April 28, 1970 G. J. ADOMSHICK ET AL 3,509,008

DECORATIVE NONCOMBUSTIBLE CEILING TILE

Filed Dec. 27, 1965

Fig. 1

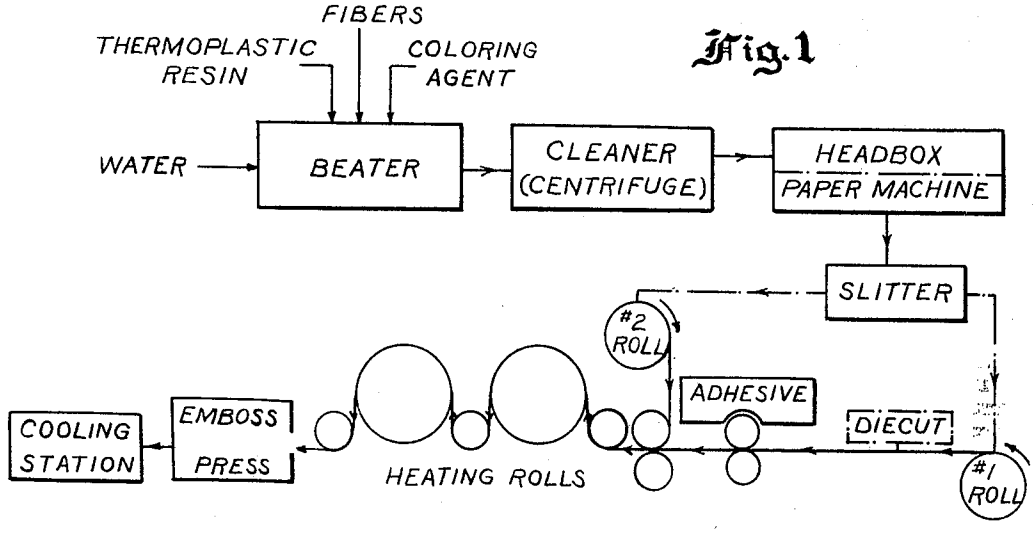


Fig. 2

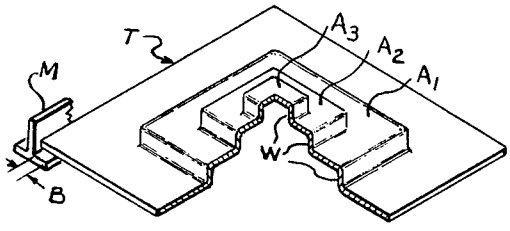


Fig. 3

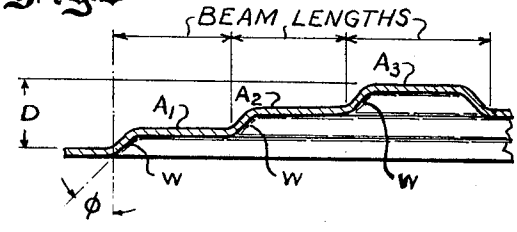


Fig. 4

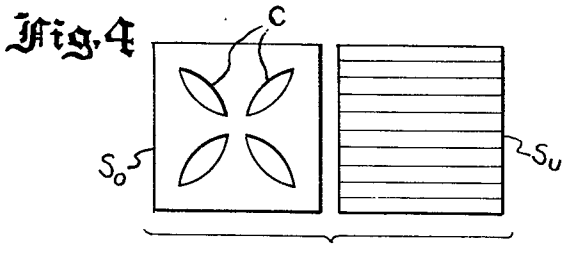
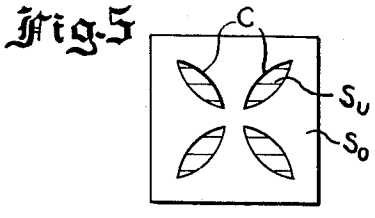


Fig. 5



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DECORATIVE NONCOMBUSTIBLE CEILING TILE

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U.S. Cl. 161—130 4 Claims

ABSTRACT OF THE DISCLOSURE

A fireproof and self-supporting ceiling tile and method of making, preferably produced by admixing by weight about 80 to about 88 percent of asbestos fibers, about 10 to about 15 percent of thermoplastic resin, and about 2 to 5 percent of a whitening agent in which the thermoplastic resin has a minimum softening point of about 200° F., subjecting the mixture to a cleansing operation such as centrifuging an aqueous slurry of the mixture, forming the cleansed mixture into a paper of substantially continuous length, slitting the length of paper into several strips of predetermined width, heating a strip of the paper prior to an embossing step, embossing a pattern on the heated strip of paper to an extent that the pattern includes displacement of at least a portion from the general linear plane of paper to provide a transverse dimension greater than the thickness of the strip of paper, and thereafter cutting the embossed paper into individual tiles.

The present invention relates to a new and improved decorative wall covering, and is particularly concerned with an improved fibrous paper base material and method of processing to form a ceiling tile.

Suspended ceilings which include lay-in panels or tiles have recently come into great favor. Heretofore, because of the relatively high cost, the use of such suspended ceilings and tiles has been primarily for commercial, as opposed to domestic, applications. Domestic applications have been primarily limited to those installations where the acoustical quality of the lay-in tiles has been such to justify the expense. There is a need, however, for lay-in tiles which are relatively inexpensive and which do not necessarily require high acoustical qualities. One such application is in covering the ceilings of basement rooms. However, one of the problems encountered in such an environment is one of high humidity. As the result, tiles have generally been fabricated from relatively thick boards to resist sagging and deterioration due to moisture.

Asbestos paper has been heretofore suggested as a wall covering (U.S. Patent No. 2,045,311). In such prior art applications, the asbestos paper has been held in place by nailing or by adhesively securing the asbestos paper to or through the use of external furring strips. These papers have also only been utilized in a two dimensional form. There exists the need of providing a tile which is capable of supporting its own weight, when supported along a peripheral strip area having a width of ½ inch or less, in arrangements of the type which are provided for in the present day suspension systems.

Starch-bonded mineral fiber boards have been employed in ceilings by supporting only the edges of a board or panel. The use of starch as a binder for ceiling covering materials is objectionable for several reasons. First of all, the rigidity of the material is decreased as the starch

absorbs water from the ambient air and as the ambient temperature increases. Further, starch lacks some of the desirable characteristics of mineral fibers, particularly asbestos fibers, and hence detracts from the advantages of such fibers.

It is accordingly a primary object of this invention to provide a relatively inexpensive, lightweight and fire resistant tile of paper thickness.

Another object of this invention is to provide fibrous paper tile having sufficient dimensional stability to resist sagging, particularly in the presence of humid conditions, and adapted for use in covering ceilings of basement rooms where such conditions prevail.

A further object of this invention is to provide a three dimensional tile and method of fabricating such tile from paper thickness stock material.

FIG. 1 is a flow diagram which schematically illustrates the successive steps in the process of forming the ceiling tile of this invention;

FIG. 2 is a pictorial view of one form of ceiling tile which may be fabricated according to the process of this invention;

FIG. 3 is a fragmentary cross-sectional elevational view of a tile, modified from that illustrated in FIG. 2; and

FIG. 4 is a schematic illustration of overlay and underlay sheets that may be combined to produce a laminate which may be fabriacted into a tile; and

FIG. 5 is a schematic illustration of a laminate produced by combining the sheets shown in FIG. 4.

The method of this invention generally comprises the formation of an aqueous slurry furnish containing inorganic fibers such as asbestos, a thermoplastic resin and a whitening agent. The furnish is mixed in a beater machine of the type conventionally used in paper-making processes and is then pumped to a cleaner, such as a centrifuge, where the furnish is cleaned of impurities or contaminants such as magnetite. The asbestos fiber is preferably of Group 6 (Quebec Standard Screen Test) or longer and well opened, to provide a surface area generally in the range of 20,000 cm.²/gm.

The furnish is transferred to the headbox of a paper-making machine for conventional wet method processing into a continuous felt or paper. The paper is then slit into suitable widths depending upon the size of tile to be made. The thickness of paper to be produced is also contingent upon the area of the tile to be made. In the production of larger sized tiles, it is preferred to provide a laminate of two asbestos paper layers, adhesively secured, rather than a single double thickness.

The paper stock, whether a single layer or a laminate, is then threaded over one or more heated rollers, which rollers serve to preheat the stock before being subjected to the embossing press. This preheat step tends to soften the thermoplastic resin, relieve any stresses within and thus deter wrinkling of the stock.

From the preheat cycle, the stock is fed to an embossing press station where the stock is subjected to pressure, embossed with the desired pattern and configuration, and cut to size. The fabricated tile is then transferred to a cooling station for cooling before being packaged.

In a specific and preferred method of this invention, an aqueous slurry furnish is provided by mixing 80–90% asbestos fibers, 10–15% thermoplastic resin, such as one of the polyvinyls which do not soften below 200° F., and 2–5% whitening agent such as titanium dioxide (the

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indicated percentages are by weight). The slurry is subjected to the action of the centrifuge for a sufficient length of time to insure that it is cleaned to at least 99% purity.

In the fabrication of tile 16" x 16", it is preferred to provide a paper having a thickness of .030" and a Gurley stiffness factor (the Gurley stiffness factors are described in the literature for use in conjunction with the Gurley Stiffness Tester sold by the W. & L. E. Gurley Company, Troy, N.Y.) of at least 20 grams in the longitudinal direction (direction of travel on machine on which paper is formed), and 15 grams in the transverse direction.

When 24" x 24" tiles are fabricated, it has been found necessary to provide a Gurley stiffness factor of at least 30 grams in a longitudinal direction and 24 grams in a transverse direction. It also has been found more economically feasible when fabricating 24" x 24" tiles to provide a laminate of two asbestos sheets, each approximately .022 inch thick, and compressing the laminate, preferably during the embossing step, to provide a thickness no less than .038 inch.

Preferably, at least 10% of resin is provided to impart the desired bonding and rigidity characteristics to prevent sagging of a tile T, such as shown in FIG. 2, when supported only along its peripheral edge by suspension members, such as members M, in an area having a width B of ½ inch or less.

When a laminate stock material is prepared, the individual layers are unrolled, an adhesive of thermoplastic material such as polyvinyl acetate is introduced between the layers and then the layers are brought together by pressure rolls. It is preferred to use an adhesive of polyvinyl acetate or other materials which have non-rotting, non-molding characteristics.

After the paper stock is subjected to the preheat treatment to relieve the stresses within the paper, and thus deter wrinkling, it is fed to the embossing station where a press is provided to emboss the paper with the desired configuration. Preferably, the press is heated to a temperature in the general range of 250–260° F. and sufficient force is applied to compress the paper stock approximately 2.5 mils.

The dimensional configuration of the tile forming part of this invention is an important aspect in that the preferred configuration tends to impart rigidity to the tile. In the fabrication of a 24" x 24" tile, it has been found desirable to provide a displacement D in a direction transverse to the general plane of the tile of approximately ½". It has also been found desirable to form the displacement in rather sharp angles ϕ, at least 45° or greater from the general plane of the tile, to define what may be described a sa series of beams, preferably of decreased lengths. While the exact reasons are not known, it is believed that the combination of the particular composition and the embossing configuration in sharp angles provide a greater than additive effect contributing to the increased rigidity of the end product.

Preferred embodiments of this invention which provide the above described displacement are disclosed in FIGS. 2 and 3. The embodiments there shown incorporate a series of concentric squares A_1, A_2, A_3, with the squares being progressively further displaced from the general plane of the laminate tile in an order which corresponds to the progressive diminution in the area of the squares. The embodiment shown in FIG. 3 varies from that shown in FIG. 2 in that the angle ϕ of the web portions w in FIG. 3 is drawn at 45° while the angle of the web portions with the concentric squares in FIG. 2 are drawn at 90°.

The use of the polyvinyl resins, such as polyvinyl chloride, polyvinyl acetate, and polyvinylidene resin provide inherent lubricating qualities which deter sticking in the embossing press operation. A polyvinyl resin that has been found to be particularly satisfactory is the B. F. Goodrich Company product sold under the trademark

"GEON 351." It is preferred not to exceed 15% by weight of thermoplastic resin because increased percentages of the resin tend to make the papermaking and paper-laying process more difficult. Further, the increased use of the resin, while adding substantially to the rigidity of the paper and the end product also substantially adds to the cost of making the paper.

One of the advantages of using the whitening agent in the indicated percentages is that the finished material has a brightness factor, or of reflectivity which enables the tile to be used without the need of additional paint and contributes to the light reflectivity and to the low cost of the end product.

As an alternative, where a further embossing effect is desired and/or where it is desired to employ different colors, one of the laminate layers, such as coming from the #1 roll in FIG. 1, may be die-cut to provide any desired pattern or configuration on an overlay sheet S_o, an example of which is shown in FIG. 4, and the other laminate layer, such as coming from #2 roll in FIG. 1, may be made of a contrasting different color to form an underlay sheet S_u. When the laminate layers are brought together the contrasting color of underlay sheet S_u will show through the die-cut portions C of the die-cut layer or overlay sheet S_o. Consequently, there is no need to separately paint the designs since the color is incorporated in the layers themselves. Thus, a composition decorative tile is produced from an overlay sheet of asbestos paper bonded to an underlay sheet, with the overlay sheet being cut in a relief pattern exposing areas of the underlay sheet.

The product and method of producing the product have been heretofore described in connection with the preferred embodiment, which includes asbestos fibers; however, it will be understood that other inorganic fibers which display a non-shirinking characteristic, such as glass fibers, may also be employed.

It will be further understood that in the cases where tiles are produced from laminate stock, the underlay sheet need not be of as high quality as the overlay sheet and hence the underlay sheet may be fabricated from fiber stock which is less pure and/or cheaper grades than that stock used in producing the overlay sheet.

One of the principal advantages of this invention is that a product is produced which is relatively inexpensive, which requires no painting, and in the event the ambient conditions are such to dirty the tile, the tiles can be discarded and replaced with new tile at less expense than would be required to wash or repain the tile.

Although certain specific embodiments of the invention have been shown and described, many modifications thereof are possible.

What we claim is:

1. A sag resistant ceiling tile comprising:

(a) a rectangular sheet of paper having a thickness of at least 0.030 inch and being of fibrous composition comprising the following ingredients, by weight, distributed therethrough:
  (1) 80% to 88% asbestos fibers,
  (2) 10% to 15% thermoplastic resin binder, and
  (3) 2% to 5% coloring agent,

(b) the sheet containing substantial areas of embossed portions displaced from the main sheet portion by a distance greater than the thickness of the paper,

(c) the displaced portions being connected to the main sheet portion by web portions forming an angle with the main sheet portion of at least 45°, and

(d) said tile, when supported along its periphery, being sag resistant.

2. A sag resistant ceiling tile as recited in claim **1** wherein the coloring agent is a whitening agent.

3. A sag resistant ceiling tile as recited in claim **1** wherein the length of the asbestos fibers is at least that which corresponds to Group 6 of the Quebec Standard Screen Test.

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4. A sag resistant ceiling tile as recited in claim 1 wherein the embossed portions are in the form of concentric squares.

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