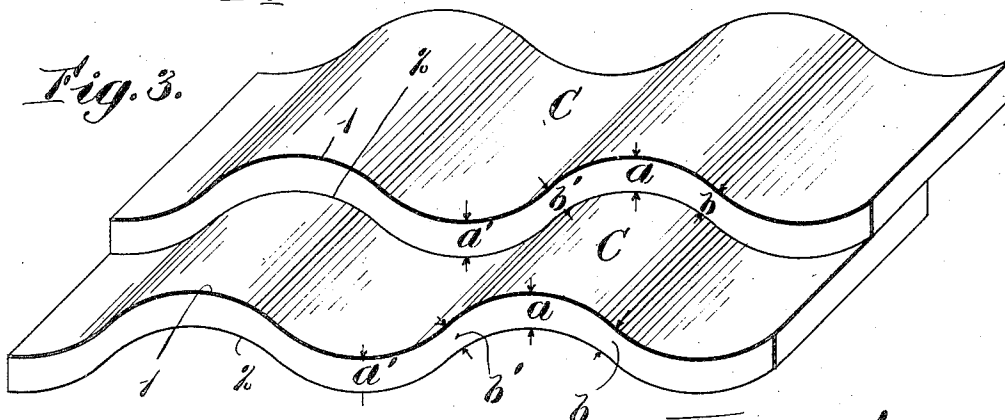
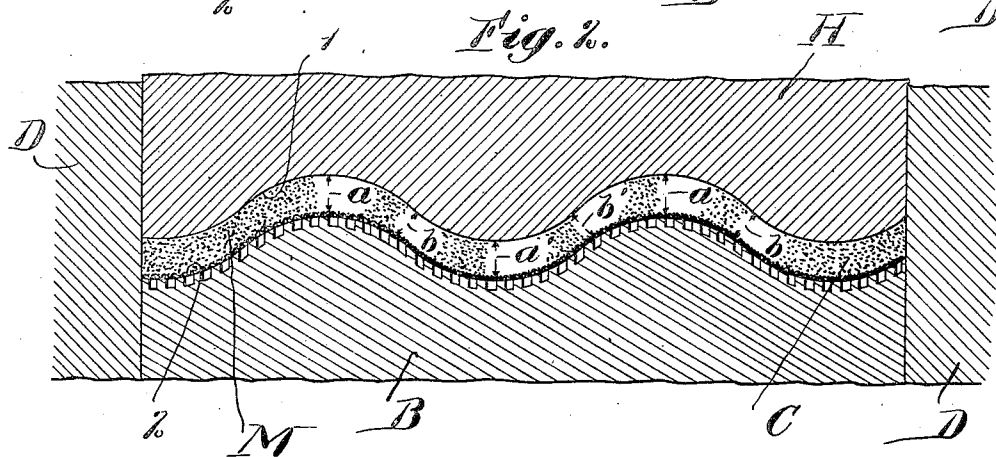
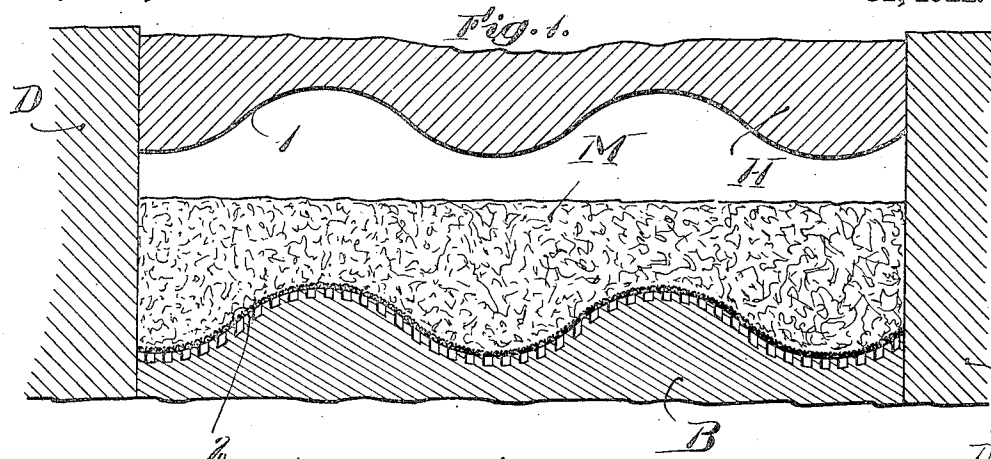


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 CORRUGATED SHEET OF FIBER CONCRETE AND METHOD OF MAKING IT.
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1,433,864.

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UNITED STATES PATENT OFFICE.

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CORRUGATED SHEET OF FIBER CONCRETE AND METHOD OF MAKING IT.

Application filed June 9, 1921. Serial No. 476,204.

To all whom it may concern:

Be it known that I, SAMUEL A. WILLIAMS, a subject of the King of Great Britain, and resident of Lockport, in the county of Niagara and State of New York, have invented new and useful Improvements in Corrugated Sheets of Fiber Concrete and the Method of Making Them, of which the following is a specification.

My invention relates to the manufacture of corrugated sheets of plastic and, preferably, refractory material for building and similar purposes, of which the material commercially known as "corrugated transite" is an example. Such material, made in rectangular corrugated sheets, is used in substantially the same manner as corrugated iron, but by reasons inherent in its structure and composition, has to be made considerably thicker than corrugated iron. The usual thickness of corrugated sheets of refractory building material is about one quarter of an inch; as sheets of this character are usually lapped one over the other when placed on a building frame, whether as siding or roofing, the undulating surface of one sheet should have the same contour as that of the sheet over which it laps, both for the sake of close fit and tightness to weather, and for secure fastening. As either side of one sheet may be lapped in contact with either side of another, it follows that on each sheet, the contour of each side should be a matrix for the other; in other words curved linear elements, taken at right angles to the lines of corrugation, should be practically identical on both sides of a sheet. Such conformation has hitherto been obtained, and sheets so made are therefore thicker at the crowns of the corrugations than at the portions where the curve of corrugation reverses.

So far as I am informed, corrugated sheets of material of the general character specified have hitherto been made by passing "green", i. e. freshly made, wet, and soft, sheets through corrugating rolls, and allowing the sheets thus corrugated to set while resting on suitably corrugated forms which support the corrugations and prevent them from being deformed by sagging, until the cementitious material in the sheets has become permanently set. The flat sheets which have thus been mechanically shaped have been either laminated sheets of asbestos fiber paper saturated with water containing a hydraulic cement in suspension, or pressed

non-laminated sheets, such as the asbestos wood, commercially so-called. In either case, or with either starting material, the flexion of the "green" sheet under the action of corrugating rolls disturbs the structural relation between fibers and cementitious material, especially at the crowns of the corrugations, where the tendency of fibers to draw apart at the outer portions of each curve is manifested by subsequent weakness of the sheet at these crowns, if not by visible cracks in the material. Moreover, as the two surfaces of such a sheet must be as nearly as possible identical in contour, the regions midway between successive maxima of the repeated curve must be pressed thinner than the material at the maxima; and while the material is "green" and to some extent plastic, it cannot flow in response to the action of the rolls without interior dislocations of the structure originally formed as a substantially flat felted or compacted sheet.

The object of my invention is to produce a corrugated sheet of fiber concrete material, possessing the requisite identity in curvature at the two sides, non-laminated, homogeneous in density, and of uniform internal structure throughout.

The terms in which this object is stated eliminate the laminated or paper-board type of material. In order to produce a corrugated sheet having the above named characteristics, the material must be made to assume an approximation to its final form while still freely fluid, in order that pressure exerted on it shall be uniform at all points. I accomplish the desired results by press-molding the corrugated sheet initially into the undulated form, in a filter press provided with a filter bed and press-head having the desired complementary undulated surfaces. The operation of this press involves a new method of manipulating the fiber-concrete material, and the product is itself a novelty, though superficially resembling the corrugated fiber-concrete sheets which have been on the market for a considerable time. The apparatus process or method, and product are all described herein, the method and product are herein claimed, while the apparatus is the subject of claim in an application for United States Letters Patent, filed by me concurrently herewith, serially numbered 476,205.

In the drawings hereto annexed, which illustrate my invention,

Figure 1 is a view in vertical section of parts of a press, including the mold box, filter bed, and press-head, the press-head about to descend upon a mass of fluid fiber-concrete material.

Figure 2 is a similar sectional view, showing the press-head in its lowermost position, and

Figure 3 is a perspective view of portions of two corrugated sheets, such as produced in the press, illustrating their relationship when lapping one another.

For clearness in illustration, the drawings show the press and sheets in practically full size as regards contour of corrugation and thickness; in practice the press-bed will be of much greater extent than here indicated. The press itself, comprising all the accessories to the operation of the press-head, box, and filter bed, is not shown, as this will be of the usual type of hydraulic press.

The mold-box is represented by D, D; the filter bed by B, the press-head by H. The surface 1 of the bed and 2 of the press-head are undulated or corrugated, and are complementary, so that if the head were brought into contact with the bed, the two surfaces would fit each other. The fiber-concrete material is represented in Figs. 1 and 2 by M, the finished product in Fig. 3 by C, C.

The material M, which may be any suitable wet fiber-concrete mixture, as for instance one comprising short asbestos fibers or ground serpentine, magnesia, and water, is a wet fluid mud, containing a great excess of water over the quantity required for setting the cementitious material, and therefore flows readily and promptly in response to the displacements occasioned by the intrusion of the salient ridges of the press-head. Thus, when the press-head first acts upon the material M, the latter flows and completely fills the space between the press-head and filter bed. The initial pressure, which begins to force the excess of water in the material through the perforated or reticulated covering of the filter bed, is communicated to all parts of the material and at any point therein is exerted equally in all directions, in obedience to the laws of behavior of liquids. Practically so, that is: The solid materials, fiber and cement, which with the water form a thin mud, produce a condition analogous to viscosity, but nevertheless the mud is sufficiently fluid before pressure-filtration, to produce the distributions and equalization of pressure substantially as if the mud were a homogeneous liquid.

As the press-members approach each other the fluid mobility of the material diminishes, but progressively as the requirements of flow diminish. Or the situation may be described thus: That as the viscosity of the material increases, the necessity and op-

portunity for flow from regions of higher to those of lower pressure diminish. The relative difference in thickness of the mass at the crown-portions of the corrugations and at the portions intermediate between the crown-portions, respectively, is established while the material is in its initial and more fluid stages. As the fluidity of the material diminishes, so that, by reason of the curved outlines of the press-head and filter bed the pressure normal to the surfaces of the material varies from a maximum at the crowns to a minimum at the regions of curvature reversal, the quantity of water remaining to be expressed from the solids becomes, by reason of variation in thickness of the material, proportionally less per unit of volume at the thinner parts than at the thicker so that the pressures at the thinner portions are adequate to express water thence as completely as the higher normally exerted pressures at the thicker crowns. Thus, despite the curved conformation of the finally compressed sheet, its structure is uniformly dense throughout, and the intrinsic strength of the material, after setting, is conserved.

The relative values of the normally exerted pressures on the material at the final instant of compression, are indicated by the dimension lines *a* and *b*, *a'* and *b'* in Fig. 2; these lines likewise indicate the thickness of the sheet C shown in Fig. 3.

On removal from the press, the fiber-concrete corrugated sheets are laid, one upon another, the bottom sheet resting on a corrugated bed plate, which fits the corrugations of the sheet and supports it while setting.

Fiber-concrete sheets, made in the manner above described, are much stronger and resistant to any stress, than corrugated sheets made as heretofore by roll-corrugating sheets of the same kind, originally pressed in the flat, and stronger still in comparison with lamented, roll-corrugated sheets, made of material of similar character and constituents. The corrugated surfaces of these new sheets are, moreover, more true to form than those of roll-corrugated sheets; therefore the improved corrugated sheets fit more exactly together when lapped, and are more effectively weather-tight. The close interfitting of thin corrugated surfaces is illustrated in Fig. 3.

The above described method is subject to no practical limitation in respect to the thickness of the corrugated sheet to be manufactured. Corrugated sheets of any desired thickness can be thus produced, and will, through the operation of the method, be uniform in density and structure and, in particular, homogeneous in regard to the distribution and binding relationship of fibers incorporated in the sheets. By what-

soever process manufactured, flat sheets of the general character described cannot practically be corrugated unless thin enough to conform to the corrugating rolls or other instruments without undue rupture at the convexities. In no case can flat sheets be corrugated without being subjected to such internal and local strains as disturb their original homogeneity and strength.

10 What I claim and desire to secure by Letters Patent is:

15 1. Method of forming corrugated sheets of fiber-concrete, characterized by initially confining a mass of fluid fiber-concrete material and water in a space of which opposite sides are complementally corrugated, progressively expressing the water by compressing said opposite corrugated sides toward each other, thus causing the confined

material to flow in the contracting space 20 with increasing viscosity as the compression progresses, and producing uniform density and internal structure in the finally compacted material.

2. Unitary, non-laminated, fiber-concrete 25 sheet, corrugated, uniform as regards density and fiber-distribution.

3. Unitary, non-laminated, fiber-concrete sheet, corrugated, uniform as regards 30 density and fiber-distribution the two undulating surfaces of said sheet being substantially identical in contour, so that either surface of such sheet will fit either surface of a similar sheet.

Signed by me at Boston, Massachusetts, 35 this fourth day of June, 1921.

SAMUEL A. WILLIAMS.