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(54) METHOD AND APPARATUS FOR PRODUCING CLADDING SHEETS WITH AN EMBOSSED PATTERN THEREON

(71) We, JAMES HARDIE & COY. PTY. LIMITED, a Company incorporated under the laws of the State of New South Wales, Australia, of "Asbestos House", Corner of York and Barrack Streets, Sydney, New South Wales, Australia, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method and apparatus for producing cladding sheets with an embossed pattern thereon, particularly, but not exclusively, sheets formed of an asbestos-cement material (hereinafter called "cladding material" sheets). The embossed pattern may be in simulation of wood graining, carving or engraving, and may take the form of striations, geometrical designs, floral designs, words or figures, or any other forms amenable to formation in depth in a sheet surface; that is, delineations which while not penetrating deeply into the sheet material from an outer surface thereof, are nevertheless three-dimensional, as distinct from being merely superficial as is the case with painted, printed or like ornamentations.

Cladding material sheets of the kind to which the present invention applies, are sheets usable as cladding sheets for buildings, wallboards, partitionings and the like, provided the sheets are of the kind formed by "sizing" or progressively building-up a thin film-like web on a roll (known in the art as a "size" roll) into the required sheet thickness severing the cylindrical sleeve thus formed in the direction parallel to the axis of the roll, then peeling the severed sleeve from the roll, and conventionally treating it (for example, curing) to give the required finished sheet. The invention is thus applicable to a number of cladding material sheets such as those in which paper, timber pulp

or other materials predominate; the cladding material essentially being one which at some stage of reduction to solid form is soft enough to accept impressions and then set or harden to the final solid condition. However, the invention is primarily intended for application to cladding sheets of asbestos-cement, and will be described herein mainly in terms of that particular application.

A common way of making asbestos-cement sheets (that which is relevant to the present invention) consists in the formation of a thin, wet, film-like web of asbestos-cement stock (about 0.5 mm thick, for example) which is wound, like a wet paper, on a size roll until the wound material is of such thickness as will provide the required thickness of the finished sheets. The axial length of the size roll is somewhat greater than the width required of the finished sheets and the circumference of the roll is somewhat greater than the length required of the finished sheets. The size roll has a longitudinally extending groove in its outer surface, and this groove houses a parting wire. When the required thickness of stock has been wound on the roll, the parting wire is mover radially outwardly so to sever through the cylindrical sleeve built up on the roll. The severed stock layer, or sleeve is then peeled from the roll, laid out flat, edge trimmed to sheet size and cured to hardness.

In the work which led up to the present invention consideration was given to formation of the size roll surfaces itself as a counterpart or mould for the required cladding material sheet patternings. This expedient was rejected however because of its shortcomings: the cost of machining or otherwise patterning the roll surface was economically prohibitive; once counterpart patterned in one design, the roll was useless not only for production of other designs, but also for the production of conventional smooth surfaced sheets; and, there is great

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difficulty in giving a patterned roll surface a sufficiently smooth surface finish as will ensure ready peeling of the severed sleeves from the roll.

5 According to the present invention in one aspect there is provided a method of producing cladding material sheets with an embossed pattern thereon, said method comprising the steps of:—

10 (a) forming a flat bendable mould layer with at least part of one face having a raised pattern thereon to form the required embossed pattern on the cladding material sheet,

15 (b) closely wrapping said mould layer, with its patterned face outermost, about a rotatable size roll,

(c) removably securing the wrapped mould layer to said size roll by separably attaching one end of the mould layer, which is to be the leading end thereof when said roll is rotated, to said roll, and by applying restraints to the side edges and the other end of said mould layer to prevent radially outward movement thereof relative to said roll,

25 (d) progressively building up a soft cladding material sleeve of required thickness on said wrapped size roll from a film-like web of soft cladding material, and

30 (e) severing said sleeve in a direction parallel to the roll axis, removing said severed sleeve from said wrapped size roll and then conventionally treating the removed sleeve to provide a finished, cladding material sheet with an embossed pattern formed by the raised pattern thereon.

The flat, bendable moulding layer is made of any appropriate material able to have the required pattern impressed in one of its surfaces, or one which of its own nature displays and provides the pattern required.

40 In this last category the mould layer may be a sheet of canvas or other woven material, a wire mesh material, a layer of striated ply-wood, a deeply etched metal sheet, or any other material provided it be one having a patterning or texture able to give the required patterning in the finished cladding material sheet, and provided it is sufficiently bendable to be amenable to being wrapped about a size roll and to being secured thereto. With such a mould layer the step of forming it may consist in no more than cutting it to size for application to the size roll.

55 It will be understood that a mould layer could be of such size as to fully envelope the size roll yet have some of its work surface quite smooth and the remainder selectively embossed as may be required.

60 The mould layer may be made of any of several different plastics materials such, as that known as "ABS" (Acrylonitrile butadiene styrene. For preference however, the

moulding layer is made from an epoxy resin reinforced with glass fibres. 65

In carrying the invention into practical effect a flat moulding bed is prepared with its upper surface patterned in direct accordance with the patterning to appear on the cladding material sheet. The moulding bed may be of any material to which the required patterning may be readily applied, or which of itself is already of that required patterning. One suitable bed material is timber, and if the required patterning is one in simulation of timber graining, the timber is selected accordingly, it being necessary, of course, for the grain to stand out sufficiently to give the required three-dimensional effect for the eventual patterning; alternatively, the grain may be "brought up" by sand-blasting the timber so that the softer portions are eroded more than the harder parts. 75

If ABS is employed, a sheet of that material may be heated to soften it and then simply pressed on to the moulding bed. 85

For preference, the mould layer is made of an epoxy resin reinforced with glass or other fibres which may be in the form of regularly or randomly laid rovings, or one or more layers or mats of woven fabric. 90

In preparing the reinforced epoxy mould layer, the moulding bed is preferably waxed and coated with a release agent. The wax may be any beeswax paste provided it does not contain any silicone oil. It may be that sold under the Registered Trade Mark "traffic wax" and it is applied by brushing sparingly so as not to fill in the mould pattern. 95 100

The release agent may be any polyvinyl alcohol solution preferably contrastingly coloured to be distinguishable when applied to the waxed surface. This agent may be that commonly known as "Red release agent". It is sparingly and evenly applied to the waxed bed; that is, so that there will be substantially no build up in the pattern cavities. 105 110

When the release agent is dry to the touch, the mould layer material is applied to the moulding bed.

By way of example, a suitable moulding layer material may be prepared by mixing 115 6 Kg. of epoxy resin (e.g. that sold under the Registered Trade Mark Epikote 828) with 1 Kg. of a plasticiser (e.g. that known as Corflex 400). These are stirred until the mix is clear, and then 4 Kg. of a hardener (e.g. that known as Polymid 75) is added. This final mix is then stirred until it becomes clear (following the initial pearly appearance which arises upon addition of the hardener). 120 125

The final mix is poured onto the prepared horizontal moulding bed and spread evenly thereon by use of a paint roller or a plastics scraper. The reinforcement mat is

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then applied and "wetted down"; that is, thoroughly wetted by and immersed in the final mix, by use of a plastics scraper, spatula or the like. In this action the applied materials are well worked so to ensure freeing of bubbles. Before setting of the applied final mix, a further layer of reinforcing material may be added and wetted down by further addition and working of final mix. Such addition is preferably made but with consideration for the desirability of the eventual mould layer being about $\frac{1}{8}$ inch in thickness.

The mould layer is allowed to cure (simply being left overnight will usually suffice) and then carefully separated from the moulding bed to avoid breakage or cracking. This is best done by prising clear one end of the mould layer and then rolling a dowel stick or plastics tube between it and the bed for the full length of the bed. Although eventually separated from the bed, the mould layer is preferably left on the bed while its exposed face is levelled (where necessary) by scraping, planing or otherwise. The mould layer is then edge trimmed to size by use of tin snips and finish planing.

According to the present invention in another aspect there is provided apparatus for use in producing cladding material sheets with an embossed pattern thereon, comprising a rotatable size roll, a mould layer which has a raised pattern on one face and which is closely wrapped about and secured to said size roll with its patterned surface outermost, said mould layer being removably secured to said size roll by a separable fastening whereby that end of the mould layer which is its leading end, when said roll is rotating, is attached to said size roll, and by means whereby the side edges and the other end of said mould layer are restrained against radially outward movement relative to said size roll, a drive mechanism to rotate said wrapped size roll, and means for feeding a film-like web of soft cladding material on to said wrapped size roll, during rotation thereof, thereby progressively to build-up, on said wrapped size roll, a soft cladding of required thickness.

Following its preparation as described above, the mould layer is then wrapped about and removably secured to the size roll. This action will now be described, by way of an example, with reference to the accompanying drawings, in which:—

Figures 1 and 2 are side and end elevations respectively of a conventional size roll and a mould layer according hereto applied to it. Figure 3 is a fragmentary sectional elevation taken (on an enlarged scale) on line 3—3 in Figure 1.

Figure 4 is a fragmentary side elevation projected from Figure 3, and

Figure 5 is a fragmentary radial section taken (on the same scale as Figures 3 and 4) on line 5—5 in Figure 2.

The mould layer 6 is mounted on the size roll 7, with its patterned surface outermost, so that it will be securely applied, but nevertheless free to move, relative to the size roll surface, sufficiently to accommodate overall dimensional changes due to expansion and contraction.

Thus the leading end of the wrapped mould layer 6 is hinged to the roll 7, and the trailing end and the circumferential sides are merely restrained against radially outward movement relative to the roll 7.

The leading end of the mould layer 6 is that which leads having regard to the direction of rotation of the roll. In the illustrated embodiment the leading end is that indicated at 8 when the direction of rotation of the roll 7 is as indicated by arrows 9.

The roll 7 is of known kind. It has a transverse groove 10 to accommodate a severing wire (not shown) as well understood.

Groove 10 is flanked by mounting strips 11 and 12 secured to the roll by screws 13. Leading strip 11 has a tongue 14 to which hinge leaves 15 are secured, for example, by rivets 16. Complementary hinge leaves 17 are connected to leaves 15 by an hinge pin 18, and the leaves 17 are joined to the leading end of the mould layer 6, for example by rivets 19.

Strip 12 is a mounting for an axial keeper plate 20 which engages the trailing end 21 of the layer 6. Circumferential keeper plates 22 similarly engage with the circumferential edge margins 23 of layer 6. Plates 22 may be secured to the roll 7 by bolts as indicated at 24.

When the mould layer 6 has been secured on the size roll 7, a cylindrical sleeve of soft cladding material is built up on the wrapped size roll in known manner, and when the required thickness of sleeve has been reached, the parting wire or other severing means are operated also in known manner. The severed sleeve is then removed from the size roll, edge trimmed and otherwise conventionally treated as though it were an ordinary unornamented sheet of cladding material.

It will be appreciated that the leading end of the wrapped mould layer 6 may be removably secured to the size roll 7 in any one of several different ways. For example, the leading end may be attached to a metal strip furnished with holes so that it may be screwed to the size roll. The mould layer 6 may be secured to the metal strip by being moulded therewith or by riveting or otherwise.

Alternatively, the leading end of the mould layer 6 may be attached to the size roll 7

by means of a metal or other clamping strip which may be secured to the size roll by screws or the like so that the leading edge margin of the size roll is clamped tightly between the strip and the surface of the roll.

WHAT WE CLAIM IS:—

1. A method of producing cladding material sheets with an embossed pattern thereon, said method comprising the steps of:—

(a) forming a flat bendable mould layer with at least part of one face having a raised pattern thereon to form the required embossed pattern on the cladding material sheet,

(b) closely wrapping said mould layer, with its patterned face outermost, about a rotatable size roll,

(c) removably securing the wrapped mould layer to said size roll by separably attaching one end of the mould layer, which is to be the leading end thereof when said roll is rotated, to said roll, and by applying restraints to the side edges and the other end of said mould layer to prevent radially outward movement thereof relative to said roll,

(d) progressively building up a soft cladding material sleeve of required thickness on said wrapped size roll from a film-like web of soft cladding material, and

(e) severing said sleeve in a direction parallel to the roll axis, removing said severed sleeve from said wrapped size roll and then conventionally treating the removed sleeve to provide a finished, cladding material sheet with an embossed pattern formed by the raised pattern thereon.

2. The method claimed in claim 1, in which said mould layer is formed on a timber moulding bed whereof the moulding face has been sand-blasted to increase the cavity depth of the more erodible parts of the timber.

3. Apparatus for use in producing cladding material sheets with an embossed pattern thereon, comprising a rotatable size

roll, a mould layer which has a raised pattern on one face and which is closely wrapped about and secured to said size roll with its patterned surface outermost, said mould layer being removably secured to said size roll by a separable fastening whereby that end of the mould layer which is its leading end, when said roll is rotating, is attached to said size roll, and by means whereby the side edges and the other end of said mould layer are restrained against radially outward movement relative to said size roll, a drive mechanism to rotate said wrapped size roll, and means for feeding a film-like web of soft cladding material on to said wrapped size roll, during rotation thereof, thereby progressively to build-up, on said wrapped size roll, a soft cladding of required thickness.

4. Apparatus as claimed in claim 3, in which said separable fastening is a hinge fixed to said roll and connected to the leading edge of said layer by way of an axially withdrawable hinge pin, and wherein the trailing end and the circumferential side edges of the wrapped layer are restrained against movement radially of said roll by an axial keeper plate and a pair of circumferential keeper plates fixed on said roll.

5. Apparatus as claimed in claim 4, in which said hinge and said keeper plates are removably fixed to said size roll.

6. A method of producing cladding material sheets with an embossed pattern thereon, substantially as herein described with reference to the accompanying drawings.

7. Apparatus for producing cladding material sheets with an embossed pattern thereon, substantially as hereinbefore described with reference to the accompanying drawings.

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by means of a metal or other clamping strip which may be secured to the size roll by screws or the like so that the leading edge margin of the size roll is clamped tightly between the strip and the surface of the roll.

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(b) closely wrapping said mould layer, with its patterned face outermost, about a rotatable size roll,

(c) removably securing the wrapped mould layer to said size roll by separably attaching one end of the mould layer, which is to be the leading end thereof when said roll is rotated, to said roll, and by applying restraints to the side edges and the other end of said mould layer to prevent radially outward movement thereof relative to said roll, (d) progressively building up a soft cladding material sleeve of required thickness on said wrapped size roll from a film-like web of soft cladding material, and

(e) severing said sleeve in a direction parallel to the roll axis, removing said severed sleeve from said wrapped size roll and then conventionally treating the removed sleeve to provide a finished, cladding material sheet with an embossed pattern formed by the raised pattern thereon.

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3. Apparatus for use in producing cladding material sheets with an embossed pattern thereon, comprising a rotatable size

roll, a mould layer which has a raised pattern on one face and which is closely wrapped about and secured to said size roll with its patterned surface outermost, said mould layer being removably secured to said size roll by a separable fastening whereby that end of the mould layer which is its leading end, when said roll is rotating, is attached to said size roll, and by means whereby the side edges and the other end of said mould layer are restrained against radially outward movement relative to said size roll, a drive mechanism to rotate said wrapped size roll, and means for feeding a film-like web of soft cladding material on to said wrapped size roll, during rotation thereof, thereby progressively to build-up, on said wrapped size roll, a soft cladding of required thickness.

4. Apparatus as claimed in claim 3, in which said separable fastening is a hinge fixed to said roll and connected to the leading edge of said layer by way of an axially withdrawable hinge pin, and wherein the trailing end and the circumferential side edges of the wrapped layer are restrained against movement radially of said roll by an axial keeper plate and a pair of circumferential keeper plates fixed on said roll.

5. Apparatus as claimed in claim 4, in which said hinge and said keeper plates are removably fixed to said size roll.

6. A method of producing cladding material sheets with an embossed pattern thereon, substantially as herein described with reference to the accompanying drawings.

7. Apparatus for producing cladding material sheets with an embossed pattern thereon, substantially as hereinbefore described with reference to the accompanying drawings.

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