May 8, 1945. G. B. BROWN 2,375,276

METHOD FOR TREATING SHEET MATERIALS

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Fig. I.

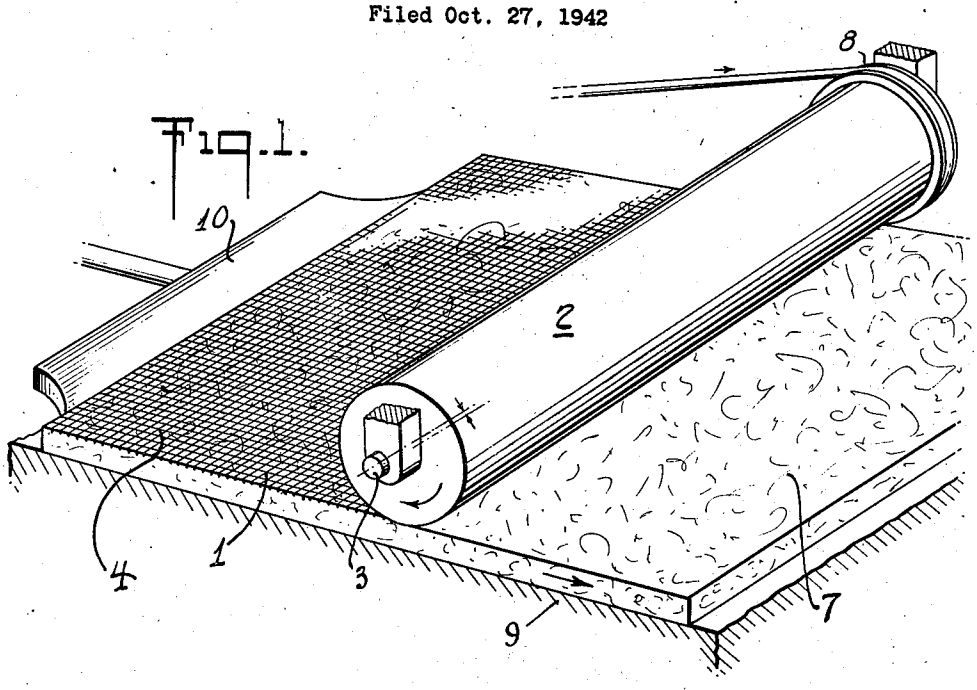
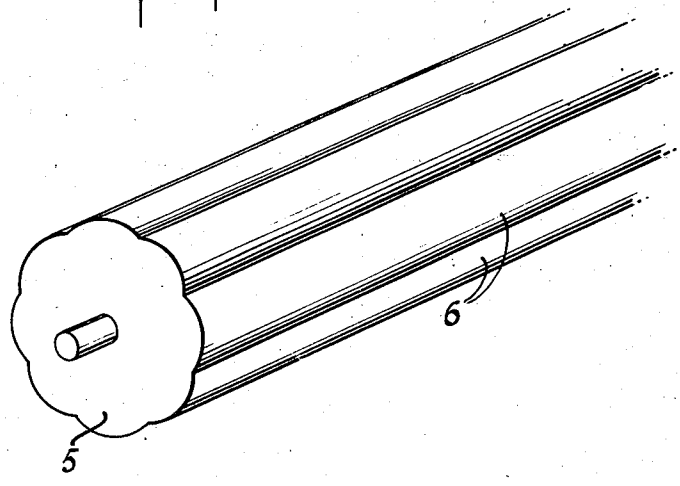


Fig. II.



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METHOD FOR TREATING SHEET MATERIALS

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2 Claims. (Cl. 25—154)

The present invention relates to the manufacture of fibro-cementitious sheets, and is more particularly concerned with an improved method for smoothing the surfaces of fibro-cementitious sheets and other shapes.

A primary object of the invention is to provide an effective method for imparting smooth surfaces to fibro-cementitious sheets and other shapes.

Fibro-cementitious sheet materials of the type now manufactured for use as interior wall linings and for similar purposes have surfaces which are frequently so rough as to require smoothing as by sanding or other treatment, preparatory to application of finishing or decorative coatings of paint and the like. The fibres employed in the manufacture of such sheet materials may be vegetable fibres such as wood fibre, or mineral fibre such as asbestos; and the cementitious bonding agents may comprise inorganic binders such as Portland cement, hydrated lime, or gypsum, or organic binders such as phenol-formaldehyde resin or other synthetic or natural resin. Frequently the sheet material also embodies inert filler substances such as finely-divided silica. One method frequently used for manufacturing fibro-cementitious sheet material is to deposit a mixture of fibres and cement from an aqueous slurry on a pervious screen, and after forming a sheet of suitable thickness, to compress, densify and partially dewater the sheet by means of a pressure filter mold. The final manufacturing operation is that of subjecting the sheet to heat-curing or other suitable treatment whereby to set and harden the cementitious bond.

Both continuous and discontinuous methods have been employed in the manufacture of fibro-cementitious sheets; and the sheets produced by such methods generally have rough and irregular surfaces. Such irregularities or imperfections in the sheet surface frequently include the impressions of wire mesh screens or other pervious elements employed in the sheet forming operation.

Conventional methods which have been used in an effort to remove such irregularities and to impart a smooth surface to the sheet have been found in practice to be generally costly and impractical or unsatisfactory. For example, the use of wire brushes or sand or other abrasives applied to a completely hardened sheet has proven to be a costly and time-consuming operation, and one which frequently imparts to the surface under treatment disfiguring marks or scratches which are as objectionable as the irregularities which it is sought to remove. The use of calender rolls or conventional troweling devices for smoothing incompletely hardened sheets has also proven to be ineffective, costly and time-consuming, and to frequently involve undesirable stretching of the sheet under treatment.

A more specific object of the present invention is therefore to provide an improved method whereby the surfaces of substantially rigid but incompletely hardened fibro-cementitious sheets may be smoothed without stretching or otherwise changing the dimensions of the sheet, by a single, rapid and efficient operation which may be continuous.

With the above and other objects and features in view, the invention consists in the improved method and means for smoothing the surfaces of fibro-cementitious sheets, as hereinafter described and more particularly defined in the accompanying claims.

In the attached drawing, which illustrates an embodiment of the invention, and wherein like reference characters designate like parts:

Fig. I is a diagrammatic perspective view of apparatus adapted for carrying out the process of the invention; and

Fig. II is a perspective view of a modified type of smoothing roll which may be substituted for the cylindrical roll in the apparatus illustrated in Fig. I.

The surface smoothing method which forms the subject of this invention is particularly adapted to the surface treatment of cementitious sheet materials containing reinforcing fibre. Examples of such sheet materials are fibro-cementitious building shapes and sheets containing 20%–50% asbestos or vegetable fibre, together with a cementitious lime or Portland cement binder and an inert filler such as finely-divided silica.

The present method is particularly adapted for treating the surfaces of fibro-cementitious sheets having a high fibre content. As the proportion of fibre is decreased, the advantages of the present method of smoothing the surfaces of the sheet material are proportionately reduced, although if the material has any substantial amount of fibre present in the areas adjacent the surface to be smoothed, the invention will give better results than conventionally known methods for smoothing such surfaces. Generally, the length of the fibre as used in the sheet material affects the operation of the invention in the same manner as does the amount of fibre used; that is, the longer the individual fibres present in the material, the more effective is the invention over conventional smoothing methods.

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In the following description, the method will be described as applied, for example, to a fibrocementitious sheet which has been formed by pouring a slurry suspension of fibres and cement into a mold having a perforated bottom covered with a wire mesh screen of sufficient fineness to prevent the fibre-cement mixture from passing therethrough while permitting drainage of water from the mold under applied molding pressure. After the sheet has been thus formed, it is permitted to set to a stage at which it is incompletely hardened, but sufficiently rigid to retain its shape and form without support. While in this incompletely hardened stage the sheet is advanced at a predetermined uniform rate over a supporting surface and the improved smoothing treatment of the present invention is applied to the exposed upper surface of the sheet by subjecting such surface to the rapidly repeated impact rubbing and troweling action of a high-speed rotary cylindrical roll segment troweling element. When the dimensions and curvature of the troweling element and the relative spacing and directions and rates of movement of the troweling element and sheet are properly adjusted, such rotary troweling action is effective for smoothing the surface of the sheet and for eliminating any imperfections therein, including imperfections caused by contact with a wire screen during the sheet-forming operation.

The action of the rotary cylindrical roll segment troweling element consists essentially in repeatedly striking the surface of the sheet at closely spaced intervals of space and time in such a manner that the incompletely hardened and still semi-plastic material at the roughened face is leveled off and burnished without displacing the fibres in the surface area and without pulling the fibres away from the cementitious bonding medium. This improved smoothing action may be secured by impacting the surface of the sheet at rapidly repeated time and space intervals with a cylinder segment troweling surface carried by a roll or equivalent means which is rotatably mounted transversely to the direction of sheet travel.

One suitable apparatus construction is illustrated in Fig. I, in which is shown a smoothing roll 2 of approximately 2 inch diameter mounted on bearings above the surface of a sheet 1 to be smoothed. Roll 2 extends transversely across the direction of travel of sheet 1 and parallel thereto, with the axis of its shaft 3 off center approximately 1/64 inch with respect to the axis of the roll 2. The distance separating the surface of the sheet 1 from the axis of rotation of roll 2 may be adjusted so that when rotated on shaft 3, the eccentric portion of the surface of the roll will impact and penetrate into the surface of the sheet to a depth approximately equal to or slightly less than the maximum depth of recesses or imperfections 4 in the surface of the sheet. The roll is then rotated by suitable driving means 8 at a rate of approximately 2000 revolutions per minute; and the sheet is simultaneously advanced over a supporting element 9, as by the action of a pusher 10, in a direction opposite to the direction of rotation of the roll at their zone of contact, at a speed of approximately 20 lineal feet per minute. When the roll rotates in a direction opposite to the direction of travel of the sheet at their zone of contact a very effective smoothing action is effected. When both the roll and the sheet are moving in the same direction at their zone of contact, the rapidly rotating roll has a tendency to accelerate the speed of the sheet and this has an adverse effect on its smoothing action. While the diameter of the smoothing roll 2 may be varied to some extent, it is important that that portion of the roll surface which functions as a troweling element have a sufficiently small arc length and small radius of curvature so that the interval of contact with the sheet is comparatively short, and so that the energy which is transmitted to the sheet is primarily that of rapidly repeated impact troweling tending to burnish the surface. On the other hand, the radius of curvature of the troweling surface portion of the smoothing roll should be sufficiently large to effect a definite troweling action and to force the somewhat plastic material at the surface of the sheet into surface depressions so as to smooth the surface without developing transverse ridges or other irregularities.

The modified form of smoothing roll which is shown in Fig. II comprises a roll 5 having on its outer surface a plurality of uniformly spaced, rounded or arcuate ridges or projections 6 having their major axes of curvature extending longitudinally of the roll surface and parallel but eccentric with respect to the roll axis. This type of roll has the advantage over the roll of Fig. I that it may be driven at a lower speed and may have a greater diameter, since it is provided with a greater number of troweling or striking surfaces. The rate of rotation of a smoothing roll of this type may be varied in inverse proportion with the diameter and with the number of troweling or striking surfaces. The curvature of the troweling surfaces or projections should be large enough to effectively trowel the surface of the sheet without being so large as to dislodge or displace the surface fibres 7. An optimum radius of curvature for these troweling surfaces is about one inch.

It will be noted that only a short peripheral portion of each of the troweling surfaces or ridges of the rolls illustrated in Figs. I and II actually contacts the surface of the sheet 1 during any single revolution of the roll. Consequently it is not necessary to employ rolls of the type illustrated for the troweling operation, because this operation can be effected by a single cylinder segment of substantially less than 90° subtended angle mounted for rotation about a supporting axis suitably spaced from the sheet surface so as to insure impact contact between the troweling surface and the sheet for a short period during each revolution about the axis, and troweling to a suitable depth of approximately 1/64 inch maximum.

The troweling action of the eccentric troweling roll which is shown in Fig. I is effected by a comparatively small segment of the roll surface having an arc length which may not substantially exceed ½ inch, and which is spaced from the axis of rotation a distance greater than any other part of the roll surface. Each of the uniformly spaced longitudinally extending ridges 6 on the surface of the troweling roll 5 illustrated in Fig. II forms a cylinder segment located at the line of greatest radial distance from the axis of rotation, which cylinder segment functions as a troweling surface. It will be recognized that these cylinder segment troweling surfaces need not be carried on the peripheries of rolls such as shown in Figs. I and II, but will perform their troweling function just as well when individually mounted on the ends of cranks, or with any other equivalent mounting which enables the troweling surface to impact the surface of the sheet for only

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a short portion of each revolution of the supporting shaft, so that the period of contact of the troweling surface with the sheet surface is followed by a longer interval in which the sheet is permitted to advance without contact by a troweling element, prior to the delivery of another troweling stroke either by the same troweling element or by a second troweling member. Thus, the terms "cylinder segment" or "arcuate roll segment" are herein employed to define a cylinder or roll segment having an arc length equivalent to a subtended angle which may be very much smaller than 90°, and having a substantially cylindrical outer surface curvature.

It is desirable that the speed of rotation of the cylinder segment troweling element be so adjusted relative to the speed of advance of the sheet that the sheet advances not substantially more than ⅛ inch between successive revolution impacts of the troweling element. This adjustment insures a substantial overlap between one troweling stroke and the preceding and succeeding troweling strokes. It is also desirable that the radius of curvature of the cylinder segment troweling surface be not substantially less than 1 inch or more than 1½ inches, and that the depth of penetration of the troweling surface in the sheet surface be not substantially greater, and preferably slightly less, than the maximum depth of surface imperfections.

While the invention is directed to the problem of smoothing the surfaces of fibro-cementitious sheets in which there is a comparatively high proportion of cementitious bonding medium, the method herein described has also been found to be effective when applied to a fibrous sheet composed almost entirely of fibres such as the conventional insulating sheet known as fibreboard. In treating a sheet of this type, the surface smoothing effected may result primarily from multiple impact compression of the fibres rather than from any troweling displacement of material into the surface recesses. In any event, when the present method is applied to the surface of fibreboard the imperfections in the surface of the board are markedly reduced and the smoothness of the board is considerably increased.

The details herein set forth are only for purposes of illustration and the invention is to be limited only by the scope of the appended claims.

What I claim is:

1. A process for smoothing a rough surface of a substantially rigid but incompletely hardened fibro-cementitious sheet which comprises, advancing the sheet continuously at a predetermined uniform rate past a troweling station, applying to the surface of said sheet, at said station, a rapid succession of short, arcuate troweling impacts, the direction of application of said impacts being counter to the direction of sheet travel, and the arcuate path of travel of said impacts extending into the surface of said sheet to a depth not greater than that of the deepest surface irregularities, the rate of advance of said sheet, the frequency of said impacts and the arcuate path thereof being so controlled that the entire area of sheet surface passing said station is leveled and burnished without displacing or pulling the fibers away from the bonding material and without stretching or otherwise changing the original dimensions of the sheet.

2. A process for smoothing fibro-cementitious sheet surfaces as defined in claim 1, in which the rate of advance of said sheet and the frequency of application of said troweling impacts are controlled to deliver impacts to the sheet surface each time the sheet advances a distance not substantially greater than ⅛ inch.

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