Nov. 23, 1943. C. BATCHELLER 2,334,694

PANEL BOARD

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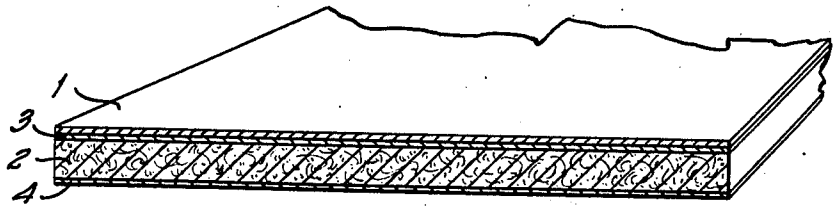


FIG. 1

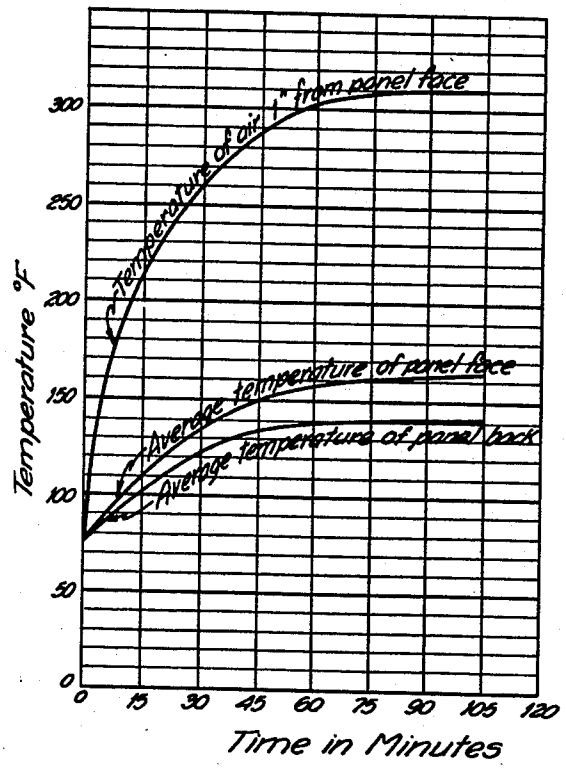


FIG. 2

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PANEL BOARD

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Application January 26, 1939, Serial No. 252,951

6 Claims. (Cl. 154—45.9)

My invention relates to panel boards or sheets and particularly to an improved panel board of the type comprising a facing of thin sheet metal which is adhesively secured to a semi-flexible backing board.

It is a comparatively simple matter to fabricate a commercially acceptable panel board or sheet consisting of a core with a facing of sheet material adhesively secured to both sides thereof. On the other hand, it has heretofore been impossible to produce a satisfactory thin panel board or sheet having a facing of thin sheet metal adhesively secured to one side only thereof. Where the backing is a comparatively thick, rigid block or board, a metal facing may be adhesively secured to one side only without distortion or warping. But where the backing board has a large surface area and is comparatively thin so that in such sizes it is flexible or semiflexible, it is impossible adhesively to apply to one side only thereof a thin metal sheet without causing the composite product to curl or warp due to the stress applied to the unit when the adhesive sets or hardens. Where metal sheets are applied to both sides of the board, the warping stresses developed by the setting of the adhesive are substantially balanced and the product is usually free from distortion.

Attempts have been made to apply a metal facing to one side of a plywood veneer by compositing in a hot plate press by means of such adhesives as hard setting casein glues, soya bean glues, blood glues and even thermoplastic films of the synthetic resin type. All these cements contract substantially and become hard in setting, and the products invariably have a concave face. Moreover, the wood backing itself is not stable under varying atmospheric conditions and the products, while concave in general, become warped and distorted in other directions.

Common cement asbestos boards are not only very dense and brittle but shrink progressively over a long period in the presence of moisture. Moreover, their high caustic content will gradually decompose any ordinary adhesive and thus destroy the bond between the facing and backing.

One of the objects of my invention is to provide a relatively thin composite panel board of the semi-flexible type having a thin metal facing on one side only and which will be substantially free from curling and warping. Another object is to provide a panel board of the character described which, in substantial lengths, may be bent or flexed to a smooth curve without injury to the backing or to the bond between the facing and backing. Another object is to provide a panel of the character described which will be capable of withstanding a comparatively high degree of heat so that it may be applied to wall construction behind gas stoves, hot plates, ovens and the like. A further object is to provide a wall panel in which the foregoing characteristics will be substantially permanent.

I accomplish these objects by means of the novel combination of features described below and illustrated in the accompanying drawing in which—

Fig. 1 is a fragmentary perspective view, partially in section, showing my improved type of panel board; and

Fig. 2 is a diagram showing the effect of heat applied to the facing of my board.

Referring to the drawing, my board comprises a facing 1 of comparatively thin sheet metal, say from 0.006" to 0.022" in thickness and preferably having its exposed face highly polished. Due to its high resistance to corrosion and its otherwise permanent characteristics, I prefer to use a stainless steel. Chrome-nickel steels of the well known 18–8 type, or straight chromium steels containing 16 to 18% of chromium are particularly satisfactory.

The backing 2 is a preformed board composed principally of fibrous material, such as asbestos, with a binder of hydraulic cement, such as Portland cement or calcined magnesite, together with a small quantity of bentonite. The composition which I prefer to use is disclosed in my application for Letters Patent Serial No. 144,032 filed May 21, 1937, a typical example of which is as follows:

Ingredients	Parts by weight
Portland cement	365
Asbestos fibers	665
Bentonite	50
Calcined magnesite	25
Water	(1)

[1] Sufficient to plasticize.

The boards are rolled or molded from this composition to a thickness somewhat greater than that desired in the finished product and are then subjected to high pressure to produce a comparatively hard, board-like sheet. Preferably, the

backing is made of a thickness of from ⅛" to ¼" but thicker backings may be used where a less flexible panel is desired.

It will be noted that the asbestos fibers in the backing comprise substantially more than 50% by weight of the product and, in this respect, my backing differs very substantially from the ordinary cement asbestos boards in which the principal ingredient is Portland cement and in which the fiber content is generally only about 25%, by weight. This large fiber content combined with the bentonite forms a dense appearing but, in fact, comparatively porous product which, in and of itself, is quite stable against warping or distortion due to variations in temperature, moisture and other factors. The porosity is due largely to the presence of the bentonitic clay which has the rather remarkable property of expanding, when wet, to thirteen or fourteen times its original volume and shrinking when dried. The high fiber content combined with the bentonite also makes a board which can be readily cut, sawed or otherwise worked with ordinary carpenter's tools.

After the backing board has hardened, the normal moisture content thereof is reduced as much as possible by air drying at a temperature of about 90° F. The dried boards are then impregnated, by spraying or dipping, with a moisture-proofing oil which is capable of being oxidized when heated to a comparatively low temperature, say of the order of 200° F. For this purpose, I prefer to use raw linseed oil because of its availability and low cost but other oils having similar oxidizing properties, such for example as tung oil and the like, may be used. Due to the high porosity of the board backing, the oil will be absorbed thereby after about three minutes immersion. After being impregnated, the boards are dried and the oil oxidized by heating at a temperature of about 200° F.

The adhesive employed in securing the facing and backing together is of the utmost importance. Any ordinary glues or cements which become hard on setting either at once or after a considerable period of time, are entirely unsatisfactory. Where a panel is of such size and thickness as to be substantially rigid, the character of the adhesive employed is not of such great importance. But where the panel is only ⅛" to ¼" thick and is fabricated in lengths of from 4 to 8 feet, the adhesive employed must be of a permanently plastic or elastic character, otherwise slight flexures of the panel will cause the adresive to "let-go." This is so because, in my panel, the layer of adhesive is in a plane substantially spaced from the neutral axis of the panel when considered as a beam, and it is therefore subjected to substantial tensile or compressive stresses when the panel is flexed.

Hence, it is necessary to employ an adhesive of a permanently plastic or elastic character. Rubber cements which are composed chiefly of latex, as well as asphalts and bituminous materials in general may remain plastic for a while but soon become oxidized or otherwise chemically changed so that their resistance to deformation is greatly reduced and their bonding properties are also destroyed.

I find that a composition which is composed largely of reclaimed or "spent" rubber in a petroleum solvent, or preferably, partly of reclaimed rubber and partly of a gum resin in a solvent such as gasoline, carbon tetrachloride, acetone or the like and either with or without a small quantity of lime, forms a pressure sensitive adhesive composition of substantially permanent plasticity. Such adhesives are commercially available, and chemically stable, and are not appreciably affected by comparatively high temperatures or by moisture.

In fabricating my panel, the best results, I believe, are attained when a film of adhesive is applied both to the facing and to the backing. After the application of the adhesive, the elements are placed together as quickly as possible, to prevent an excessive evaporation of the solvent, and subjected to a pressure of the order of about one pound per square inch of surface. The excess solvent in the adhesive to some extent "cuts" the oxidized vegetable oil in the backing board and is absorbed or dissipated in this way.

A comparatively light pressure must be used in fabricating my panel due to the relatively thin gauge metal used in the facing. Where, for example, stainless steel polished to a mirror-like finish is used for the facing, any very heavy pressure ruins the product because the thin metal is pressed into the high and low zones of the backing element. These high and low zones in the surface of the backing board may not be apparent to the eye, but if the mirror-like metal, when applied is not perfectly plane, images reflected thereby are distorted and extremely minute irregularities are immediately discernible.

All pressure sensitive adhesives of the type described have a tendency to contract somewhat with the loss of solvent therefrom. In thin panels of my type, this shrinkage or contraction of the adhesive, although very slight, is, nevertheless, sufficient to effect a slight concaving of the panel on the metal side. To overcome this condition, I apply to the back of the panel, preferably by spraying, a thin oil-resin film which in drying and contracting will apply to the panel a distorting stress substantially equal to but in a reverse direction to the stress applied by the shrinkage of the adhesive between the facing and backing. For this purpose I have found that a film of China-wood oil containing a small but effective amount of a resin such as dammar or gum copal when applied to the back of my panel will produce a product having the internal stresses therein substantially balanced so that it is a smooth, plane structure.

Although ordinary cement asbestos products such as the ordinary cement shingles are hard and brittle, the cement asbestos backing board in the large sizes used in my panels is quite flexible. For example, one of my panels which is ¼" thick and 2 feet wide and 8 feet long may be bent or flexed lengthwise into a complete semicyclinder without rupturing the bond between the facing and backing or cracking the backing. In such case it will be obvious, if the metal is on the convex side of the curve, that the adhesive between the facing and backing is subjected to very appreciable tension and it becomes possible to flex my panels to this extent only because of the combined properties of the backing board employed and the permanently plastic adhesive.

What I claim is:

1. A semiflexible wall panel sheet comprising a facing of thin, corrosion-resisting sheet metal, and a hard backing board formed of fibrous material and hydraulic cement; said facing and backing being substantially coextensive and secured together by an adhesive of substantially

permanent plasticity comprising reclaimed rubber; said backing being impregnated with an oxidized vegetable oil and having a resinous film on the exposed face thereof; said adhesive and said film being so correlated as to apply substantially balanced curling stresses to said sheet.

2. A hard, semiflexible panel sheet comprising a facing of thin gauge corrosion-resisting sheet metal, and a hard, preformed backing board formed principally of fibrous material with a minor quantity of hydraulic cement as a binder; said facing and backing being secured together by an adhesive of substantially permanent plasticity comprising reclaimed rubber; and said sheet, when of a length of about eight feet or more and of a thickness up to about one-quarter inch, being characterized in that it may be flexed into substantially semi-cylindrical form without rupture of the plastic bond between the facing and backing or cracking the backing.

3. A hard, semiflexible panel sheet comprising a facing of thin gauge, corrosion-resisting sheet metal, and a hard, preformed backing board formed principally of fibrous material with a minor quantity of hydraulic cement as a binder; said facing and backing being secured together by an adhesive comprising reclaimed rubber and a resin gum, whereby a substantially permanent plastic bond between said facing and backing is attained; and said sheet, when of a length of about eight feet or more and of a thickness up to about one-quarter inch, being characterized in that it may be flexed into substantially semi-cylindrical form without rupture of the plastic bond between the facing and backing or cracking the backing.

4. A hard, but semi-flexible panel comprising a facing of thin gauge, flexible, stainless steel, a hard, preformed backing substantially coextensive therewith containing more than 50% by weight of fibrous material, a binder of hydraulic cement and a minor quantity of bentonite, and an adhesive of substantially permanent plasticity comprising reclaimed rubber securing said facing and backing together; said panel sheet in lengths of eight feet or more and thicknesses up to about one-quarter inch being characterized in that it may be flexed into substantially semi-cylindrical form without rupture of the plastic bond between the facing and backing or cracking the backing.

5. A hard but semi-flexible panel sheet comprising a facing of thin gauge stainless steel, a hard preformed backing substantially coextensive therewith and comprising, by weight, more than 50% of fibrous material with a binder of hydraulic cement, and bentonite, and an adhesive of substantially permanent plasticity comprising reclaimed rubber securing said facing and backing together; said backing having on its exposed face a film of resinous material so correlated with said adhesive as to apply substantially balanced curling stresses to said panel; and said panel sheet in lengths of about eight feet or more and thicknesses up to about one-quarter inch, being characterized in that it may be flexed into substantially semi-cylindrical form without rupture of the plastic bond between the facing and backing or cracking the backing.

6. A hard but semi-flexible panel sheet comprising a facing of thin gauge stainless steel, a hard preformed backing substantially coextensive therewith and comprising, by weight, more than 50% of fibrous material with a binder of hydraulic cement, and bentonite, and impregnated with an oxidized vegetable oil, and an adhesive of substantially permanent plasticity comprising reclaimed rubber securing said facing and backing together; said backing having on its exposed face a film of resinous material so correlated with said adhesive as to apply substantially balanced curling stresses to said panel; and said panel sheet in lengths of about eight feet or more and thicknesses up to about one-quarter inch, being characterized in that it may be flexed into substantially semi-cylindrical form without rupture of the plastic bond between the facing and backing or cracking the backing.

CLEMENTS BATCHELLER.