United States Patent

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[54] **METHOD OF MAKING HEATED CONCRETE FORM ASSEMBLY**
4 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **29/611,** 25/DIG. 10, 249/78
[51] **Int. Cl.** **H05b 3/00**
[50] **Field of Search** ..... 29/610, 611; 249/189, 78 X, 79; 25/DIG. 10 X; 219/213

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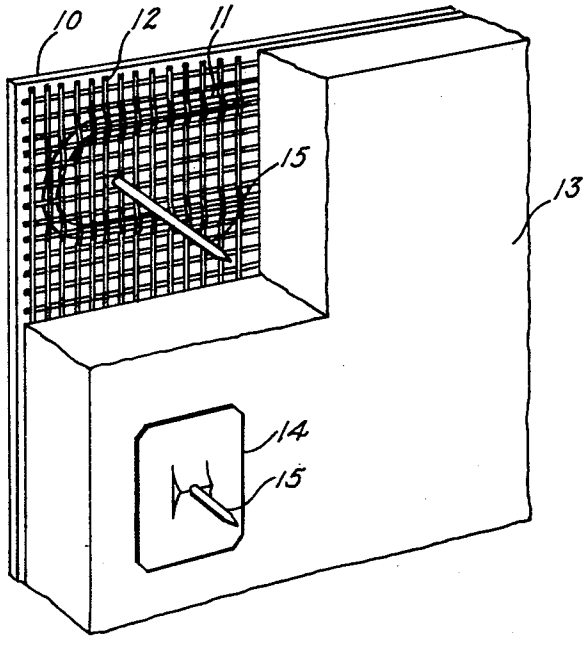
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ABSTRACT: A method for attaching heating grids and thermal insulation to metal concrete forms comprises the welding of protruding spikes or pins at a multiplicity of points on the form placing a flexible backing having heating elements bonded thereto over the pins and against the form, pressing a rigid plastic insulating sheet over the pins and against the backing and locking the insulation in position against the form by applying friction locknuts on the pins and against the plastic sheet. A flexible plastic layer or sheet may be employed between the grid and the rigid sheet for distributing the pressure and minimizing air passages. The heated concrete form assembly provides for the continuous pressing of the heater elements against the metal of the form and when including a flexible plastic layer between the rigid plastic and the form minimizes the effect of bumps or other irregularities on the surface of the metal form.



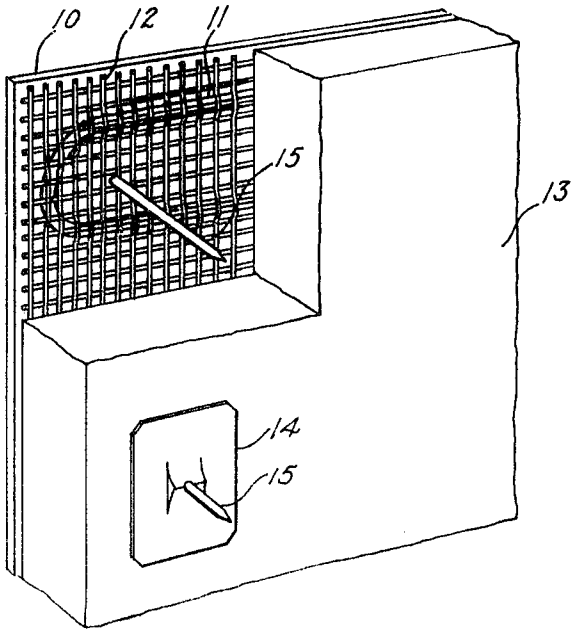


FIG. 1

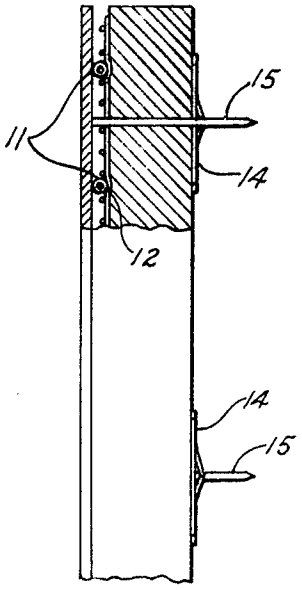


FIG. 2

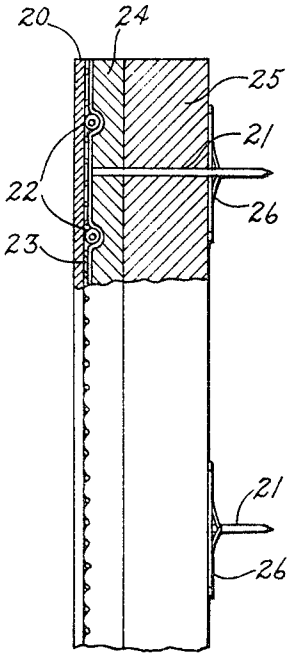


FIG. 5

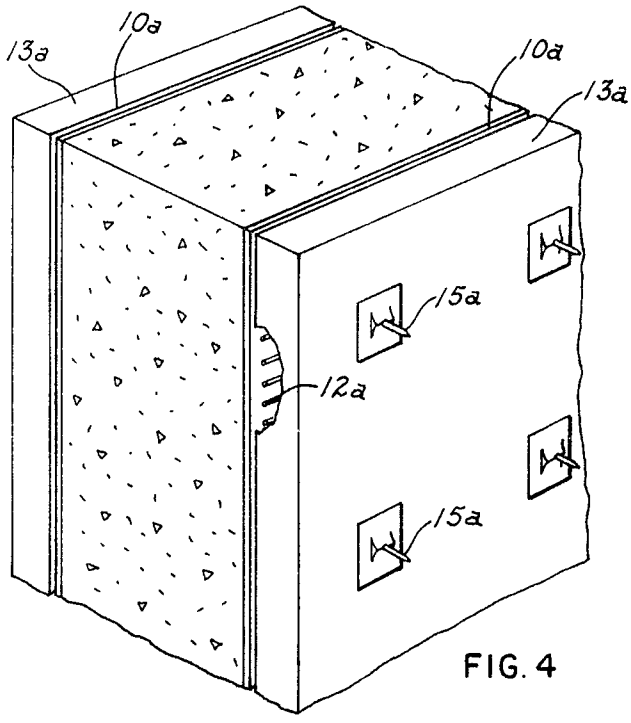


FIG. 4

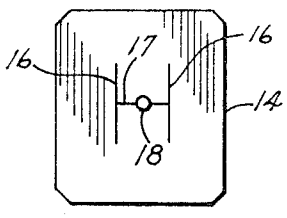


FIG. 3

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METHOD OF MAKING HEATED CONCRETE FORM ASSEMBLY

This invention relates to heated concrete forms and particularly to an improved metal concrete form assembly and to an improved method for attaching insulated heating grids to steel or other metal concrete forms.

In the building of concrete structures it has been found desirable to employ sheet steel forms and to apply flexible heating pads or grids to the outside of the forms in order to effect rapid curing of the concrete. To conserve heat, thermal insulation has been applied over the heating grids. The assembly of such heated forms has been accomplished heretofore by cementing the heating grid or blanket to the outside metal surface of the form and then by cementing the thermal insulation to the grid or blanket. During adverse weather conditions and particularly when dampness or low temperatures are present, difficulties have been encountered in obtaining effective cement bonding of the assembly, the cement or adhesive being subject to variable performance during such conditions. Accordingly, it is an object of this invention to provide an improved method for assembling blanket heaters and insulation on metal concrete forms.

It is another object of this invention to provide an improved method for attaching heating grids and insulation to metal concrete forms and for effecting better transfer of heat between the heating grid and the metal of the form.

It is another object of this invention to provide an improved method for attaching heating grids to metal concrete forms and for holding the heating grid in close contact with the metal form regardless of irregularities in the configuration of the metal surface.

It is another object of this invention to provide an improved assembly of a heating grid and thermal insulation on a metal concrete form.

Briefly, in carrying out the objects of this invention in one embodiment thereof, a multiplicity of outwardly extending pins are welded or otherwise bonded to the surface of a metal concrete from and a flexible element heating grid is placed over the pins and against the form; a sheet or body of rigid thermal insulation is then pressed over the pins and against the grid and friction locknuts are placed over the pins and against the rigid insulation to maintain it in its position pressing the grid against the metal form. In another embodiment, a layer of flexible insulating material is placed between the heating grid and the rigid plastic body and when the plastic body is pressed against the form acts to equalize pressure throughout the assembly and to maintain the heating elements in good heat transfer relationship with the metal of the concrete form regardless of irregularities therein.

The features of novelty which characterize this invention are pointed out with particularity in the claims annexed to and forming a part of this specification. The invention itself, however, both as to its organization and method of assembly, together with further objects and advantages thereof will be best understood upon reference to the following description taken in connection with the accompanying drawing, in which:

FIG. **1** is a perspective view partly broken away illustrating a concrete form assembly embodying the invention;

FIG. **2** is an end elevation view partly in section of the assembly of FIG. **1**;

FIG. **3** is an enlarged plan view of one of the locknuts employed in the assembly of FIGS. **1** and **2**;

FIG. **4** is a perspective view of a pair of parallel-spaced forms such as the one illustrated in FIG. **1** showing concrete in place therebetween; and

FIG. **5** is a view similar to FIG. **2** illustrating a second embodiment of the invention.

Referring now to the drawing, the concrete form assembly illustrated in FIGS. **1** and **2** comprises a sheet steel form or plate **10** having a sinuous or zigzag grid of insulated heating wire **11** bonded to a backing comprising a grid or net **12** of

plastic material held in place against the form **10** by a rigid flat insulating block or panel **13** preferably of a foamed plastic such as polyurethane. The block **13** is held in position against the heating wire grid **11** by a multiplicity of metal lock washers **14** which are pressed over pins **15** previously welded to the form **10**. These lock washers are of the type indicated in FIG. **3** wherein each washer comprises a sheet of thin resilient metal having parallel slits **16** joined by a cross slit **17** in the form of the letter "H" and having a small hole or orifice **18** at the center of the slit **17** of a size slightly smaller than the nails **15** with which the washer is to be used. When this washer is pressed over one of the nails **15** and against the block, the bending of the portions or tongues of the washer formed by the slits provides resilient lock elements which prevent the withdrawal of the washer from the pin **15** and hold the block **13** securely in position.

It will thus be seen that the method for holding the heating grids securely against the metal forms comprises the welding of a multiplicity of pins to the metal form, placing a heating wire grid over the pins and against the form and pressing a rigid block of insulating material such as foamed polyurethane onto the pins and against the grid to press the grid firmly against the form **10** and then locking the plastic block against the grid by locking members such as spring lock washers of the type illustrated in FIG. **3**. This method of attaching the grid provides substantially uniform pressure over the face of a flat form such as the steel form **10** and maintains the heating wires in good contact with the form while also holding the rigid insulating material against the heater.

FIG. **4** illustrates a corner of a complete form assembly comprising two spaced metal sheets indicated at **10***a* rigid foamed plastic insulating plates or blocks **13***a* are secured on the two sheets **10***a* by a multiplicity of pins **15***a* previously welded to the sheets **10***a* and as indicated on the face of the nearest side of the form the plastic sheet **13***a* is locked into position against the sheet **10***a* and against heating wires held on a grid **12***a* securely held between the steel sheet **10***a* and the block **13***a*. The steel sheets **10***a* are held in the required spaced parallel position by suitable clamps or tie bars (not shown).

For some applications, particularly when there are slight irregularities in the configuration of the surface of the sheet steel form the heating wires can be held in good heat exchange relationship with the metal form in the manner illustrated in FIG. **5**. The method employed in this figure is similar to that of FIGS. **1** and **2**, a sheet steel form **20** being provided with a multiplicity of pins **21** welded at substantially equally spaced intervals to the face of the sheet. A grid of insulated heating wires **22** bonded to a backing **23** which may be of the same construction as the backing **12** of FIG. **1** is then placed over the pins **21** and then a sheet of flexible plastic insulation **24** is placed over the pins **21** and against the heating grid, a rigid backing sheet or block **25** of the same material as the block **13** of FIG. **1** is then pressed onto the pins and against the flexible sheet **24** and lock washers **26** of the same construction as the washer **14** of FIG. **3** are then placed over the pins and against the block **25** to urge it against the flexible sheet **24**. The flexibility of the sheet **24** enables it to press the backing or netting **23** against the form as illustrated and the flexible sheet surrounds the heating wires **22**. This method of assembling a heater on the form minimizes the circulation of air by substantially closing the spaces between the wires and between the form sheet and the insulation and furthermore assures that the wires will be pressed against the form regardless of irregularities in the surface thereof.

During the use of the forms as illustrated and assembled in the manner described, the heating wires are connected in an electric circuit to apply heat at substantially uniformly spaced intervals throughout the area of the metal form sheet and the heat is distributed over the face of the sheet because of the heat conductivity thereof. At the same time, the insulating material prevents or minimizes the loss of heat over the face of the form except to the concrete within the form and thus ef-

fective use of the heat energy is assured. Furthermore, it is unnecessary to cement the heating grid to the form and the heating grid is securely held against the form regardless of adverse weather conditions. In accordance with the usual practice, the current supplied to the heating grid is controlled so that heat is adequate for providing the desired temperature and may easily be maintained at temperatures below those at which adverse curing conditions might exist.

The forms provided by this method of assembly may be reused without removing the heating grids and insulating blocks and in the event that the insulating block becomes loose during the handling between installations at different sites, it is merely necessary to press the flexible metal washers again tightly against the rigid block to assure the required continuous engagement of the heating wires with the metal face of the form. Applicant's method of attaching the grid wires to the forms and insulating them has the further advantage that the method may be practiced at the construction site, the required pins being spot or butt welded at the site and the whole assembly made at the time of installation of the form. In this manner, the forms are not required to have the metal pins welded to them before they are brought to the site and furthermore locations and arrangement of the pins on odd-shaped form sections may be determined and effected at the site without the necessary of transporting the spiked sheets or of rearranging the forms and heating wires to meet specific configurations of the form required at the site.

We claim:

1. The method of securing a heating grid to sheet metal forms and the like and for insulating the grid and form which comprises:

providing a heating grid having a multiplicity of runs of elongated heating members attached to a flexible backing sheet,

attaching a multiplicity of metal pins to the sheet metal form to be heated,

placing the heating grid against the form with the attached pins passing through the backing sheet and with the heating members on the side thereof adjacent the form,

providing a thick sheet of substantially rigid plastic insulating material,

placing the rigid plastic sheet against the pins and pressing it into the pins and into position in face engagement with the heating grid,

and pressing friction retaining clip elements onto said pins and against said rigid plastic sheet to urge the rigid plastic sheet against said heating grid and press the heating members thereof against the metal form to retain the heating members in good heat conducting relationship with said form.

2. The method of securing a heating grid to a sheet metal form as set forth in claim 1 wherein said rigid plastic sheet is of foamed plastic material.

3. The method of securing a heating grid to sheet metal forms as set forth in claim 1 wherein said backing sheet is an open mesh plastic netting and including the step of bonding the netting to the heating members to retain them in spaced configuration.

4. The method of securing a heating grid to sheet metal forms as set forth in claim 1 including the step of placing a relatively thin sheet of flexible plastic insulation in engagement with the heating grid and backing sheet and pressing the flexible sheet against the grid upon pressing the rigid plastic sheet into position on the pins.