

June 24, 1952

C. B. HEMMING ET AL

2,601,284

HEAT RESISTANT PANEL

Filed Jan. 18, 1947

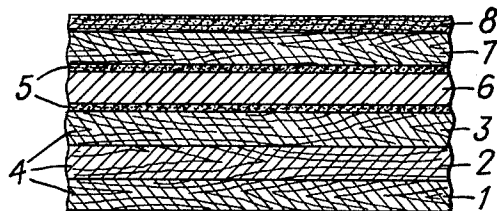


Fig. 1

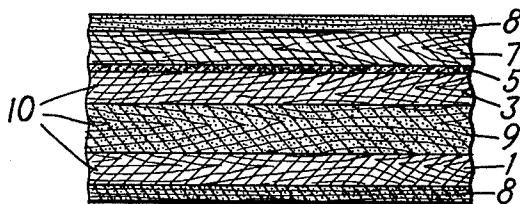


Fig. 2

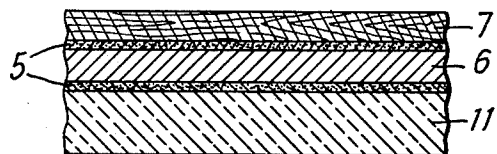


Fig. 3

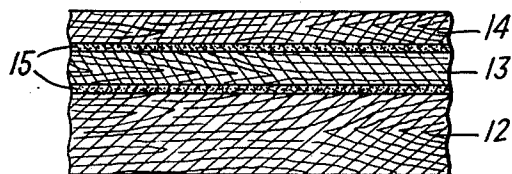


Fig. 4

INVENTOR.
CHARLES B. HEMMING
RAY L. OVERHOLT
BY *James M. Heilman.*
Att'y.

UNITED STATES PATENT OFFICE

2,601,284

HEAT RESISTANT PANEL

Charles B. Hemming and Ray L. Overholt, New Rochelle, N. Y., assignors to United States Plywood Corporation, New York, N. Y., a corporation of New York

Application January 18, 1947, Serial No. 722,840

2 Claims. (Cl. 154—45.9)

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This invention relates to the woodworking field, and particularly to the building material industry, the furniture industry, and the fancy container industry.

One of the objects of this invention is to provide a cigarette-proof, scorchproof, or burn-proof material which will withstand the heat of cigarettes indefinitely, and, also, for a short period time, will withstand the heat of hot pans, hot irons, and other hot objects, without marring the finish or the veneer proper.

Another object of this invention is to provide a surface coating which will form a high finish on the veneer and make the veneer appear extremely brilliant and glossy, while at the same time the coating itself acts as a protective shield for the wood against marring by heat and water.

Still another object of the invention is to impart a finish to a wood veneer which by combination of a high refractive index and good wetting action, i. e., excellent, intimate contact between the film and the veneer with resultant displacement of air, brings out the contrast and texture in startling fashion but without staining or changing the color or tone of the veneer in any way.

A fourth object of this invention is to mask the grain and checks in the relatively inexpensive base material, such as, fir, by providing a layer of metal or inexpensive hardwood between the base material and the expensive face veneer.

A fifth object of this invention is to provide on a panel a surface coating having a brilliant finish produced by heating certain resins and catalysts at low temperatures for a short period of time.

Other and further objects will appear from a reading of the following specifications.

Cigarette-proof panels have been made in the past by taking a stack of thin paper sheets or rags, completely impregnating the stack with a resin, and subsequently subjecting the stack to a high pressure under heat. Large quantities of resin are expensive, and the initial cost and maintenance cost of high pressure presses, and solid, sturdy foundations and buildings to house such high pressure presses, are also expensive. In addition, the resulting product is not particularly attractive to most people because it looks artificial and lacks life. Furthermore, it is difficult to produce flat panels. This is the first time, as far as is known, that a cigarette-proof or heat-proof board having a brilliant finish which sets off the grain has been made by the low pressure and, hence, inexpensive method.

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With the foregoing and other objects in view, the invention resides in the novel arrangement and combination of parts and in the details of construction and process of manufacture hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein described may be made within the scope of what is claimed without departing from the spirit of the invention. It will be further understood that our invention is susceptible of embodiment in many and various forms, some of which are illustrated in the accompanying drawing, and that the structural details or particular steps of the method herein set forth may be varied to suit particular purposes and still remain within our inventive concept.

Referring to the drawings:

Fig. 1 is a cross-sectional view of one embodiment of our invention showing not only the brilliant finish but also the metallic heat dispersing element.

Fig. 2 is a modified form of our invention illustrating a different type base material, and having a brilliant surface coating applied to both sides of the panel.

Fig. 3 is a further modification and discloses a different base material and a metal heat conducting material between the base and the face veneer.

Fig. 4 is a still further modification of our invention and shows a lumber base material and a relatively inexpensive hardwood veneer between the base material and the expensive face veneer.

A plywood panel is indicated by numeral 4 and comprises veneers 1, 2 and 3. This base material is preferably fir plywood or pine plywood or some other of the inexpensive coniferous species. The basic material has been illustrated as plywood. However, even though plywood performs much better than other materials due to its great strength per unit weight, it is understood that other base materials, such as illustrated in Figs. 2, 3 or 4, may be used.

To one side of the plywood panel 4 a synthetic resin adhesive 5, preferably a thermosetting resin, such as, phenol formaldehyde, urea formaldehyde, melamine aldehyde, furfural resin, polyvinyl resin, or any of the synthetic rubber cements, or a mixture of phenol formaldehyde resin and butadiene acrylonitrile synthetic rubber, or a mixture of synthetic rubber derivative mixed with phenol formaldehyde resin, or other adhesive which will bind metal to wood, may be ap-

plied. However, thermosetting resins take a comparatively long time to set and are not sufficiently "elastic" or flexible after setting. Thermoplastic resins, on the other hand, are too "elastic" when set. The result of the use of the foregoing resins for a metallic plate or metallic foil to wood adhesion has been that the shrinkage of the heat resistant finish has caused peeling of the finish with age. These faults have been eliminated by the discovery of an intermediate adhesive which is neither strictly thermosetting nor strictly thermoplastic and might be described as a thermosetting resin which is slightly plasticized. This new adhesive formed of polyvinyl butyral mixed with alcohol soluble, unmodified phenol formaldehyde in equal proportions by weight, or 75% polyvinyl butyral to 25% alcohol soluble, unmodified phenol formaldehyde by weight produces startling results.

An aluminum sheet or aluminum foil, a copper sheet or copper foil, a copper clad iron plate, or some other appropriate metal element 6 is placed over the adhesive and a second layer of adhesive is applied to the metallic element. Since the wood base will absorb moisture from the adhesive, in most cases it will be found advantageous to apply both coats of adhesive to the metal foil.

If the adhesive is applied to the metal element, both sides may be coated by one passing through the roller coating or glue spreading machine. Preferably, the adhesive should then be partially or fully dried before assembling the veneer to the metal element. Adhesive may also be applied by spraying, dipping, or other conventional ways of coating. Above the second layer of adhesive, a veneer 7, preferably an expensive veneer, such as, teak, mahogany, etc., of the order of $\frac{1}{24}$ inch to $\frac{1}{85}$ inch, is placed.

To the outer side of the veneer a heat and water resistant protective coating 8, of a polyester resin, such as, styrene alkyd and a catalyst is applied. The coating may be applied by spraying, dipping or otherwise coating the outer surface of the thin veneer. However, in order to obtain an exceptionally brilliant finish, the resin must be entirely free of all dirt or dust. Favorable results may be obtained in an air conditioned room, but the following procedure has been found to be the best method of applying the resin to the veneer. A temporary metallic transfer plate (not shown in the drawing), preferably a chromium plated metal of some kind, such as, iron, steel, stainless steel, etc., having a smooth finish and high polish, is rubbed liberally with a parting agent, such as, a fatty component of certain vegetable oils, such as, soy bean and castor, generally known as lethicin, carnauba wax, silicone grease, etc., and subsequently is covered with the resin coating. The temporary transfer plate is then heated so that the resin will become firm or gelled in its intermediate stage. The time for the resin to gel is short, i. e., thirty minutes or less, and the temperature comparatively low, i. e., approximately 150° F. For example, styrene alkyd with a benzoyl peroxide catalyst will set in twenty minutes at 150° F. temperature, while styrene alkyd with a tertiary butyl hydroperoxide catalyst will set in ten minutes at 150° F. temperature. The rapidity with which the resin becomes firm is exceedingly important because the output of the plant is directly proportional to this rate.

The temporary transfer plate with the gelled coating 8 applied to it is positioned with the coating 8 against the veneer 7. The various sep-

arate laminations of elements 1, 2, 3, 5, 6, 7, 8, and the transfer plate are placed in a conventional plywood or similar hot press, such as, a high frequency press. After the assembly has been in the hot press for a time range of from approximately 5 to 25 minutes at approximately 300° F. and approximately 200 pounds per square inch pressure, due to the action of the catalyst which is critical in this portion of the procedure, the resinous coating leaves the metal plate and attaches securely and permanently to the veneer. There is nothing critical about the specific pressure which is used as long as it is sufficient to bond the various laminations together.

The reason for the above action is that the partially cured resin probably has more adhesion for the relatively coarse surface of the wood veneer than for the smooth surface of the metal transfer plate. Also parting is aided by a slight shrinkage of the coating film, and is further encouraged by the use of a parting agent as mentioned previously. Furthermore, the partially cured film is still thermoplastic. The net result is that the veneer surface will "pull" the film off the metal surface so that a true permanent transfer is achieved at the same time that complete polymerization of the resin occurs.

One or more coats 8 may be applied to the veneer. However, the second coat normally will not be applied until the preceding coat has partially dried. If desired, a clear priming coat for elasticity and toughness, or an adhesive, may be used between the coating 8 and the veneer 7. However, if a proper catalyst in the correct percentages is used, a priming coat or an adhesive becomes unnecessary.

We have found the styrene alkyd type to be particularly effective in producing a brilliant finish. Two of the styrene alkyls, known as "Selectron 5003" and "Selectron 5007," made by Pittsburgh Plate Glass Company, to which tertiary butyl hydroperoxide has been added in the above proportions produces a brilliant finish which is perfect in transfer and in reliability of results. "Selectron 5003 and 5007" can be specifically identified as conjoint copolymers of styrene and the reaction product of a dibasic acid and a polyhydric alcohol. The preferred acids are phthalic, maleic, and adipic acids. The preferred alcohols are glycerine, and ethylene glycol. Successful applications have been made of the following other infusible and insoluble resins with appropriate catalysts: allyl esters, allyl alkyls, acrylate esters polymerized with an alkyd ester, polyvinyl chloride-diallyl succinate, styrene-divinyl benzene, isobutyl urea formaldehyde, isobutyl melamine formaldehyde and other resins of these general types.

The catalyst which has produced unexpected and unlooked for results is tertiary butyl hydroperoxide. The critical range of tertiary butyl hydroperoxide is, for example, approximately two parts by weight of tertiary butyl hydroperoxide to 100 parts by weight of styrene alkyd. Other catalysts, such as, benzoyl peroxide, lauroyl peroxide, para tertiary butyl perbenzoate, etc., are satisfactory but do not produce as good results.

The polyester resins or allyl resins, etc., upon heating in the presence of a catalyst, expel the solvent, if any, and change into a viscous or gel stage, after which they gradually show a further increase in viscosity. If further heating is applied, the mass becomes hard and finally becomes a strong, infusible, clear, colorless solid. This conversion to a thermo-hardened resin occurs

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without the evolution of water, ammonia, or other by-product.

Solvents are generally necessary for thinning the solution or dispersion to obtain adequate flow for application to a surface. Ketones are used because they are the best solvents for the polyester resins, and because they can be relatively easily expelled from the film. If all solvent is not expelled from the film, poisoning takes place, and the resin will not cure.

The appropriate thickness range of the coating film is .008" to .015". If the film is too thick, excessive shrinkage and cracking will be experienced. If the film is too thin, there will be insufficient material and a hungry finish results.

Due to the fact that the outside of the coating, particularly while it is wet and being processed, is next to and is protected by the transfer plate, the coating remains clear, clean, dust, bubble, and imperfection free. Furthermore, it "photographically" acquires all the perfections or imperfections in minutest detail of the surface of the transfer plate and thus will faithfully reproduce the desired type finish and degree of brilliance required by judicious choice of the type transfer plate, as well as the type resin coating and catalyst. In other words, the polish of the transfer plate is imitated reliably. Consequently, the coating of the panel is of great brilliance due to the high refractive index of the coating and the wetting action of the resin. Good contact between the coating and the veneer takes place since there is a flow of the coating during the transfer and the grain is therefore enhanced. The high gloss produced by the highly polished surface of the transfer plate is not diminished subsequently because the aluminum caul in the hot press is also highly polished.

The above transfer method for coating panels or other wood surface articles is, of course, longer and more expensive than spraying or brush coating the face veneer direct. However, we have found two general types of coatings which produce a brilliant heat resistant finish if applied directly to the veneer and subsequently the board is placed in a press for forming and polishing. The first type, directly applied coating, is from the class of compound copolymers or polyesters of the styrene-free type, such as, a monomeric form of an organic ester of allyl alcohol and methyl methacrylate mixed in the proportion of a monomeric form of an organic ester of allyl alcohol 65% by weight and methyl methacrylate 35%. The second type coating is a mixed polyester containing diallyl phthalate, such as, a 50-50 mixture by weight of an organic ester of allyl alcohol and a mixture of organic allyl esters to which it is unnecessary to add either styrene or methyl methacrylate.

The second type coating can be used in the plate transfer method as well as by direct application, but inasmuch as the direct application method produces equally satisfactory results for this type resin, the transfer plate method normally would not be used. The transfer plate method will not work with a monomeric form of an organic ester of allyl alcohol methyl methacrylate resin so the direct application method obviously must be used.

Fig. 2 illustrates a modified form of our invention, in which the base material or base member 10 comprises a three-ply board having the two outer plies 1 and 3 of wood veneer and the center ply or core of imitation wood or synthetic

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wood 9, such as, "Masonite," "Celotex," insulation board, or a mixture of sawdust and cotton, or any other combination. In this modification the metal plate is eliminated and the base veneer 7 having a heat resistant coating applied thereto is secured directly to the base member 10.

If desired, the high luster coating 8 could be applied to the base member as well as to the face veneer. The method of applying the coating 8 to the base member would be as stated above, namely, either by applying the coating directly to the base member or by applying the coating to a transfer plate and then affixing it to the base member. Normally, however, the coating will be applied only to the face veneer.

Fig. 3 illustrates a modified form of our device in which the base member 11 is formed of a one-piece synthetic wood, such as, "Masonite," "Celotex," wallboard, insulation board, etc. As illustrated in this figure a metallic plate is inserted between the base member and the veneer, but no coating is applied to the veneer.

Fig. 4 illustrates another modified form of our invention in which a single piece of lumber, such as, of the coniferous species, is used as the base member 12 and a veneer of inexpensive hardwood such as beech or birch is interposed between the expensive face veneer and the base member.

In cases where coniferous wood such as fir lumber or fir plywood is used as the base material, the grain of this base material will show through the thin outer veneer unless an intermediate sheet is interposed in order to mask this grain raising of the hard and soft grain of the summer and spring growth of the base material. Therefore, the metal plate 6 has two functions, namely, to shield the grain of the coniferous base and to dissipate and conduct the heat of the cigarette or hot pan away from the immediate area to other portions of the panel and thereby equalize the temperature throughout the entire panel.

In Fig. 4 the thin veneer of hardwood 13 serves merely to mask the grain of the base material from showing through to the rare or expensive face veneer.

It is understood that the drawing is only illustrative of the invention. For example, metal plate 6 of Fig. 1 could be applied to Fig. 2, or could be substituted for hardwood veneer 13 in Fig. 4. Likewise, element 13 of Fig. 4 could be substituted for metal plate 6 in Fig. 1. Also, a cement-asbestos fiber mixture could be used in place of the metallic sheet in Fig. 1 since a cigarette will not mar the coating or the face veneer when such a ply is placed beneath the veneer and a heat resistant coating, such as, an organic ester of allyl alcohol, and a mixture of organic allyl esters to which it is unnecessary to add either styrene or methyl methacrylate is used. Furthermore, in certain cases it may be desirable to dispense with the base member and use only the metal plate and the veneer, with or without the coating.

It is also understood that the foregoing resins are capable of being used effectively not only in a heatproof or heat resistant construction having a metal underlay but also as a brilliant coating for any type surface. For example, the coating 8 illustrated in Fig. 2 could be applied to either the expensive hardwood veneer 14 or to the fir lumber base 12 as illustrated in Fig. 4, where the primary consideration may be to obtain a brilliant, long lasting, wear resistant finish and the heat resistant quality is a secondary consideration.

Mixed synthetic resin-synthetic elastomer or high polymer adhesives are mentioned as being preferable where a metal plate is used. However, any of the less expensive common phenol formaldehydes, urea formaldehydes, or melamine resins, in solvents of water, alcohol, or acetone, may be used in the construction as illustrated by 15 in Fig. 4. Also, a dry film glue, such as, tissue paper or other thin paper impregnated with an appropriate resin, might be used. The hardwood veneer 13 does need to be grade A, but can be of a poor quality both as to soundness and color.

A coloring agent is very likely to be desirable and may on occasions be necessary. When the finish is applied to wood veneers, there will be occasions when a little color added to the top film may be desirable to control tone.

The mentioned resins have great resistance to abrasion and marring and withstand the effects of wear, water, alcoholic beverages, etc., in a superior manner, while remaining remarkably clear. The resins named are inherently fire resistant to a limited extent. However, if desired, any fire retarding elements, such as, sulfamic acid derivatives, ammonium bromide, ammonium phosphates, borax, zinc chloride, cellulose acetate, and mixtures of these materials may be incorporated into the resin.

It can thus be seen that we have invented a new and extremely saleable, heatproof material 30 for room construction, elevator cabs, table tops, furniture generally, etc., having a very striking and brilliant finish, which can be taken from the press while the press is hot, will resist wearing and marring to a great extent, and which will 35 not sweat when a cigarette or other hot object is placed thereon. As a building material, the exquisite finish will be desirable and inherently the material will tend to be fire resistant.

What we claim is:

1. As a new article of manufacture, a low pressure laminated material comprising a wood base member, a metal sheet, a wood veneer, and an adhesive comprising polyvinyl butyral mixed with phenol formaldehyde; said base member and said veneer each being directly secured at one face thereof to an opposite surface of said metal sheet by said adhesive; and a heat resistant coating applied to the other face of said

veneer and comprising approximately 65 parts by weight of a monomeric form of organic ester of allyl alcohol, approximately 35 parts by weight of methyl methacrylate, and approximately 2 parts by weight of tertiary butyl hydroperoxide.

2. As a new article of manufacture, a low pressure laminated material comprising a wood base member, a metal sheet, a wood veneer, and an adhesive comprising from approximately 50% to approximately 75% by weight of polyvinyl butyral mixed with from approximately 25% to approximately 50% by weight of phenol formaldehyde; said base member and said veneer each being directly secured at one face thereof to an opposite surface of said metal sheet by said adhesive; and a heat resistant coating applied to the other face of said veneer and comprising approximately 65 parts by weight of a monomeric form of organic ester of allyl alcohol, and approximately 35 parts by weight of methyl methacrylate, and approximately 2 parts by weight of tertiary butyl hydroperoxide.

CHARLES B. HEMMING.
RAY L. OVERHOLT.

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