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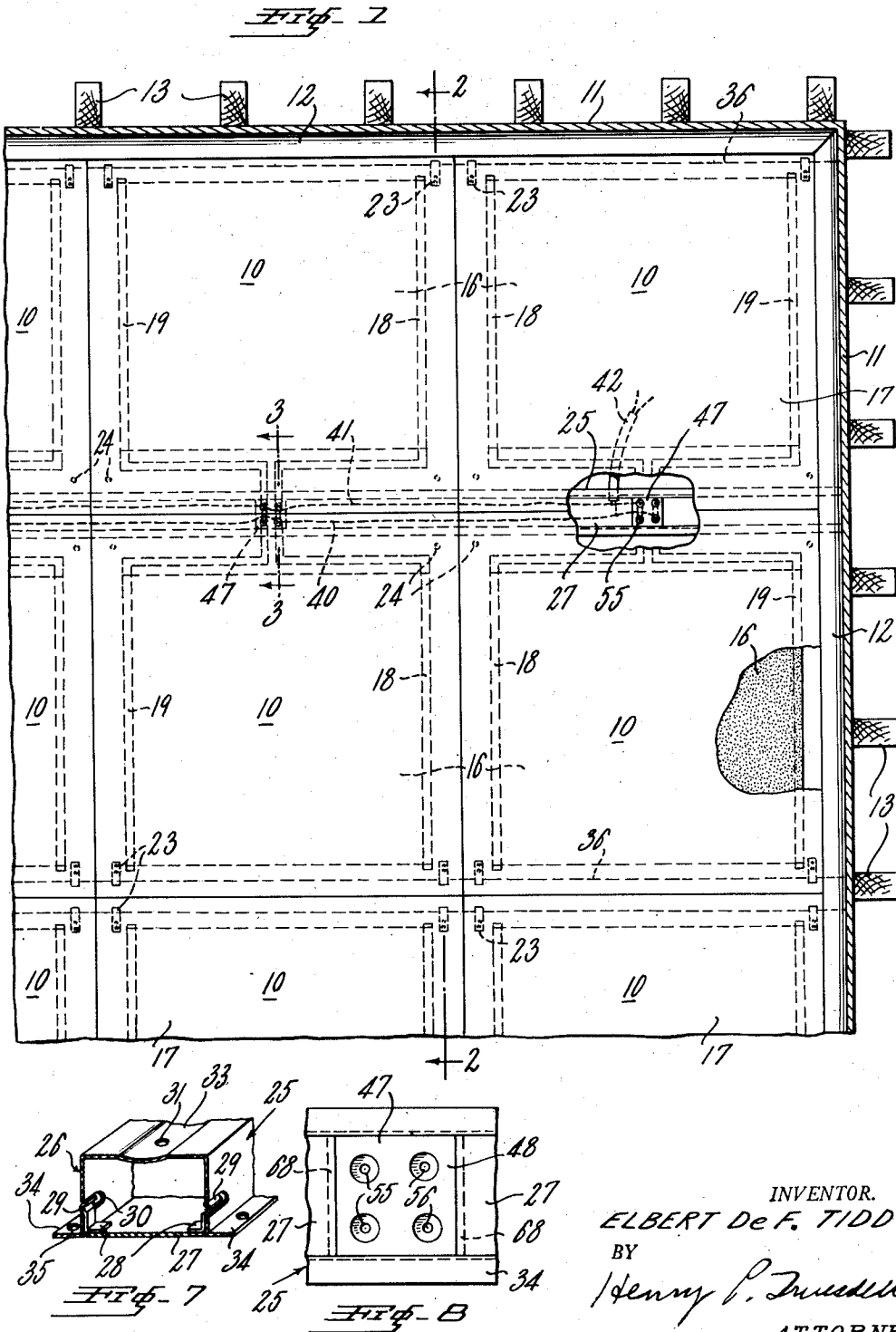
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RADIANT HEATING INSTALLATION

Filed May 19, 1950

2 Sheets-Sheet 1



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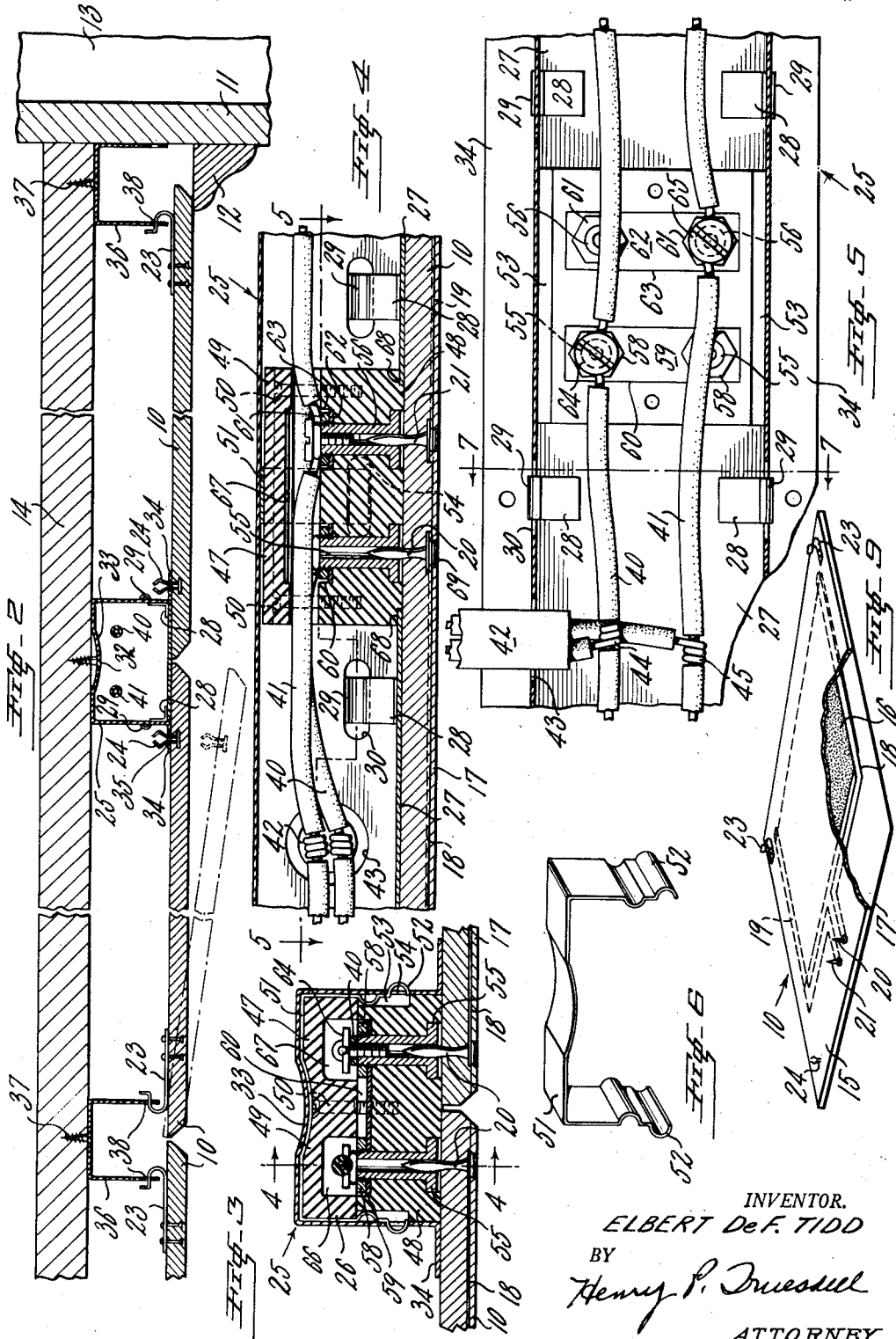
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UNITED STATES PATENT OFFICE

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RADIANT HEATING INSTALLATION

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This invention relates to radiant space heating installations, and more particularly it relates to electrical heating systems which are incorporated in the ceiling or walls of a room.

It is an object of the invention to provide means for assembly of a plurality of electrical heating elements in the form of panels in the wall or ceiling of a room and to connect such panels in electrical parallel with a minimum of electrical wiring.

Another object is the provision of radiant heating panel installations in which the electrical connections of the panels to the supply wiring are concealed and protectively enclosed, but yet are readily accessible for inspection or repair.

Still another object is to provide means for supporting radiant heating panels in the ceiling of a room in such manner that the panels are secured safely in place, yet are easily removable.

A further object of the invention is the provision of means for incorporating radiant heating panels in the walls or ceiling of a room in a manner which is efficient yet inconspicuous.

Still a further object is to provide an improved heating panel which can be connected to, or disconnected from, a building wiring system without necessity for making splices or disturbing the wiring.

Additional objects and advantages of the invention will be made evident in the following detailed description when read with reference to the accompanying drawings, wherein:

Fig. 1 is a partial plan view, with parts in section and parts broken away, of a ceiling of a room viewed from below, showing a heating panel installation of the present invention;

Fig. 2 is a sectional elevation on a larger scale of the ceiling panel installation taken along line 2—2 of Fig. 1;

Fig. 3 is a fragmentary sectional elevation of the installation on a still larger scale taken, along line 2—2 of Fig. 1, and showing details of a terminal block for electrically connecting the panels to the wiring system;

Fig. 4 is a longitudinal sectional view of the raceway showing the wiring and terminal block connections, taken along line 4—4 of Fig. 3;

Fig. 5 is a longitudinal sectional view of the raceway taken along line 5—5 of Fig. 4;

Fig. 6 is a perspective view of a spring clip for securing the terminal block within the raceway;

Fig. 7 is a fragmentary perspective view on a smaller scale of the raceway;

Fig. 8 is a fragmentary plan view on a smaller scale of the terminal block and raceway, viewed

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from below with the heating panels removed; and

Fig. 9 is a perspective view, with certain parts broken away, of the improved electrical heating panel.

Referring to Fig. 1 of the drawings, the installation shown therein comprises a plurality of rectangular electrical heating panels 10 arranged adjacently in rows in the ceiling of a room. The edges of the panels adjacent to the walls 11 of the room are covered with a suitable decorative cove molding 12 fastened to the wall to conceal the gap between the panels and the wall. The room structure includes the usual vertical studs 13 and transverse ceiling beams 14 (Fig. 2).

As shown most clearly in the perspective view, Fig. 9, each panel 10 is composed of an electrically non-conducting board 15, such as an asbestos-cement composition building board. Over the central area of the front or lower face of the board 15 there is applied a film 16 of conducting composition, such as may be obtained by dispersing a finely divided conductive powder, such as acetylene black, in a plastic medium, such as rubber. The conductive film 16 serves as the heating element. The face of the panel is covered with a layer 17 of electrically non-conducting material so that the conductive film 16 is effectively embedded in the panel. For the purpose of feeding electrical energy to the heating element 16, conductive tapes 18 and 19 are associated with the opposite marginal edges of the film 16, in electrical contact therewith, and such tapes extend to connecting prongs 20 and 21 passing out of the upper or rear face of the panel for the purpose of making connection to the electrical supply wiring in a manner that will be explained in detail below.

The rear face of the panel 10 is also provided with fastening means by which the panel may be removably supported in the ceiling of the room. The fastening means includes suitably bent strips 23 constituting hinge members disposed near one edge of the panel, which are secured to the panel by screws or other means. Disposed near the opposite edge of the panel are snap fastener members 24 made of suitably bent spring wire. The snap fasteners 24 may be associated with the panel by drilling suitable holes therethrough, inserting the fasteners, and filling the holes with suitable plastic material (not shown) to anchor the fasteners in place.

Turning now to the structure for supporting the panels 10 and for carrying electrical supply wiring thereto, a grid of spaced channels or

enclosing raceways 25 is provided in the ceiling of the room behind the panels. Although only one such channel 25 is shown in the assembly view Fig. 1, it will be understood that a plurality of such raceways are arranged in parallel in the ceiling of the room to form, in effect, a grid system capable of accommodating the desired number of panels.

The raceway 25, as seen most clearly in the perspective view Fig. 7, is composed of a generally U-shaped channel portion 26, having a snap-on cover 27 over its frontal opening, thereby forming a protective enclosure for electrical wiring and connections therein. Upwardly extending spring strips 28 on the inner marginal edges of the cover have outwardly bent portions 29 which frictionally engage small transverse slots 30 in the side walls of the raceway thereby removably maintaining the cover 27 in place.

Spaced holes 31 in the center of the top of the raceway accommodate flat head wood screws 32 (Fig. 2) which fasten the raceway to the bottom surface of the ceiling beams 14 of the room. The top wall of the raceway is provided with an inward curve or bend 33 over its medial section to permit the use of flat head screws in fastening the raceway to the ceiling beams without any necessity for counter-sinking the ceiling beams to accommodate such screws. Such flat head screws are preferred because they do not objectionably project into the raceway channel, as would the heads of round head screws.

The lower extremities of the sidewalls or legs of the raceway channel 26 are bent outwardly to form laterally extending flanges 34. Spaced holes 35 in the flanges 34 receive the snap fasteners 24 extending from the rear faces of the panels 10 when the panel is installed in the ceiling as indicated in Fig. 2. The spring action of the fasteners 24 maintains the panel securely in place against the bottom of the raceway, but at the same time permits the panel to be pried away from the raceway with a suitable tool inserted behind the edge of the panel when it is desired to remove the panel.

The raceways 25 are spaced apart by a distance equal to the length of two of the panels 10, and the panels are arranged to extend laterally in opposite directions from each raceway. Alternately disposed with respect to the raceways 25 there are provided U-shaped supporting channel members 36 (Fig. 2). The channels 36 are fastened to the under surface of the ceiling beams 14 by means of screws 37 passing through the upper wall of the channel into the beams. The downwardly extending sidewalls or legs of each channel 36 are provided with small longitudinal slots 38 adapted to receive hooked ends of the hinge members 23 on the rear surfaces of the panels 10 as shown most clearly in Fig. 2. The panels may be swung into and out of position in the ceiling on the hinges 23 as indicated by the dotted lines in Fig. 2. Each of the channels 36 supports the ends of two rows of panels 10 which extend in opposite directions laterally from the channels to the raceways 25. Similarly, each raceway 25 serves to support the ends of two rows of panels and to supply such rows with electric current.

Insulated electrical supply wires 40 and 41 for feeding electric current to the panels 10 pass longitudinally through the raceway enclosure 25. As shown in Figs. 4 and 5 an armored electrical cable 42 passing through an opening 43 in the side of the raceway 25 connects the supply wires

to the building wiring system (not shown). It will be understood that the electrical connections 44 and 45 shown in Fig. 5 to the supply wires 40 and 41 may be suitably insulated, as by wrapping with rubber tape. The supply wires in each of the raceways 25 of the grid system are connected to the building wiring system in a similar manner.

For the purpose of electrically connecting the supply wiring 40, 41 to the heating panels, insulated terminal block assemblies 47 are provided at intervals along the length of the raceway. The individual terminal assemblies are spaced apart a distance equal to the width of one panel, and each terminal assembly serves to connect two of the panels, as will be clear by inspection of Figs. 1 and 3.

As indicated most clearly in Figs. 3 and 4, each terminal assembly 47 is made up of a lower body block 48 of insulating material, and an upper piece or cap 49, the two parts being held together by screws 50 passing therethrough and the whole assembly being shaped so as to fit snugly within the raceway 25. In order to removably maintain the terminal assembly 39 in place within the raceway there is provided a generally U-shaped spring clip 51 which embraces the cap portion 49 of the assembly and conforms to the external contour thereof. The spring clip 51 has leg portions provided with reversely curved terminal sections 52 (Fig. 6) adapted to cooperate with lateral recesses 53 (Fig. 3) on each side of the block assembly, and with longitudinal openings 54 in each side of the raceway 25, as shown most clearly in Fig. 3, thereby frictionally maintaining the block in place in the raceway. The block assembly 47 may be pried out of the raceway 25 when desired.

Passing transversely from top to bottom of the lower insulating block 48 of the assembly 47 there are two pairs of metallic sockets, two of the sockets 55, 55 being electrically connected to the supply wire 40 and the remaining two sockets 56, 56 being connected to the remaining supply wire 41. The lower portions of the sockets are adapted to receive the prongs 20 and 21 extending upwardly from the rear face of the panels 10 when the panels are swung into position in the ceiling. The external surface of the prongs frictionally engages the interior of the sockets, thereby making electrical contact therewith. The upper portion of the sockets are threaded internally and externally. The external thread on sockets 55, 55 accommodates nuts 58 by which the sockets are secured in place in the terminal block and by which a connecting metallic terminal strip 59 is secured to each of the two sockets to electrically connect them together. A recess 60 in the upper face of the block 48 accommodates the strip 59. Similar nuts 61 secure the remaining sockets 56, 56 in place and secure thereto a connecting terminal strip 62 within a recess 63 on the inner face of the block.

Supply wire 40 is connected to one of the sockets 55 by means of a screw 64 threaded into the internal thread in the upper portion of the socket, while supply wire 41 is similarly connected to one of the sockets 56 by means of a screw 65.

The cap portion 49 of the terminal assembly 47 is provided with longitudinal passageways 66 and 67 for the supply wires 40 and 41 respectively. The passageways 66 and 67 are enlarged over their medial portions, the better to accommodate the electrical connections. The supply wires 40 and 41 extend throughout the length of the raceway as indicated in Fig. 1, and are connected to each

of the terminal block assemblies 47 therein in the manner described.

As shown in Figs. 4 and 8, the marginal edges of the front face of the lower block 48 are provided with recesses 68 for accommodating the ends of the snap-on cover strips 27 of the raceway 25, so that the lower face of the block 48 is flush with the outer face of the cover strips 27.

As will be evident from inspection of Figs. 3 and 4, the male connecting prongs 20 and 21 extending from the panels 10 into the sockets 55 and 56 are assembled in the panel in electrical contact with the embedded feeding tapes 18 and 19 by drilling suitable holes in the panel assembly, inserting the prongs, and covering the holes with a suitable plastic material 69.

In operation, electric current introduced from armored cable 42 to the supply wire 40 passes by means of the screw connection 64 and connecting terminal strip 59 to each of the two sockets 55, 56 in the terminal assembly 47. The current flows through the prong 20 of each heating panel to the internal feeding tape 18, whence it flows across the embedded conductive film 16, in which heat is generated by reason of the resistance of the film 16 to the flow of current. The heat thus produced is emitted from the surface of the panel 10 and is absorbed by occupants and objects in the room. The current leaves the film 16 through feeding tape 19 and prong 21 and passes through sockets 56 in the terminal assembly 47, whence the current flows by means of connecting screws 65 and connecting strips 62 into the other supply wire 41, and back into the cable 42 of the building wiring system.

From the foregoing, it is evident that the invention provides a radiant heating installation which can be assembled in a room surface with a maximum of convenience and safety. The provision of a grid of spaced raceways in the room surface with the heating panels extending laterally in parallel rows from either side of such raceways permits a large number of panels to be connected in parallel with a minimum of electrical wiring.

Because of the manner in which cooperating plug and socket means are employed to electrically connect the panels to the raceway, the panels can be inserted in, or removed from, the installation without making splices or disturbing the wiring.

The hinge and snap fastener suspension of the panels permits easy insertion and removal thereof, and results in an inconspicuous installation of neat external appearance. To remove a panel it is simply necessary to pry the edge held by the snap fasteners away from the ceiling, and swing the panel down on the hinges. The hinges are then easily lifted from the supporting channel.

Since all of the wiring and connections are enclosed within the protective metal raceway, the installation is safe. At the same time, since the terminal block assemblies are easily removable from the raceway, and the covers of the raceway are easily removable, the wiring is readily accessible.

Having thus described my invention, what I claim and desire to protect by Letters Patent is:

1. A radiant heating installation comprising a grid of metal raceways extending across a surface of a room, rows of electrical heating panels engaging said raceways along their marginal edges and extending laterally from each side of said raceways across the surface of a room, electrical supply wiring within said raceways, and

electrical connecting means extending from each of the heating panels into the raceways and connected to said supply wiring.

2. A radiant heating installation comprising a grid of metal raceways extending across a room surface, heating panels detachably supported in said room surface, electrical supply wiring within said raceways, and plug and socket connecting means carried by each of said panels and raceways electrically connecting said panels to the supply wiring within the raceways.

3. A radiant heating installation including metal raceways extending across a ceiling of a room, electrical supply wiring within said raceways, heating panels hingedly supported in said ceiling and adapted to be swung into engagement with said raceways, and electrical connecting means attached to said panels adapted to make electrical contact with said electrical supply means within said raceway when said panels are swung into engagement with said raceways.

4. A radiant heating installation including a metal raceway extending across a room surface, electrical supply wiring within said raceway, a heating panel detachably supported in said room surface, the rear surface of said panel being in engagement with said raceway, said panel containing an embedded electrical heating element, prongs connected to said heating element extending out of the rear surface of said panel, and socket means in said raceway connected to said supply wiring for receiving said prongs to electrically connect the panels to the supply wiring.

5. A radiant heating installation comprising a plurality of parallel metal channels extending across a ceiling of a room, rows of electrical heating panels hinged near one of their marginal edges to alternate channels, and detachably secured near their opposite marginal edges to channels intermediate said alternate channels, electrical supply wiring within said intermediate channels, and electrical connecting means extending from said panels to said intermediate channels for making electrical connections between said panels and said supply wiring, said intermediate channels serving as enclosing raceways for said wiring and connections.

6. An electrical heating panel comprising a non-conducting building board, a heating element embedded in said board, means for hingedly supporting said panel on a room surface including hinge means attached to the rear face of the panel near one edge thereof and snap-on fastening means attached near the opposite edge of the panel, and electrical connecting means extending from said embedded element out of the rear face of the panel near said opposite edge, said connecting means being adapted to make electrical contact with an electrical supply means installed in a room surface behind the panel when the panel is swung into position in said room surface on said hinges.

7. In an electrical heating panel installation the combination of a metal raceway installed in the surface of a room, electrical supply wiring within said raceway, a pair of heating panels engaging the raceway on their rear marginal faces and extending laterally from the raceway in opposite directions across the surface of the room, a pair of prongs extending into the raceway from each of said panels for making electrical connection thereto, an insulating block assembly within said raceway, said insulating block

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including a body portion having sockets for receiving said prongs, said supply wiring being connected to said sockets, and said insulated block assembly having a top portion secured to said body for covering the connections between said sockets and said wiring, and means for removably maintaining said insulating block assembly in place within the raceway.

8. An electrical heating panel comprising a non-conducting building board, a heating element embedded in said board, means for hingedly supporting said panel on a room surface including hinge means attached to the rear face of the panel near one edge thereof and snap-on fastening means attached near the opposite edge of the panel, and electrical connecting means extending from said embedded element out of the panel.

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