

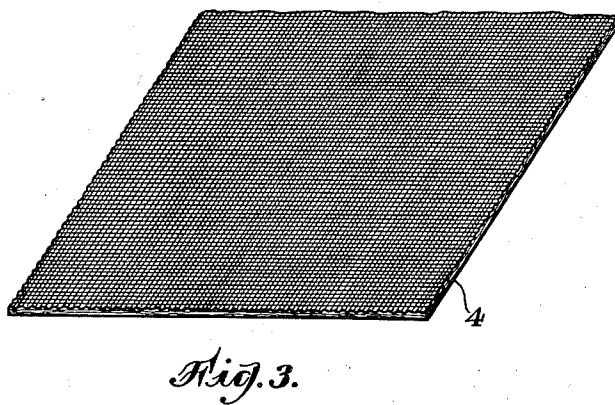
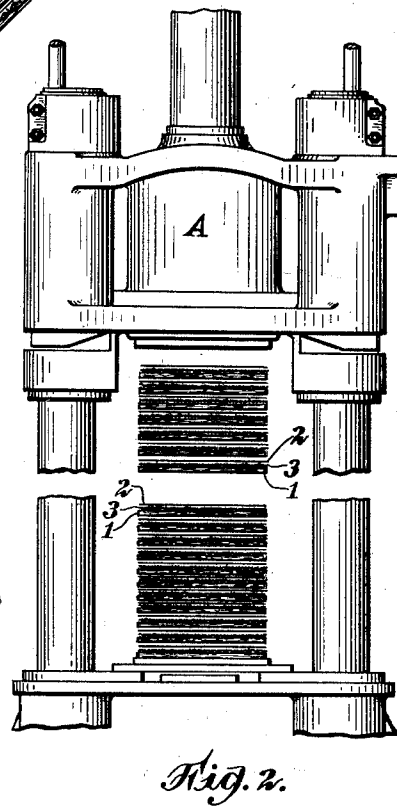
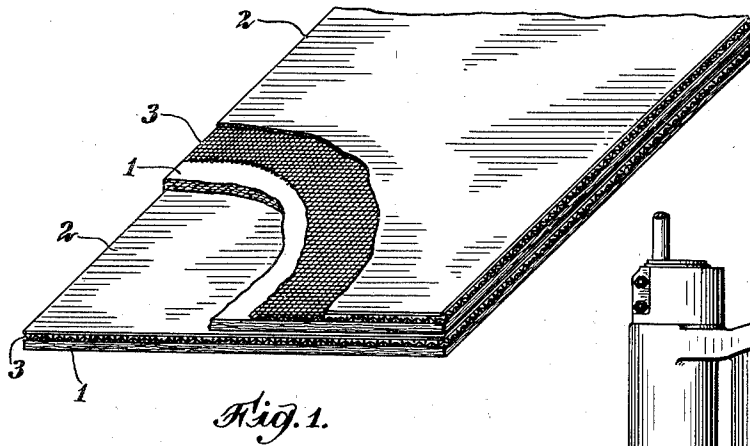
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FLEXIBLE WALLBOARD

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FLEXIBLE WALLBOARD

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4 Claims. (Cl. 92-61)

This invention relates to an improved sheet product and the method of making the same, especially to a strong but thin sheet of hydraulic cementitious material and reenforcing fibres associated therewith.

There has been made heretofore fibre-reinforced cementitious sheets or "boards" of asbestos and Portland cement. These are of great commercial importance. Such asbestos and cement sheets have been made, for example, as described in U. S. Reissue Patent 12,594 to Hatschek, reissued January 15, 1907.

While asbestos and cement boards have very desirable properties, there has long been needed, a method of making these sheets stronger for a given thickness and particularly means for making the sheets both strong and flexible.

I have now found means of accomplishing this desired object, as well as smoothing a surface of the sheets.

The present invention will be described particularly with reference to a product made initially as described by Hatschek, on a wetboard machine, a departure being made from the procedure of Hatschek in that the laminated sheet material first formed and containing composited relatively soft, easily united laminae is subjected to treatment first to weld the soft laminae together and then to densify the unitary product.

Certain features of the invention will be described in connection with the drawing, in which

Fig. 1 shows a perspective view, partly broken away for clearness of illustration, of laminated sheets of asbestos and cement board, metal plates, and screen wire in an assembly suitable for being subjected to strong compression;

Fig. 2 shows a side view, in part diagrammatic, of an assembly, of the type illustrated in Fig. 1, in position and ready for compression in a hydraulic press; and

Fig. 3 shows a perspective view of a portion of a finished sheet product made in accordance with the present invention.

In following the method of making sheet material described in the Hatschek patent, there is made first an intimate suspension of fibres of the type of asbestos, a hydraulic cementitious material of the type of Portland cement, and water, as in a conventional paper beater, with the beater roll spaced relatively far from the plate thereunder, in order to avoid excessive disintegration of the asbestos fibres.

The proportions of materials may be varied within limits. When asbestos and Portland ce-

ment are selected as raw materials, there may be used 15 to 75 parts by weight of the fibres to 100 parts of combined weight of fibres and cement. However, particularly good results have been obtained, with the procedure of the present invention, when the asbestos fibres and Portland cement are present in approximately equal proportions by weight.

Also, the asbestos used is preferably moderately long in average length of fibre. I have used to advantage chrysotile asbestos from Canadian mines showing the following results in the usual screening test:

Screen (meshes per linear inch)	Per cent (by weight)
On 2-mesh.....	0
Through 2-mesh and on 4-mesh.....	9
Through 4-mesh and on 10-mesh.....	60
Through 10-mesh.....	31

The suspension or intimate mixture from the beater is formed into a sheet on a drum, as by the method described in the said patent to Hatschek. The suspended materials are first picked up on a moving belt, of duck or the like, which passes through the suspension in a suitable tank. At a later stage in its travel, the belt passes over a roller and under and against the periphery of a collecting roller or drum and transfers thereto, in the form of a soft layer, the material picked up from the suspension. The process is repeated, the drum being rotated meanwhile, until the material transferred to the surface of the drum is adequate to make a finished sheet of desired thickness. The weight of the drum provides moderate compression and composites the soft laminae successively applied thereto, into a wet compressible sheet adapted to be self-sustaining. The material on the drum is then removed therefrom, as by being severed lengthwise of the drum, partially straightened out from the cylindrical shape, and separated from the drum by any convenient means.

The resulting product is laminated, the several laminae being constituted of the successively applied layers of material. In each lamina, the fibres are oriented, in predominating proportion, in direction generally parallel to the plane of the lamina. Furthermore, Hatschek describes the individual layers as being themselves somewhat laminated by the partial segregation therein of asbestos fibres and Portland cement.

Because the fibres in this process are so

thoroughly dispersed with the large volume of water, they are somewhat gelatinous and more difficult to dehydrate, as by pressing water therefrom, than fibres that have been dispersed less thoroughly in water.

I have found particularly desirable results from thoroughly consolidating the materials in the laminated sheet product made as described.

In effecting this consolidation, I assemble sheet material 1, made as described, a rigid plate 2 and a readily water-permeable member 3 adapted to permit the ready flow of water therethrough, such as a wire screen that may have, for example, 16 to 25 meshes to the linear inch. Such an assembly is illustrated in Fig. 1. In the assembly, the sheet material that is to be consolidated is disposed between the rigid plate 2 and the water-permeable member 3. Preferably, an assembly of a large number of these component elements is made, as illustrated in Fig. 2, and the assembly is strongly compressed hydraulically, as by the press indicated generally at A. During the compression, the water-permeable member 3 is in each instance disposed directly against, above or below, the sheet 1 which is to be compressed thereagainst and is substantially coextensive with the sheet; this provides for the ready removal through the water-permeable member 3 of water expressed from the sheet 1.

The compression is made at a very high pressure adapted to remove excess water from the sheet and weld together and consolidate thoroughly the several soft laminae of which a given sheet 1 is composed, to give a unitary product. Thus, there have been used pressures in excess of approximately two thousand pounds per square inch, say, of the order of three thousand pounds per square inch of sheet material being compressed. The higher the pressure, the greater will be the degree of consolidation of the materials of the sheet, within limits.

The compression is applied for a relatively long period, say, for a period of the order of ten minutes duration.

A typical wire screen 3 that has been used has 22 meshes to the linear inch, contains relatively heavy wire, of diameter 0.023 inch, and is rolled subsequent to being woven.

Such a wire screen has laterally extending closely spaced openings or outlets for fluid forced thereinto. Such a wire screen is to be distinguished from a conventional screen such as a perforated plate, in that such plates do not have laterally extending escape channels or outlets for fluid. Furthermore, such plates have substantial areas between the perforations; water being expelled from the sheet material behind such areas must pass laterally through the sheet before it can reach one of the outlets extending through the plate. The effect of using plates, having no lateral outlets or closely spaced perforations is seen especially readily when the pressing of plastic asbestos, cement and water compositions of the type described, for example, is made between imperforate metal sheets such as those illustrated at 3. The material pressed between such sheets is caused to flow in edgewise manner, that is, is squeezed out in part between the plates and caused to extend beyond the edges thereof. Also, as the water is caused to flow laterally through the sheet of material, the water opens cracks which are visible and cause areas of weakness in the finished hardened product.

A particular advantage arises in the present process and the product made thereby, from the

use of an assembly of a plurality of sheets to be compressed, as illustrated in Fig. 2. This assembly includes a plurality of composites including each a somewhat flexible metal plate 2 of plane surface, a wire screen 3, and the sheet material 2 disposed therebetween and contacting, on opposite sides, with the said plate and screen, respectively. The assembly yields somewhat as the pressure is applied; when such an assembly is compressed, the thickness of the assembly including compressible elements promotes yieldability and causes a slight give or flexing of the plates and sheets therein. The sheet material 1 becomes locked, at one surface, in gauze 2 and is prevented thereby from creeping or slipping laterally with respect to the gauze. On the other hand, the metal plate 2 of plane surface is free to shift appreciably, that is, to move slightly laterally over a large part of its area, with respect to the surface of the material 1 in contact therewith. The sheet material also may creep laterally on the one surface. The result is a substantial polishing action upon the said surface of the sheet adjacent to the metal plate 2. This effect may be further increased by alternately increasing and decreasing the pressure. Thus, the assembly may be compressed under substantially the maximum pressure, until the rates of flow of water and escape of air become very slow. Then the pressure is reduced, as, for example, approximately to atmospheric. After a few moments the pressure is again brought up approximately to the maximum.

Suitably the smooth surface of the sheet material as made on the Hatschek machine is placed against the plate in making the assembly for pressing as described above.

After the compression is completed, the pressure is released, the assembly removed from the press, the members 1, 2 and 3 are separated from each other, and the compressed sheets 1 are allowed to harden, to give a sheet product 4 such as illustrated in Fig. 3. It will be noted that one face of the sheet retains the impression of the wire gauze, the conspicuousness of the impression being somewhat exaggerated in Fig. 3, for the sake of clearness of illustration. If desired, the sheet may be repressed between plane plates to remove the impression of the wire. In being hardened, the sheets are stacked in alternation with plates 2.

The pressing to which the sheet material is subjected is preferably completed within about one hour of the time of forming the original laminated sheet.

Because the compression, as stated, is applied substantially uniformly over the entire sheet and because the excess of water is caused to escape also substantially uniformly from the entire sheet, without appreciable restriction, the sheet as taken from the hydraulic press contains the solid ingredients in uniformly, highly consolidated condition. In distinction from sheets made by prior practice, in which water is allowed to escape during the final or repressing operation only by lateral movement or in which the pressure is applied unequally over different areas of the sheet, the finished, hardened sheets made in accordance with the present invention are relatively uniformly strong and free from weak spots, such as commonly observed in sawing through commercial sheets, and are very much stronger on the average than previously made asbestos cement sheets of the same thickness.

Thus, there have been made, by the present method, sheets having a modulus of rupture aver-

aging about 6,830 to 7,260 pounds to the square inch as compared with a modulus of rupture averaging about 4,250 pounds for typical standard asbestos and cement wallboard previously made. Furthermore, sheets made by the present invention have been found to have an impact resistance of 61.9 units as compared with 29.2 comparable units for the standard wallboard. The improved sheeting is very flexible and adapted, therefore, to yield somewhat before breaking. Also, the strength of the improved product is such that it may be made as thin as one-sixteenth inch, for example, and yet be sufficiently strong for use as the facing material in a partition of an office building or the like. Such thin material is adapted to be sawed and applied readily, by nailing, to a supporting sub-structure. Finally, the improved product has a hardness, expressed in standard units, that ranges from about 18 to 23, as compared to 15.9 for conventional asbestos and cement wallboard.

The invention is not limited to any theory of explanation of the surprising results obtained. The magnitude of the improvements realized remain not fully understood with certainty justifying commitment of the invention to any theory of explanation.

It will be understood that the details given are for the purpose of illustration, not restriction, and that variations may be made within the scope of the appended claims.

What I claim is:

1. In making a fibre-reinforced cementitious product, the method which comprises forming a composition of asbestos fibres, Portland cement and water into soft laminae containing fibres oriented in predominating proportions in a direction generally parallel to the plane of the several laminae, combining the soft laminae into a sheet under low pressure, strongly compressing the sheet between a water-permeable member of the type of a wire screen and a somewhat flexible metal plate of plane surface, causing the said sheet to become locked on one face in the said screen, causing the said plate, under high pressure, to move slightly laterally with respect to the surface of the said sheet, releasing the pressure,

separating the said screen from the said sheet, and allowing the sheet to harden.

2. In making a fibre-reinforced cementitious product, the method which comprises forming a composition of asbestos fibres, Portland cement and water into soft laminae containing fibres oriented in predominating proportion in a direction generally parallel to the plane of the several laminae, combining the soft laminae into a sheet under low pressure, strongly compressing the sheet between a water-permeable member of the type of a wire screen and a somewhat flexible metal plate of plane surface, causing the said sheet to become locked on one face in the said screen, causing the said plate, under high pressure, to move slightly laterally with respect to the surface of the said sheet, releasing the pressure, reapplying and again releasing the pressure, separating the said screen from the said sheet, and allowing the sheet to harden.

3. A strongly compressed and consolidated sheet comprising asbestos fibres and Portland cement in hardened condition, being constituted of a plurality of laminae containing the said fibres oriented predominately in direction generally parallel to the plane of the several laminae, having a smoothed surface, and being identical with the product resulting from the process described in claim 1.

4. In making a sheet product, the method which comprises forming an intimate mixture of asbestos fibres, a hydraulic cementitious material of the type of Portland cement, and water in excess, forming the mixture into a sheet, disposing against a face of the sheet a wire gauze substantially coextensive with the sheet and provided with closely spaced openings and with laterally extending water-escape channels, strongly compressing the sheet against the wire gauze at a high pressure applied substantially uniformly over the sheet, so as to force water from the sheet and into the said openings and escape channels and to form an approximately uniformly compressed sheet, and then allowing the sheet to harden.

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