Jan. 7, 1969 C. J. E. J. MARTINET 3,420,981

LAMINATED HEATING PANEL AND TABLES EQUIPPED THEREWITH

Filed Feb. 14, 1966 Sheet 1 of 4

FIG. 1

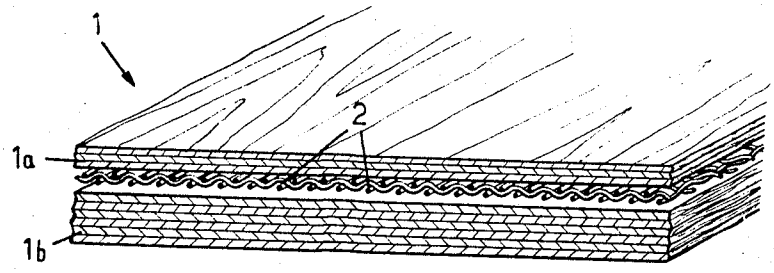
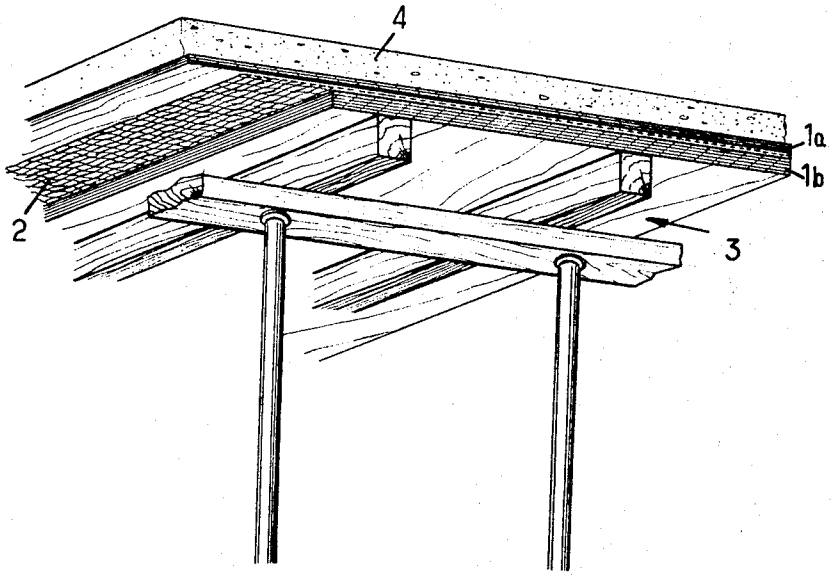


FIG. 2



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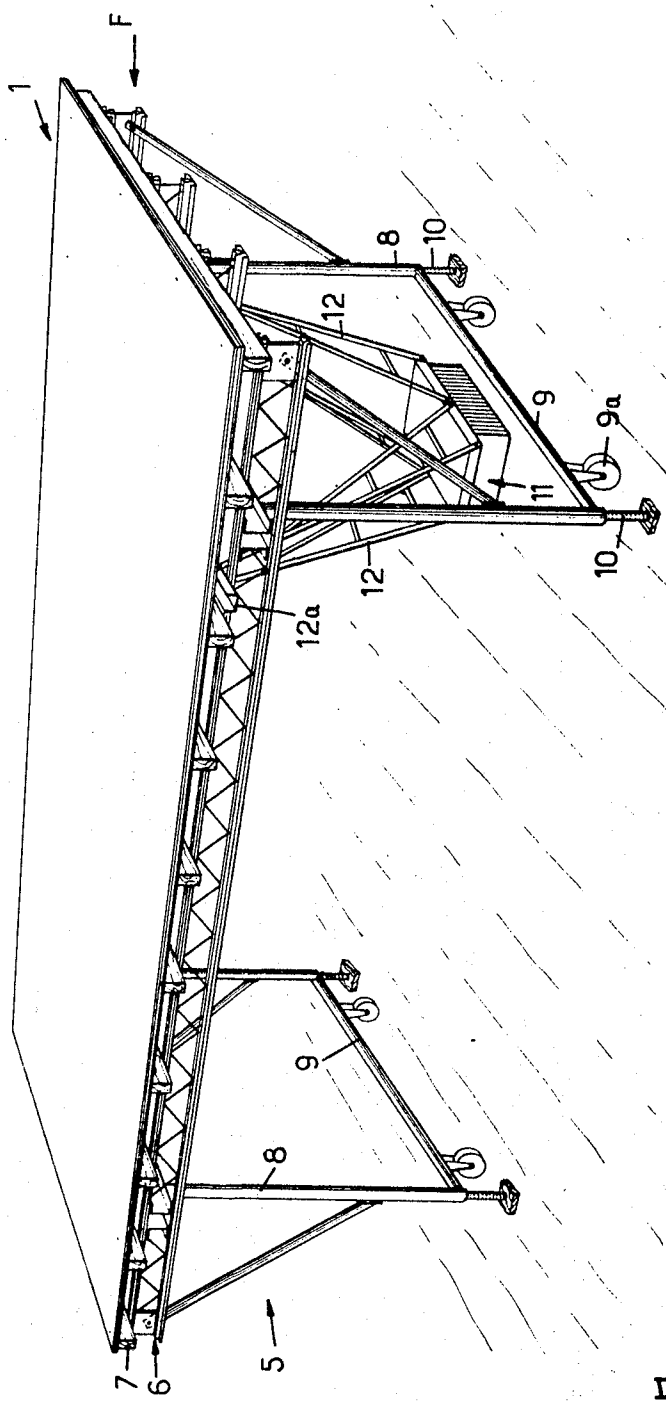


FIG. 3

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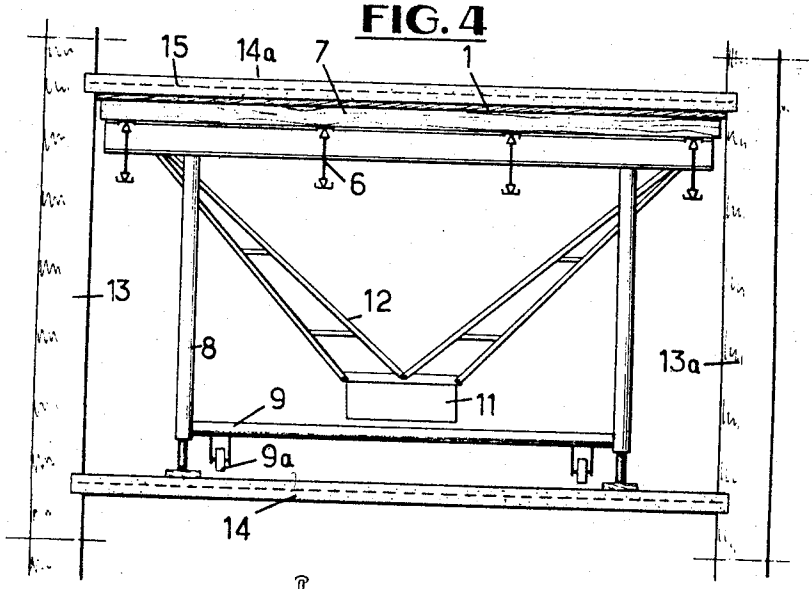
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FIG. 4



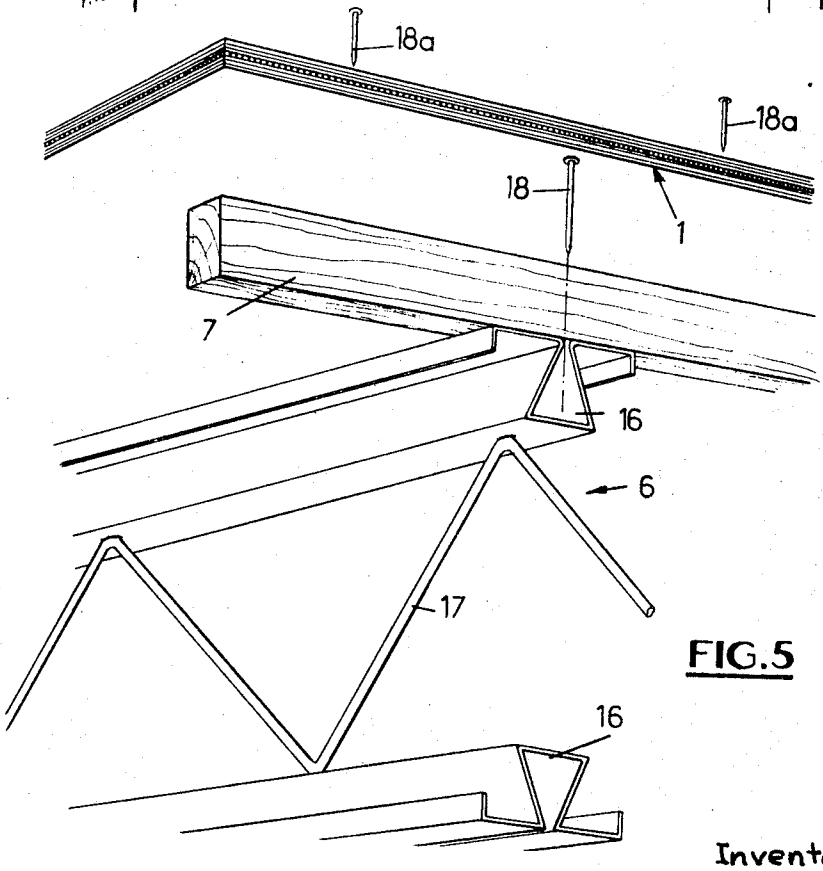


FIG.5

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FIG. 6

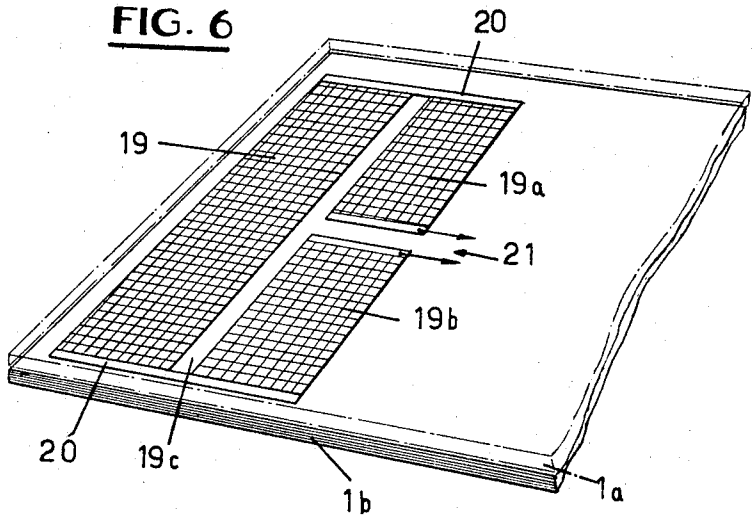
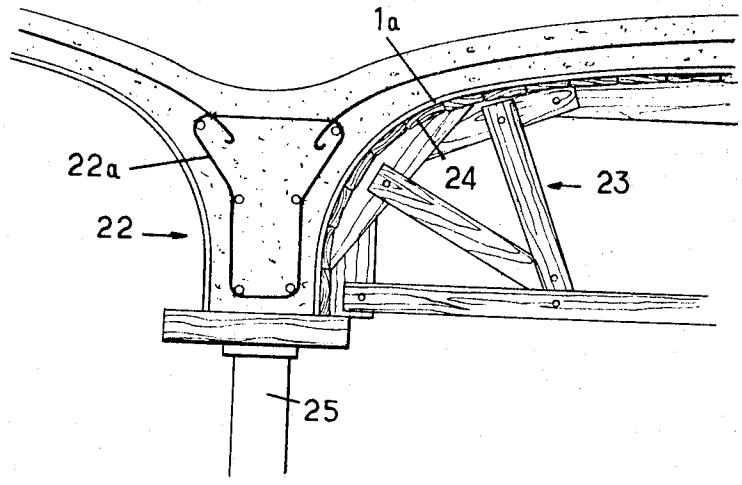


FIG. 7



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United States Patent Office 3,420,981
Patented Jan. 7, 1969

3,420,981

LAMINATED HEATING PANEL AND TABLES EQUIPPED THEREWITH

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Filed Feb. 14, 1966, Ser. No. 527,210
Claims priority, application France, Mar. 22, 1965, 10,240
U.S. Cl. 219—218 8 Claims
Int. Cl. H05b 1/00

ABSTRACT OF THE DISCLOSURE

A heating panel for use in curing concrete comprising electrically conductive strips of base-metal cloth mounted between a thin layer and a relatively thick rigid layer of insulating material, said layers being permanently fastened together by metallic fasteners having thin flat heads.

Fat heating panels are already in use to speed up the hardening and curing of certain structures made of concrete. These are intended to be placed in contact with certain equally flat surfaces of the aforesaid structures after the pouring and vibration of the concrete of which they are made.

Such heated forms usually comprise electrical resistors embedded in an insulating material which separates their resistors from that part of the forms which is to be placed in contact with the aforementioned concrete structures.

In any case, the poor thermal conductivity of the materials making up all or part of these forms and the high cost of materials based on heat-conductive magnesium, which may be used to electrically insulate the electrical resistors, particularly when the outside of the aforesaid forms is metallic, have led the applicant to look for more economical solutions.

An object of the present invention is to provide a new article of manufacturing consisting of a heating panel on which a concrete slab may be poured directly. This panel comprises an assembly of strips of metal cloth or foil made of a common metal which has a substantial electrical conductivity, appropriately interconnected to permit them to be supplied at low voltage, the aforesaid strips being placed between two laminated sheets of wood having different thicknesses, so that a substantial amount of heat is transferred only through the thinner sheet. The two sheets are held together preferably by nails which have a length greater than the thickness of the thinner sheet, these nails being capable of penetrating the aforesaid strips of metallic foil or cloth and having preferably a flat head which may be driven into the thinner sheet and insulated by using an appropriate electrically-insulating varnish which must be able to withstand the temperature which the nail-heads may attain even when the heads are in contact with one of the metallic cloths.

It goes without saying that the two panels may also be adhesively secured to each other without omitting the nails, which are indispensible in case the sheets come unglued, if an adhesive is used which can withstand the equilibrium temperature attained by the aforesaid heating cloths after a certain amount of time.

In any case, such an adhesive is rarely used, because of the high cost of the materials necessary to its manufacture.

It is preferable to use as resistors strips of red copper cloth weighing 500 g. per square meter and comprising, in both the longitudinal and transverse directions, 500 threads per meter. The electrical resistors made of this cloth may be fed in such a manner as to dissipate 1200 watts per square meter, which permits the concrete placed under the thinner sheet to be heated to a temperature of about 75 to 80° in eight hours.

On the heating side, a very thin sheet of laminated wood is used, having a minimum thickness of about 4 mm., which prevents the sheets composing it from becoming unstuck when heated or from bending. It will be appreciated that the sheet must stay absolutely flat so as to prevent the pouring of a concrete article having a curved surface.

As concerns the thicker sheet, it goes without saying that only the cost needs to be taken into account, and that no upper limit is imposed in order to assure good thermal insulation for the heating element as compared with the thinner sheet of the heating panel.

In practice, a thickness of not more than 20 mm. is usual, this thicker sheet being usually held in place by ribs to give it the desirable rigidity.

This relatively thick laminated sheet may be replaced by a plurality of parallel strips, in the case of concrete structures having a curved lower surface.

The heating panel just described may also comprise between the thicker sheet and the heating cloths, a thermal insulation such as a cloth of glass or asbestos fibers for example, a cloth which normally will not break up when compressed between the two sheets of the "heating plate."

Another object of the invention is to provide heating tables for the forms used to make concrete floors, these tables being equipped with the aforesaid heating panels and characterized by the fact that they comprise, at least at the upper end, members made of longitudinal metallic beams of the type known as "Macomber beams" comprising a throat whose walls converge at the upper end, and which permit transverse ribs to be nailed on the metallic lattice work of the heating tables. The aforesaid heating panels are nailed on the transverse ribs by means of nails which are electrically insulated from the nails used to fasten in place the aforesaid transverse ribs.

A final aim of the invention is to provide a new manufacturing process for concrete structures characterized by faster curing, using the aforesaid heating plates or heating tables.

The characteristics of the present invention will be better understood on reading the following description of one embodiment of the heating table furnished with heating panels in accordance with the invention, this embodiment being given purely by way of example and described with reference to the attached drawings on which:

FIG. 1 is a fragmentary section taken through a laminated heating panel according to the invention;

FIG. 2 represents a form for supporting a slab of concrete and comprising a heating panel according to the invention,

FIG. 3 is a perspective view of a table with its transformer, showing ribs of the heating panel;

FIG. 4 is an elevational view of a table in the course of use;

FIG. 5 is a detail view of a lattice beam supporting the table and showing how the ribs supporting the heating panel may be nailed directly to the beam.

FIG. 6 is a perspective view showing the arrangement of the heating elements in a heating table, in the case of a three-phase supply; and

FIG. 7 is an elevational view showing a form comprising a heating panel in which the thin sheet is curved so as to be adapted to the contour of a ceiling provided with transverse beams, the thicker sheet having been replaced by a plurality of narrow planks which make it easier to conform to the particular contour of the ceiling.

FIG. 1 shows that heating plate 1 consists of metallic

cloths **2** placed between a thin plate **1***a* and a thicker plate **1***b*.

As has been said above, the metallic cloths **2** may be replaced by thinner sheets of metal foil.

The pillars supporting a form utilizing a heating panel are shown at **3** on FIG. 2, in which **4** represents a slab of concrete poured onto the panel **1***a*.

The table **5** shown on FIG. 3 comprises the longitudinal lattice beams **6** carrying the transverse ribs **7**, the table being supported by legs **8** connected together by rungs **9** carried on rollers **9***a*, the rungs **9** being adjustable in height by means of the screw-jacks **10**.

The table **5** is equipped with a transformer **11** suspended beneath the table from a support **12** carried by metallic crossbars **12***a*.

Referring now to FIG. 4, the table **5** with its transformer **11** is mounted on a platform **14** connecting the two walls **13** and **13***a*. The upper platform **14***a* is poured onto the heating panels **1** mounted on the transverse ribs **7**. The upper platform may comprise reinforcing means **15**.

The lattice beam **6** is provided at top and bottom with channel members **16** of the Macomber type, in which the walls of the channel slope inwardly to a narrow neck at the top of the channel member.

The members **16** are connected together by tubular crossbars **17**.

FIG. 5 shows that the nail **18** extends through the rib **7** and its pointed end seats itself in the neck formed in the upper member **16**.

The heating panel **1** is attached to the ribs **7** by means of other nails **18***a* which may pass through the heating elements and which are electrically insulated from the beams **6** and the nails **18** in electrical contact with the members **16**.

FIG. 6 shows the sections **19**, **19***a*, **19***b* of metal cloth being supplied by one of the phases of a three phase power source. The two sections **19***a* and **19***b* are in series with the section **19** through the strips **20**, and the current comes in at the terminals **21**.

It will be readily understood that if the ribs **7** are positioned along the open spaces **19***c* shown in FIG. 6, it will be possible to use a single type of nail **18** which may pass through the heating panel **1** and the ribs at said open spaces.

Referring now to FIG. 7, it will be seen that the form **23**, instead of supporting a thick laminated sheet such as **1***b*, supports a plurality of parallel planks **24**, which carry the thin webs of metal cloth or foil **1***a*.

Reference numeral **22** indicates a concrete beam which may be made using the heating means according to the invention and **22***a* indicates the reinforcing means for this beam. The concrete forming the beam is poured onto a temporary support **25**.

It will of course be understood that the embodiments which have been described may be modified as to detail without thereby departing from the basic principles of the invention as defined by the following claims.

What is claimed is:

1. A heating panel for use in curing concrete which comprises a heating element made of thin elongated electrically conductive strips of metal cloth made from a base metal having a resistivity less than 4.0 ohm-cm. and mounted between a thin layer of electrically insulating material through which substantial heat may be transmitted and a relatively thick rigid layer of electrically insulating material which also acts as a heat insulator so that a majority of the heat radiated by said heating element passes through said thin layer of electrically insulating material, and elongated metal fasteners penetrating both said layers to secure them permanently together, said fasteners being provided with thin flat heads which are sunk into the surface of said relatively thin layer.

2. A panel as claimed in claim **1** in which said relatively thick layer is composed of a plurality of narrow planks, and said thick layer is curved in a section taken perpendicular to the lonigtudinal edges of said planks.

3. A heating panel as claimed in claim **1** in which the heads of said fasteners are covered with an electrically insulating coating which resists temperatures at least as great as those to which said nails are subjected in use.

4. A heating element as claimed in claim **1** in which said heating element is made of strips of copper cloth weighing about 500 grams per square meter, comprising about 500 threads per meter in each direction, and supplied at a voltage resulting in the dissipation of 1200 watts per square meter.

5. A heating panel as claimed in claim **1** in which said thin layer is about 4 mm. thick.

6. A heating panel is claimed in claim **1** comprising a layer of inorganic heat insulating material between said thick layer and said heating element.

7. A table for supporting a concrete slab being cured, said table including a panel which comprises a heating element made of thin elongated electrically conductive strips of metal cloth made from a base metal having a resistivity less than 4.0 ohm-cm. and mounted between a thin layer of electrically insulating material through which substantial heat may be transmitted and a relatively thick rigid layer of electrically insulating material which also acts as a heat insulator so that a majority of the heat radiated by said heating element passes through said thin layer of electrically insulating material, and elongated metal fasteners penertating both said layers to secure them permanently together, said fasteners being provided with thin flat heads which are sunk into the surface of said relatively thin layer, a plurality of spaced wooden ribs supporting said panel, and a plurality of metallic channel members extending transversely below and supporting said ribs, said channel members being formed with an opening so narrow as to frictionally receive nails extending through said ribs into said channels, said last mentioned nails being spaced away from the flat headed nails connecting said layers together.

8. A table as claimed in claim **7** comprising a supporting framework and a transformer carried by said framework.

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U.S. Cl. X.R.

219—213, 345, 533; 249—78

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,420,981 Dated January 7, 1969

Inventor(s) CHRISTIAN JACQUES EMILE JOSEPH MARTINET

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In Claim 1, line 63 of column 3, and in Claim 7, line 30 of column 4, "less than 4.0 ohm-cm." should read --less than 4.0×10^{-6} ohm-cm."

SIGNED AND
SEALED
MAR 3 - 1970

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents