Sept. 24, 1974 N. S. GREINER ET AL 3,838,001

ASSEMBLY FOR PRESS-FORMING SHEET MATERIAL

Filed June 15, 1972

Fig. 1.

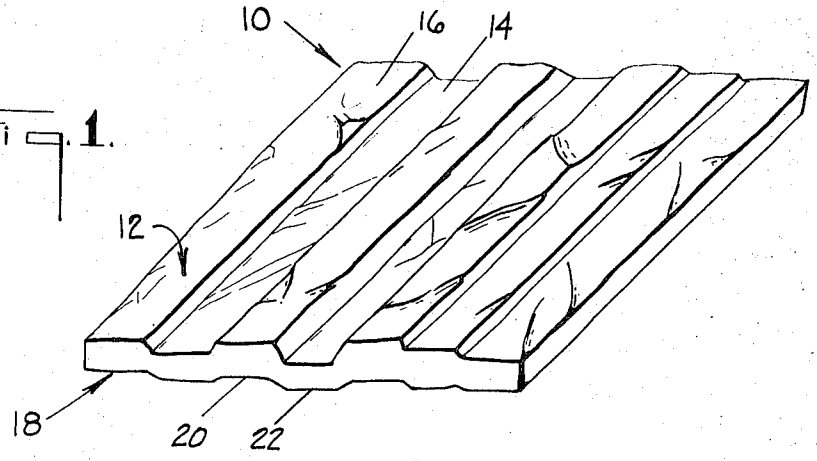


Fig. 2.

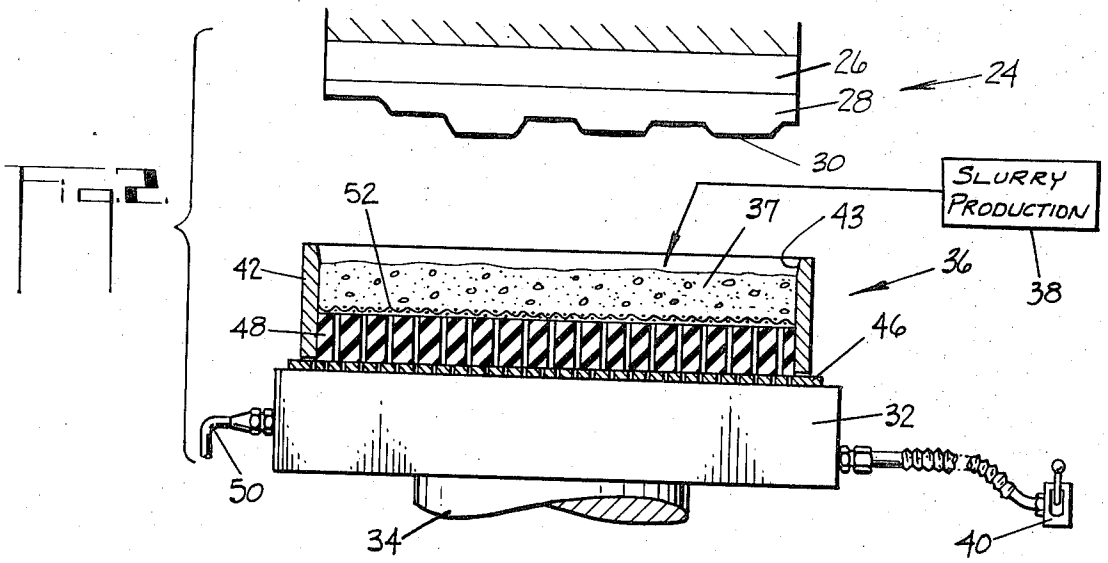
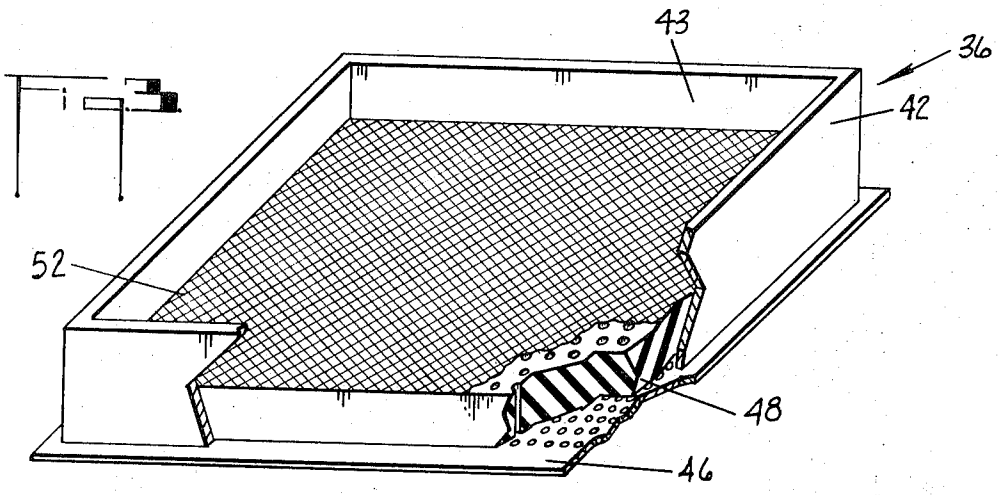


Fig. 3.



United States Patent Office 3,838,001
Patented Sept. 24, 1974

3,838,001

ASSEMBLY FOR PRESS-FORMING SHEET MATERIAL

Norman Shirk Greiner, Somerville, and Norman Hannington, Piscataway, N.J., assignors to Johns-Manville Corporation, New York, N.Y.

Filed June 15, 1972, Ser. No. 263,059
Int. Cl. D21j 3/00
U.S. Cl. 162—416 3 Claims

ABSTRACT OF THE DISCLOSURE

A method of and an assembly for press-forming sheet material such as, for example, asbestos-cement sheets displaying a predetermined deep textured design is disclosed herein. In carrying out the method, a slurry of the sheet material is placed in an open mold comprising part of a press assembly and on top of a resilient pad positioned within the mold. A texture plate fastened to the top die face of the press assembly is provided for applying forming pressure to the slurry so as to consolidate the latter into sheet material displaying the desired texture. During consolidation and in response to the forming pressure, the aforestated pad is deformed to provide substantially uniform density to the sheet material.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention is directed generally to the formation of sheet material such as asbestos-cement sheets and more particularly to the formation of sheet material having a predetermined deep textured design.

Discussion of the Prior Art

Sheet material such as, for example, asbestos-cement sheets have been used for many years as architectural panels, siding panels, roofing and siding shingles, furniture table tops and other related products. In this regard, a noticeable trend in design today is to simulate the appearance of natural products. For example, a stone appearance can be simulated by providing a textured design in the sheet material.

Heretofore, the formation of a textured sheet has not been completely satisfactory, especially where a deep textured design is desired. For example, the sheet is commonly formed in the cavity of a die press by consolidating a slurry of the sheet material against a textured die plate. Typically, the bottom slurry supporting surface of the die cavity is hard and undeformable. Hence, the pressure applied to the slurry for consolidation, is not uniform, greater pressure localizing at the valleys of the textural design. Because of the nonuniformity of applied pressure the valleys formed by the protruding portions of the textured die plate consolidate to ultimate density before proper densification of the texture crowns. This results in soft crowns and poor texture fidelity which, of course, does not provide for a completely satisfactory product.

OBJECTS OF THE INVENTION

In accordance with the foregoing deficiencies of the prior art as well as other deficiencies thereof, an object of the present invention is to provide a new and improved method of forming sheet material displaying a predetermined textural design.

Another object of the present invention is to provide a new and improved method of consolidating a slurry into sheet material displaying a predetermined textural design and substantially uniform density throughout the sheet.

Still another object of the present invention is to provide the last-mentioned method wherein the textured sheet material displays enhanced texture fidelity.

Yet another object of the present invention is to provide the last-mentioned method wherein uniform pressure is applied to opposite sides of the slurry during consolidation so as to achieve uniform density throughout the sheet material.

Still another object of the present invention is to provide the last-mentioned method wherein a resilient pad is utilized in the consolidation process so as to provide the aforestated uniform pressure.

Yet another object of the present invention is to provide the last-mentioned method wherein excess liquid in the slurry is suitably drained off during the consolidation process.

A further object of the present invention is to provide a new and improved press-forming assembly utilized in forming sheet material displaying a predetermined textural design and uniform density.

Still a further object of the present invention is to provide a new and improved sheet of material displaying a predetermined textural design and substantially uniform density throughout the sheet.

These and other objects and features of the present invention will become apparent from the following descriptions.

DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view of a sheet of a material displaying a predetermined textural design and formed in accordance with the present invention;

FIG. 2 is a partial frontal sectional view of a press-forming assembly designed in accordance with the present invention and preferably utilized in forming the sheet material of FIG. 1; and

FIG. 3 is a partially broken away perspective view illustrating a mold arrangement which is constructed in accordance with the present invention and which comprises part of the assembly of FIG. 2.

DETAILED DESCRIPTION

The present invention is directed to a new and improved method of forming sheet material such as, for example, asbestos-cement sheets displaying a predetermined textural design. In accordance with a preferred method of formation, a liquid slurry of the material is directed into a die mold which is designed in accordance with the instant invention and which comprises part of a press-forming assembly. The slurry is consolidated in the die mold by the exertion of pressure against an appropriately designed die plate fastened to the upper die face of the press-forming assembly.

In accordance with one aspect of the present invention, a resilient pad constructed of, for example, urethane rubber is positioned in the aforestated die mold and acts as a bed for the liquid slurry. During consolidation of the slurry, this pad deforms to provide an irregular surface in response to the pressure exerted by the die plate so as to apply uniform pressure against the underside of the slurry and in a direction opposite to the die plate pressure. In this manner, the slurry is uniformly consolidated. The resulting texture displays excellent fidelity and the crowns and valleys comprising the texture are uniformly densified and display the same enhanced hardness so as to provide an improved product. Other aspects of the present invention will become apparent from the following description of the drawing.

Turning now to the drawing, wherein like components are designated by like reference numerals throughout the various figures, attention is directed to FIG. 1 which illustrates a sheet of material **10** formed from a liquid

slurry of, for example, asbestos-cement. As illustrated in FIG. 1, sheet **10**, which has been formed in accordance with the present invention, includes on its top surface **12** a deep textured design of interconnected valleys **14** and raised crowns **16**. Sheet **10** also includes on its bottom surface **18** a textured design of interconnected but less exaggerated valleys **20** and crowns **22** which, as illustrated, is approximately negative in design to the design on top surface **12**. For reasons to be described hereinafter, the sheet material of FIG. 1 displays substantially uniform density, enhanced texture fidelity and uniform hardness so as to provide an improved product.

Turning to FIG. 2, a press-forming assembly **24**, which is constructed in accordance with the present invention and which is preferably utilized in the formation of sheet **10**, is illustrated. The assembly includes a top, preferably fixed, die face **26** to which a die plate **28** is suitably fastened. The die plate includes a downwardly facing surface **30** of a predetermined textural design, that is, a design which, as will be seen hereinafter, is responsible for producing the textured surface of sheet **10**. In this regard, it is to be understood that the present invention is not limited to the particular textural design illustrated in FIG. 1.

Assembly **24** also includes a press bottom comprising a press face **32** fixed to a movable ram **34** and, in accordance with the instant invention, a mold arrangement **36** supported on press face **32** and directly under die plate **28**. As will be seen hereinafter, mold arrangement **36** is adapted to receive a liquid slurry **37** of the sheet material from a suitable source generally designated by the reference numeral **38**. The entire press bottom and mold arrangement may be moved upwardly by actuation of, for example, a suitable control mechanism **40** so that the die plate **28** enters into the mold and consolidates the slurry. The press assembly could, of course, be designed such that the die face **26** moves towards the press bottom or such that the two move toward one another. In this regard, conventional means (not shown) would be provided for moving the press bottom and/or die face.

As illustrated best in FIG. 3, mold arrangement **36** includes a housing or stripper **42** which is opened at the top and which defines a cavity **43** suitably dimensioned to tightly but slidably receive the die face **26**. In this manner the slurry is prevented from rising up the sides of the cavity during consolidation. A perforated support plate **46** constructed of, for example, steel is positioned directly on press face **32** and extends across the entire top surface defined by the press face. The support plate is held in this position by housing **42**, the latter being located on the support plate, as illustrated in FIG. 2.

Plate **46** supports a perforated and initially flat pad **48** constructed of a deformable material such as, for example, urethane rubber which extends within and across the entire housing or stripper cavity, as illustrated best in FIG. 2. In a working embodiment of the present invention pad **48** was constructed of urethane rubber having a durometer hardness of 70–90 Shore A scale. However, the pad may be of any suitable material so long as it will deform under pressure in the manner set forth hereinafter.

Both support plate **46** and pad **48** are perforated to allow excess liquid from the aforestated slurry **37** to drain to the press face **32** during consolidation of the latter, as will be seen hereinafter. In this regard, the press face preferably includes slots and a suitably positioned drainage valve **50** for removiong the excess liquid. In addition, a mesh screen **52** defining individual openings smaller in size than the perforations defined in pad **48** is preferably provided as part of mold arrangement **36** and is positioned over the entire top surface of pad **48**. In this manner, during consolidation of slurry **37**, the latter is prevented from extruding through the perforations in the pad.

While mold arrangement **36** has been described as an entity separate from the press bottom of assembly **24**, it is to be understood that the present invention is not limited to this particular design. For example, the press face **32** may defined an integral cavity so as to replace housing **42**. As a further example, support plate **46** may be an integral part of the press face or, for that matter, the plate may be an integral part of housing **42**.

With press-forming assembly **24** constructed in the aforedescribed manner, attention is now directed to a preferred method of forming sheet **10** illustrated in FIG. 1. Specifically, a wet slurry of the material making up sheet **10** is conventionally provided by, for example, adding water in sufficient quantity to a prepared dry mix formula. The slurry, indicated by the reference numeral **37**, is charged into cavity **43** of mold housing **42** and over perforated pad **48** and screen **52**. Thereafter, the press bottom and mold arrangement are moved upward so that the textured die plate **28** enters into housing **42** and in so doing exerts a pressure against the slurry so as to consolidate the latter. The exact amount of pressure required for consolidating the slurry and the dwell time in which maximum pressure is applied will, of course, depend upon the particular slurry. These calculations may be readily made by one with ordinary skill in the art.

During consolidation of slurry **37**, the excess liquid thereof is allowed to drain through screen **52**, pad **48** and support plate **46** to press face **32** where it may be removed through valve **50**. After consolidation, the press bottom and mold arrangement are returned to their initial lowered position where the consolidated sheet **10** may be conventionally removed from housing **42**.

In accordance with the instant invention, as the slurry **37** is consolidated into textured sheet material **10**, the pressure exerted by die plate **28** causes the initially flat supporting surface of pad **48** to deform in an irregular or nonflat fashion and to a sufficient degree so as to apply uniform pressure against the bottom surface of the slurry. In this regard, the pad must be of sufficient resiliency and yet of sufficient hardness such that upwardly directed forces applied to the slurry by the pad are substantially equal in magnitude and substantially equally distributed throughout the bottom surface of the slurry so as to provide the uniform pressure. In this manner, the pressure on opposite sides of the slurry will be equal and uniform, thereby providing uniform consolidation of the slurry and particularly at the high crowns and adjacent deep valleys. The resulting texture displays uniform density, hardness and excellent fidelity in both the crowns and valleys. In this regard, if the pad is either too hard or too resilient, forces of larger magnitude exerted thereby will tend to localize in certain areas while forces of lesser magnitude will tend to localize in other areas, resulting in varying localized pressure and hence, a product displaying varying density.

Because the pad deforms during consolidation such that the initially flat support surface takes the form of an irregular surface, the bottom side of the ultimately formed sheet **10**, like the top surface thereof, takes on a textural design. In fact, the design on the bottom side will be similar to the design of die plate **28**, however less exaggerated and with less degree of fidelity.

Attention is now directed to a particular example of the present invention wherein a deep textured asbestos-cement sheet was formed in the foregoing manner. A dry mixture was provided and included the following ingredients (by weight):

	Percent
Asbestos fiber	41.8
Silica	18.6
Titanium dioxide	4.6
Portland cement	35.0
	100

Water was added to the above dry mixture in a quantity sufficient to make a twenty-five percent (by weight) solid slurry. The slurry was charged into a mold housing and over a wire screen and pad, the latter being constructed

of urethane rubber having a durometer hardness of between 70 and 90 Shore A scale. The pad was perforated with 3/16 inch diameter holes spaced ½ inch apart. To consolidate the slurry, a maximum pressure of approximately 1500 p.s.i. was applied to the slurry for a dwell time of approximately one minute.

The foregoing example is merely to illustrate a working embodiment of the present invention and is not intended to limit the same. In addition, while the invention has been explained primarily with respect to asbestos-cement products, it should be understood that it can be used equally as well with other types of material. Further, the depth and design of the texture may vary according to taste.

It is to be understood that variations and modifications of the present invention may be made without departing from the spirit of the invention and that the scope of the invention is not to be interpreted as limited to the specific embodiment disclosed herein, but rather in accordance with the appended claims when read in light of the foregoing disclosure.

What we claim:

1. An assembly for press-forming a predetermined textural design in a deformable material, said assembly comprising:

(a) a first press component including a pressing surface displaying a predetermined textural design;

(b) a second press component spaced from said first press component and defining an open mold cavity adapted to receive said deformable material therein;

(c) means for moving one of said press components towards and away from the other press components such that said pressing surface respectively moves into and out of said mold cavity,

(d) a flat resilient pad having a plurality of openings extending therethrough, said pad being positioned along the bottom of said open mold cavity and being sufficiently resilient

(i) to deform during press-forming of said deformable material within said cavity and

(ii) to apply uniform pressure to the underside of said material during press-forming thereof; and

(e) a screen positioned directly over said pad within said cavity, said screen defining openings smaller in size than the openings extending through said pad.

2. An assembly according to Claim 1 wherein said pad is constructed of urethane rubber having a hardness durometer within the range of 70 to 90 Shore A scale.

3. An assembly according to Claim 1 wherein said second press means includes a perforated plate supporting said pad whereby to allow said excess liquid to drain therethrough.

References Cited

UNITED STATES PATENTS

773,671	11/1904	Palmer	162—227
2,407,514	9/1946	Rembert	264—313
2,955,323	10/1960	Rivenes	264—313
1,234,160	7/1917	Hargrave	264—333
1,209,308	12/1916	Lanhoffer	264—316
2,655,196	10/1953	Magnani	264—316

S. LEON BASHORE, Primary Examiner

P. CHIN, Assistant Examiner

U.S. Cl. X.R.

100—110, 211, 297; 162—227; 425—84