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"CURVED CEILING-BUILDING METHOD AND INORGANIC
CEILING PLATES FOR USE IN SAID METHOD"

The present invention relates to a curved ceiling-building method and inorganic ceiling plates for use in the method. More particularly, it relates to a method for building a curved ceiling by securing
5 at least one inorganic ceiling plate onto a curved ceiling base.

Incombustible and sound-absorbing inorganic ceiling plates are commercially available as rock wool plates, gypsum boards and slates. These plates usually have a
10 thickness of from about 9 to 25mm, and their flexibility is poor. They, therefore, readily crack on bending at a radius of curvature of 250cm or less and are not suitable for practical use.

It has been desired to form an inwardly or outwardly
15 curved surface at a radius of curvature of up to about 30cm in order to increase the decoration of the ceiling surface. It is, however, impossible to build such curved ceilings by conventional methods and utilizing known inorganic ceiling plates.

It is therefore an object of the present invention to
20 provide a curved ceiling-building method which enables a curved ceiling to be built using an inorganic ceiling plate.

Another object of the invention is to provide an
25 inorganic ceiling plate for use in the above-described method, which is provided with sufficient flexibility to permit the required amount of bending without cracking.

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According to the invention there is provided a method of building a curved ceiling by securing at least one inorganic ceiling plate to a curved ceiling base, which comprises the steps of providing the or each inorganic ceiling plate having a plurality of rectangular notches in a front or rear surface thereof, the number of notches being determined by the radius of curvature of the curved ceiling base and said notches being in parallel with the normals of the curve at the corresponding points, bonding reinforcing means onto at least part of the rear surface of the or each inorganic ceiling plate, coating an adhesive on the rear of the or each inorganic ceiling plate, bringing the or each inorganic ceiling plate so that it matches or substantially matches the curvature of the curved ceiling base to which it adheres by means of said adhesive, and securing the or each inorganic ceiling plate to the curved ceiling base by means of nails except at said notches, wherein said reinforcing means is a plurality of tape-like paper or cloth pieces which are bonded onto the rear surface of the or each ceiling plate in such a manner that the pieces and the notches are disposed relative to one another at right angles.

According to another aspect of the invention an inorganic ceiling plate for building a curved ceiling is characterized by a plurality of rectangular notches

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provided in a front or rear surface of the plate at appropriate intervals and in parallel with each other, and reinforcing means bonded onto at least part of said rear surface of the plate, wherein the reinforcing means is a plurality of tape-like paper or cloth pieces bonded onto the rear surface of the plate, in such a manner that the pieces and the notches are disposed relative to one another at right angles.

The invention will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 is a plan view of the rear surface of an inorganic ceiling plate of the invention;

Figure 2 is an enlarged cross-sectional view taken along the line A-A of Figure 1;

Figure 3 is a cross-sectional view of an inwardly curved ceiling built in accordance with the method of the invention; and

Figure 4 is a cross-sectional view of an outwardly curved ceiling built in accordance with the method of the invention.

The method of the invention can be used in bonding and securing an inorganic ceiling plate onto a curved ceiling base having a radius of curvature of from about 30 to 300cm.

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A decorative curved ceiling has usually been built by a method in which an inorganic ceiling plate is used as such - i.e. it has a flat surface pattern - or is provided with a rugged pattern which is continuous or repeated at given intervals, in the surface thereof to form a three dimensional decorative surface, and the rear surface of the inorganic ceiling plate is bonded to the ceiling base by means of an adhesive. In this method, nailing is used in combination with an adhesive in order to maintain the plate in a secured condition until the adhesive is completely solidified. When, however, the ceiling base is curved, the internal stress developed by the bending of the ceiling plate is focussed at the positions at which the nails are hammered in. This causes the formation of cracks at such positions, and it is therefore necessary to strike in additional nails. Particularly, when the radius of curvature of the curved ceiling base is 250cm or less, the inorganic ceiling plate may crack and break. In building such curved decorative ceilings utilizing conventional ceiling plates, therefore, it is inevitably necessary to narrow the width of each ceiling plate, or alternatively to produce a special curved ceiling plate.

The present invention is intended to overcome the above-described problems arising in using the conventional ceiling plates. In accordance with the method of the invention, a plurality of notches are provided in the rear surface or front surface of a commonly used

inorganic ceiling plate in the direction of the normals of the curved ceiling base at the corresponding points, and a plurality of reinforcing thin tape-like paper or cloth pieces are bonded to the rear surface in such a manner that the tape-like pieces and the notches intersect at right angles. In this way, the inorganic ceiling plate is provided with flexibility, reduction in strength of the inorganic ceiling plate is prevented, and it is readily possible to bond and secure the ceiling plate onto a curved ceiling base having a small radius or curvature.

Figures 1 and 2 show an unbended rectangular inorganic ceiling plate 1 and Figure 2 illustrates a stripe pattern formed on the front surface of the ceiling plate, comprising concave depressions 5 and convex ridges 6 extending in parallel with each other in the lengthwise direction of the ceiling plate. A plurality of deep rectangular notches 3 having a width of from 1 to 1.5mm are provided in the rear surface 2 of the plate at predetermined intervals aligned with the concave depressions 5 while leaving a connecting portion 7 having a depth of from 1 to 2mm. Two rectangular paper tapes 4 are bonded transversely to the rear surface in such a manner that the notches and the paper tapes intersect at right angles.

It is preferred for the paper tape 4 to be made of craft paper, for example, which is finely wrinkled, has a suitable degree of elongation, and has a high

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strength. In addition, other film-like tapes can be used. Rough cloth, such as cheesecloth may be bonded onto the entire rear surface of the ceiling plate. Alternatively cloth pieces can be bonded on the rear surface of the plate in the same orientation as the paper tape 4.

In connection with the cross-sectional shape of the notch, the width and depth are determined according to the strength and flexibility of the inorganic ceiling plate, and the radius of curvature of the curved ceiling base, and the intervals at which the notches are provided are also determined according to these conditions.

Figure 3 shows how a curved ceiling base 11 which is formed by sticking gypsum boards and has a radius of curvature R, is secured to a ceiling structure 10 by means of nails 12. The inorganic ceiling plate 1 with small adhesive coated areas distributed onto the rear surface 2 thereof is pressed into contact with the surface of the curved ceiling base which itself may be coated with adhesive. By bending the ceiling plate at the connecting portion 7 of each notch 3 to widen the upper portion of the notch as at 13, the ceiling plate can be curved substantially to match the curve of the ceiling base and, thereafter, nails 17 are hammered in through the concave depressions 5 of said stripe pattern to secure the ceiling plate onto the curved ceiling base. Voids 14 are created by the bending of the plate, between the ceiling base and the rear surface portions 2 between the grooves 3. Successively, other ceiling plates 1' and 1'' are provided in the same manner as above with joints 15 and 16 provided therebetween. Also in the lengthwise direction, other ceiling plates are bonded so as to be connected to each

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other, thereby building a decorative inwardly curved ceiling. When the adhesive existing in the small clearance between the rear surface 2 of the ceiling plate and the curved ceiling base 11 solidifies, the ceiling plate is stably secured to the ceiling base.

Figure 4 is a cross-sectional view of an outwardly curved ceiling built in accordance with the method of the invention. This is exactly the same as in Figure 3 except that the upper portion of the notch 3 is narrowed or closed as the plate is curved substantially to match the curvature of the ceiling base, resulting in the formation of a void 14' between the closed portion and the curved ceiling base, and that the longitudinal contact edge of each of the ceiling plates 1, 1' and 1'' is slightly bevelled.

The inorganic ceiling plates are composed mainly of inorganic fibers, such as asbestos, rock wool, and glass fibers, and inorganic binders, such as gypsum, calcium silicate, and cement, and if desired, further containing small amounts of inorganic aids, such as starch and a phenol resin.

In accordance with the invention, as described hereinbefore, an inorganic ceiling plate can be stably and surely fitted to an inwardly or outwardly curved ceiling base and, furthermore, the patterned surface of the ceiling plate is not adversely affected at all. The invention, therefore, offers the commercial advantage that a decorative curved ceiling can be easily built without needing complicated equipment and many steps of production as in conventional methods - e.g. molding of special curved plates, and application of a number of narrow plates onto a curved surface.



CLAIMS:

1. A method of building a curved ceiling by securing at least one inorganic ceiling plate to a curved ceiling base, which comprises the steps of: providing
5 the or each inorganic ceiling plate having a plurality of rectangular notches in a front or rear surface thereof, the number of notches being determined by the radius of curvature of the curved ceiling base and said notches being in parallel with the normals of the curve
10 at the corresponding points, bonding reinforcing means onto at least part of the rear surface of the or each inorganic ceiling plate, coating an adhesive on the rear of the or each inorganic ceiling plate, bringing the or each inorganic ceiling plate into contact with
15 the curved ceiling base so that it matches or substantially matches the curvature of the curved ceiling base to which it adheres by means of said adhesive, and securing the or each inorganic ceiling plate to the curved ceiling base by means of nails
20 except at said notches, wherein said reinforcing means is a plurality of tape-like paper or cloth pieces which are bonded onto the rear surface of the or each ceiling plate in such a manner that the pieces and the notches are disposed relative to one another at right angles.
- 25 2. A method as claimed in claim 1, wherein the notches are in the rear surface of the or each inorganic ceiling plate and widen at their respective upper portions when the or each plate is used to build an inwardly curved ceiling and narrow when used to build
30 an outwardly curved ceiling.



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3. A method as claimed in claim 1, wherein the notches are in the front surface of the or each inorganic ceiling plate and narrow or completely close when the or each plate is used to build an inwardly curved ceiling.

4. A method as claimed in any one of the preceding claims, wherein an adhesive is coated on the entire surface of the curved ceiling base onto which the or each inorganic ceiling plate is to be engaged.

5. An inorganic ceiling plate for building a curved ceiling, characterized by a plurality of rectangular notches provided in a front or rear surface of the plate at appropriate intervals and in parallel with each other, and reinforcing means bonded onto at least part of said rear surface of the plate, wherein the reinforcing means is a plurality of tape-like paper or cloth pieces bonded onto the rear surface of the plate, in such a manner that the pieces and the notches are disposed relative to one another at right angles.

6. A plate as claimed in claim 5, wherein the pieces are of a sufficient length so as to intersect all the notches.

7. A plate as claimed in either claim 5 or claim 6, wherein the front surface of the plate is formed with parallel ridges and depressions.

8. A plate as claimed in any one of claims 5 to 7, wherein the notches are in the rear surface of the plate.



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9. A plate as claimed in any one of claims 5 to 7, wherein the notches are in the front surface of the plate.
- 5 10. A method of building a curved ceiling by securing at least one inorganic ceiling plate to a curved ceiling base substantially as hereinbefore described with reference to, and as shown in, Figure 3 or Figure 4 of the accompanying drawings.
- 10 11. An inorganic ceiling plate for building a curved ceiling substantially as hereinbefore described, with reference to, and as shown in Figures 1 to 3, or Figure 4 of the accompanying drawings.
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