with the embossing design. The overlay sheet 3 is a nobler thermosetting resin impregnated paper sheet which upon completion of the process becomes transparent so as to reveal the beauty of the design of the print sheet. The release sheet 4 has printed on its reverse side a design compatible with the design of the print sheet in which the embossed portion contains a heavy ink deposit and said deposit is printed on that side of the release medium which is further away from the laminate assembly. The polished stainless steel press plates 5 are used to hold the assembly in stacked relationship, while the heat and pressure from the press is applied for conventional periods of time until the total assembly is converted into a unitary structure. Thereupon the press is opened, the laminate cooled and the release sheet is peeled from the laminate

structure revealing a beautiful, intricately-embossed designed surface on the laminate.

In FIGURE 2, the core material 1, the printed decorative sheet 2, the overlay sheet 3 as well as the polished stainless steel press plates 5 are the same as in FIGURE 1. In FIGURE 2 the raised print sheet 7 is positioned below the printed decorative sheet 2 and has the raised embossed design on its upper surface so as to be available to contact the lower unprinted surface of the printed decorative sheet 2 and is arranged so that the two printed designs on sheets 2 and 7 are substantially in register with one another. The release sheet 6 is substantially the same as the release sheet 4 in FIGURE 1 except that it carries on its upper surface no embossed or raised printed design. The two or more sheets of kraft paper 8 are optional and are used as a cushion to avoid any diminution of the embossed characteristic during the heating and pressure consolidation step. As an alternative, not shown, one could print the raised embossed design on the under side of the decorative print sheet 2 in which the raised embossed design would be substantially in register with the printed design on the surface of the decorative print sheet 2.

The embossing composition when applied to the release sheet as in FIGURE 1 or applied to a separate paper sheet and superimposed above the release sheet as a modification of FIGURE 1 may be a comparatively high melt thermoplastic, thermosetting or thermoset resin composition. Certain printing inks have been found to be advantageous for this purpose such as those conventional inks used in silk screen printing. The preferred embossing composition should have a comparatively high solids content, i.e., from about 20% to 100% solids based on the total embossing ink composition with little or no tendency to flow under heat and pressure. The embossing composition can be applied to the carrier medium from a solvent solution or from a dispersion whereupon the solvent or dispersion medium can be flashed off by the application of heat to leave the solids of the embossing composition remaining on the carrier. If a thermosetting resinous material is used in solution as the embossing composition, conversion to the thermoset state can be accomplished while drying the solvent from the resin, thereby assuring that the deposited resin when converted to the thermoset state will have little or no tendency to flow under the heat and pressure subsequently applied during the laminating operation. The embossing composition may be applied to the appropriate carrier surface by such techniques as hand paintings, air brush techniques, spray and stencil as well as silk screen techniques previously mentioned. Gravure and thermographic printing techniques may also be used. When the technique of FIGURE 2 is practiced, a further alternative modification of this process can be practiced by positioning the embossing composition on a separate paper sheet 7 between the print sheet and the upper core sheet in which event the embossing composition carrier sheet becomes a part of the ultimate laminate and is not removed after the heat and pressure consolidation step has been accomplished.

In order that the concept of the present invention may be more fully understood, the following examples are set forth. These examples are provided primarily for the purpose of illustration and any specific enumeration of detail contained therein should not be interpreted as a limitation on the case except as is indicated by the appended claims.

Example 1

Following the outline illustrated in FIGURE 1, a stack of three phenolic resin impregnated kraft sheets are arranged in superimposed relationship on a polished steel plate. Above the upper kraft paper sheet there is positioned a print sheet impregnated with a conventional melamine formaldehyde resin. Thereabove is positioned a melamine formaldehyde resin impregnated overlay sheet. On top of the overlay sheet there is positioned a release sheet comprising an aluminum foil having bonded

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to its upper surface a sheet of thin tissue paper onto which has been printed, in a raised printed design, a match of the print on the print sheet and the release sheet carrying the raised printed design is positioned so as to have its design substantially in register with the design carried on the print sheet. Thereupon, a second polished steel plate is placed above the release sheet and the entire assembly is heat and pressure consolidated to a unitary structure. Upon cooling, the laminate assembly is removed from the press and the release sheet carrying the raised printed design is removed from the laminate assembly. It should be noted that the raised printed design on the paper side of the release sheet was on that side which was not in contact with the overlay sheet. Instead, the unprinted metallic surface of the release sheet was in contact with the overlay sheet.

Example 2

The general procedure of Example 1 is followed except that the general arrangement of plies as seen in FIGURE 2 was observed. More specifically, an assembly of four phenolic resin impregnated kraft sheets are arranged in stacked relationship on the upper of which sheets there is positioned a sheet carrying a raised printed design on its upper surface. Above the sheet carrying the raised printed design, there is positioned the print sheet carrying the conventional printed design. Above the conventional print sheet there is positioned the overlay sheet which is then covered with a release sheet. Above the release sheet there is positioned two layers of kraft paper not impregnated with any resinous material and designed to function as a paper cushion. The entire assembly is then positioned in said stacked relationship between a pair of polished stainless steel press plates and the entire assembly is heat and pressure consolidated to a unitary structure whereupon after cooling the laminate is removed from the press and the release sheet together with the kraft paper cushion sheets are removed from the assembly. It should be noted here that, unlike Example 1, the raised printed design imparting sheet becomes a part of the ultimate laminate whereas in Example 1 the raised design imparting release sheet was removed from the laminate and did not become a part thereof.

Example 3

Example 2 is repeated in substantially all details except that the print sheet with the conventional printed design carries on its undersurface a hand painted ink design using an epoxy resin ink, wherein the raised design on the underside of the print sheet is substantially in register with the non-raised design on the upper side of the print sheet. After the heat and pressure consolidation step, the release sheet and the kraft paper cushion sheets are removed. Again as in Example 2, the print sheet with the non-raised design on its upperside and the raised design on its underside becomes part of the ultimate laminate.

Example 4

Example 2 is repeated again in all essential details except that the ink composition used to impart the raised printed design to the underside of the print sheet is composed of twenty-two parts of a polydiallyl phthalate resin, forty-four parts of clay, thirty-three parts of methyl-ethyl ketone and one part of a conventional peroxide polymerization catalyst. The manipulative steps are the same as in Example 2. The polydiallyl phthalate resin is a commercially available material comprising a major amount of polydiallyl phthalate dissolved in a minor amount of diallyl phthalate monomer.

Example 5

Example 2 is repeated again in all essential details except that the print sheet carries, on its non-raised printed surface, a design from a conventional printing ink and on the underside thereof a raised design is printed substantially in register with the non-raised design on

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the upper side of the print sheet, which ink composition comprises a mixture of 20 parts of a commercially available melamine formaldehyde resin pigmented to choice, 10 parts of solvent for the melamine resin and 70 parts of clay. It should be noted that in each of Examples 4 and 5, that after the application of the raised printed design to the reverse side of the print sheet that the thus printed sheet is treated by the application of heat in order to flash off the solvent present and to advance the cure of the resinous component to a substantially thermoset state.

Example 6

Example 1 is repeated in substantially all details except that the release sheet carries on its upper surface (i.e., the surface further away from the overlay sheet) a raised ink design, which ink composition is substantially identical with that used in Example 5.

Example 7

Example 6 is repeated in all essential details except that above the release sheet there is positioned a separate paper sheet having a design applied to its upper surface by use of a conventional melamine resin silk screen ink using a silk screen printing technique. It should be noted that in Examples 6 and 7 that the raised design used in each of these examples is ultimately removed and does not become a part of the textured laminate.

Example 8

Example 7 is repeated in all essential details except that above the release sheet there is positioned a sheet of kraft paper carrying a raised design thereon applied by the method of gravure printing techniques using a hot vinyl resin at substantially 100% solids. Again as in Examples 6 and 7 the kraft paper carrying the raised design does not become a part of the ultimate textured laminate.

Example 9

Example 1 is repeated in all essential details except that the number of phenolic resin impregnated core sheets is nine, and the decorative sheet is a solid yellow color melamine resin impregnated α -cellulose sheet. The raised printed design printed in the form of a plurality of circles having varying diameters is printed on the release sheet comprising aluminum foil having bonded to its upper surface a sheet of thin tissue paper onto which the circular designs have been printed in a raised printed design. The raised print is on that side of the release sheet which is away from the yellow decorative sheet. The entire assembly is heat and pressure consolidated to a unitary structure in a conventional laminating manner.

Example 10

The general procedure of Example 1 is followed except that the printed decorative sheet is a simulated mosaic tile with the appearance of a binding agent printed between the individual irregular chips in the simulated mosaic tile to give the affect of a cemented structure. The release sheet has a printed design of the same exact configuration as the binder simulated on the non-raised print sheet, and the raised printed design is then produced by bonding thereto a substantial plurality of NaCl particles. The thus treated raised design carrying release sheet is then superimposed in register on the regular printed design sheet and the entire assembly is then heat and pressure consolidated to a unitary structure. Again here, it should be noted that the raised printed design was on that side of the release sheet that is further away from the surface of the unraised printed design sheet. Upon removing the laminate from the press, the release sheet carrying the raised printed design is removed to reveal a beautiful multi-colored mosaic-like affect in which the simulated binder carries the appearance of a true cementitious appearances.

We claim:

1. A process for producing a decorative laminate with an embossed surface comprising preparing an assembly in superimposed relationship of

- (1) a plurality of thermosetting phenolic resin impregnated core sheets,
- (2) a decorative sheet positioned immediately above said core sheets and impregnated with a noble thermosetting resin which is not subject to significant darkening upon the application of heat,
- (3) a release sheet positioned above said decorative sheet carrying on the side of said release sheet away from said decorative sheet a raised printed design providing increased thickness in the printed area wherein the raised printed design has substantially no tendency to deform under the subsequently applied laminating conditions, thereupon heat and pressure consolidating the assembly to a unitary structure and removing the release sheet carrying the raised printed design.

2. The process according to claim 1 in which the raised printed design is accomplished by adhering to a printed design a plurality of small hard particulates.

3. The process according to claim 1 in which the decorative sheet is a printed design sheet.

4. The process according to claim 3 in which the raised printed design is accomplished by adhering to a printed design a plurality of small hard particulates.

5. The process according to claim 3 in which an overlay sheet impregnated with a thermosetting resin of the same quality as that in the decorative sheet is positioned immediately above said decorative sheet.

6. The process according to claim 3 in which the raised printed design is on the reverse side of the sheet carrying the decorative printed sheet.

7. The process according to claim 3 in which the raised printed design is in register with the printed design on said decorative sheet.

8. The process according to claim 6 in which the raised printed design is in register with the printed design on said decorative sheet.

9. The process according to claim 1 in which the raised printed design is associated with the release sheet.

10. The process according to claim 9 in which said raised printed design is printed on the release sheet.

11. A process for producing a decorative laminate with an embossed surface comprising preparing an assembly in superimposed relationship of

- (1) a plurality of thermosetting phenolic resin impregnated core sheets,
- (2) a paper sheet superimposed on said core sheets carrying on the side of said paper sheet away from said core sheets a raised printed design providing increased thickness in the printed area wherein the raised printed design has substantially no tendency to deform under the subsequently applied laminating conditions,

- (3) a decorative sheet positioned immediately above said sheet carrying the raised printed design wherein said sheet is impregnated with a noble thermosetting resin which is not subject to significant darkening upon the application of heat,
- (4) a cushioning release sheet positioned above said decorative sheet, thereupon heat and pressure consolidating the assembly to a unitary structure and removing the release sheet from the laminate.

12. A process for producing a decorative laminate with an embossed surface comprising preparing an assembly in superimposed relationship of

- (1) a plurality of thermosetting phenolic resin impregnated core sheets,
- (2) a decorative sheet positioned immediately above said core sheets and impregnated with a noble thermosetting resin which is not subject to significant darkening upon the application of heat, said decorative sheet carrying on that side of the decorative sheet away from the decorative side a raised printed design providing increased thickness in the printed area wherein the raised printed design has substantially no tendency to deform under the subsequently applied laminating conditions,

- (3) a cushioning release sheet positioned above said decorative sheet, thereupon heat and pressure consolidating the assembly to a unitary structure and removing the release sheet from the laminate.

13. A process for producing a decorative laminate with an embossed surface comprising preparing an assembly in superimposed relationship of

- (1) a plurality of thermosetting phenolic resin impregnated core sheets,
- (2) a decorative sheet positioned immediately above said core sheets and impregnated with a noble thermosetting resin which is not subject to significant darkening upon the application of heat,
- (3) a release sheet positioned above said decorative sheet,
- (4) a separate paper sheet positioned above said release sheet carrying on that side of said separate sheet away from said release sheet a raised printed design providing increased thickness in the printed area wherein the raised printed design has substantially no tendency to deform under the subsequently applied laminating conditions, thereupon heat and pressure consolidating the assembly to a unitary structure and removing from the laminate thus produced the release sheet as well as the separate sheet carrying the raised printed design.

No references cited.

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