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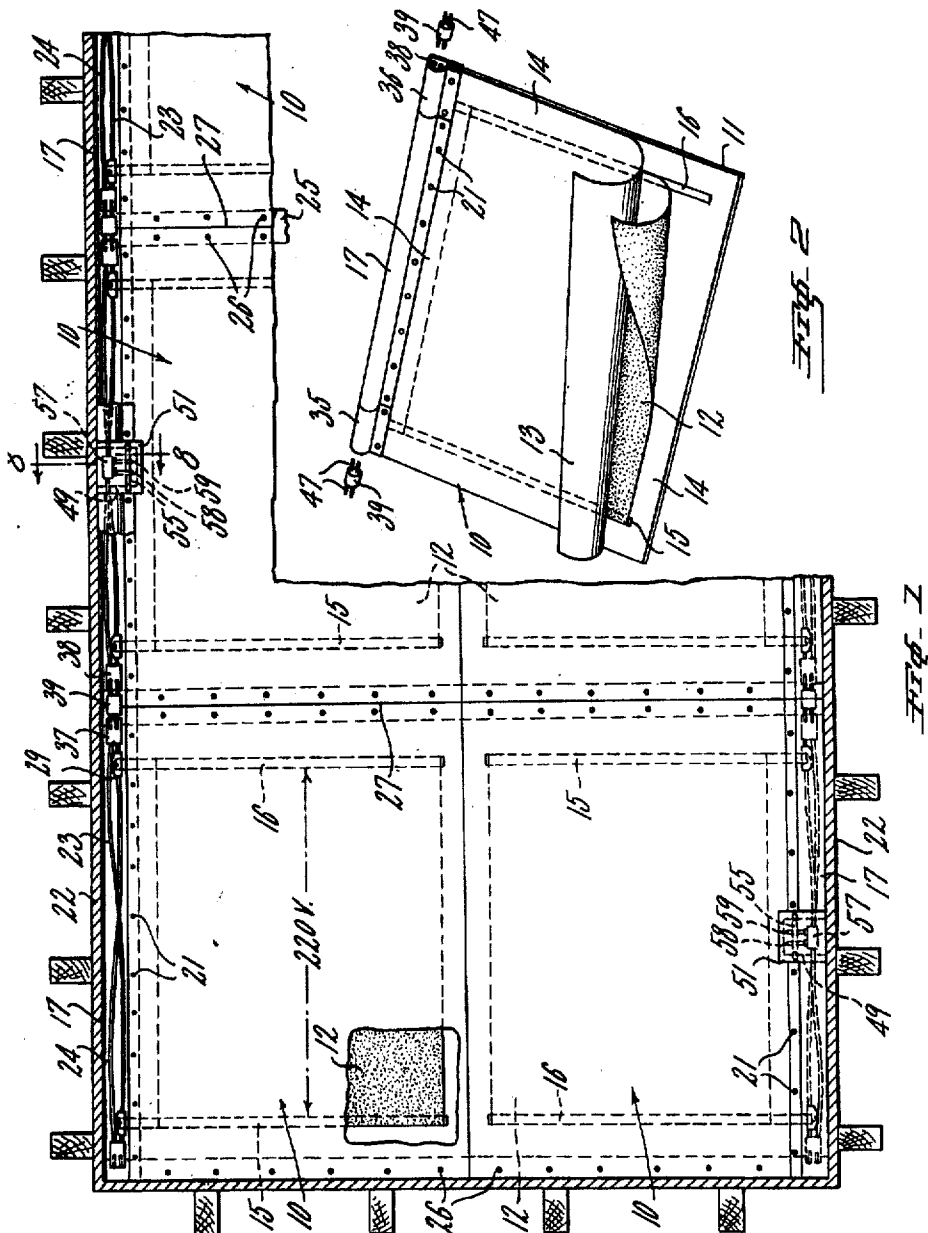
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2,608,634

RADIANT HEATING INSTALLATION

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2 SHEETS—SHEET 1

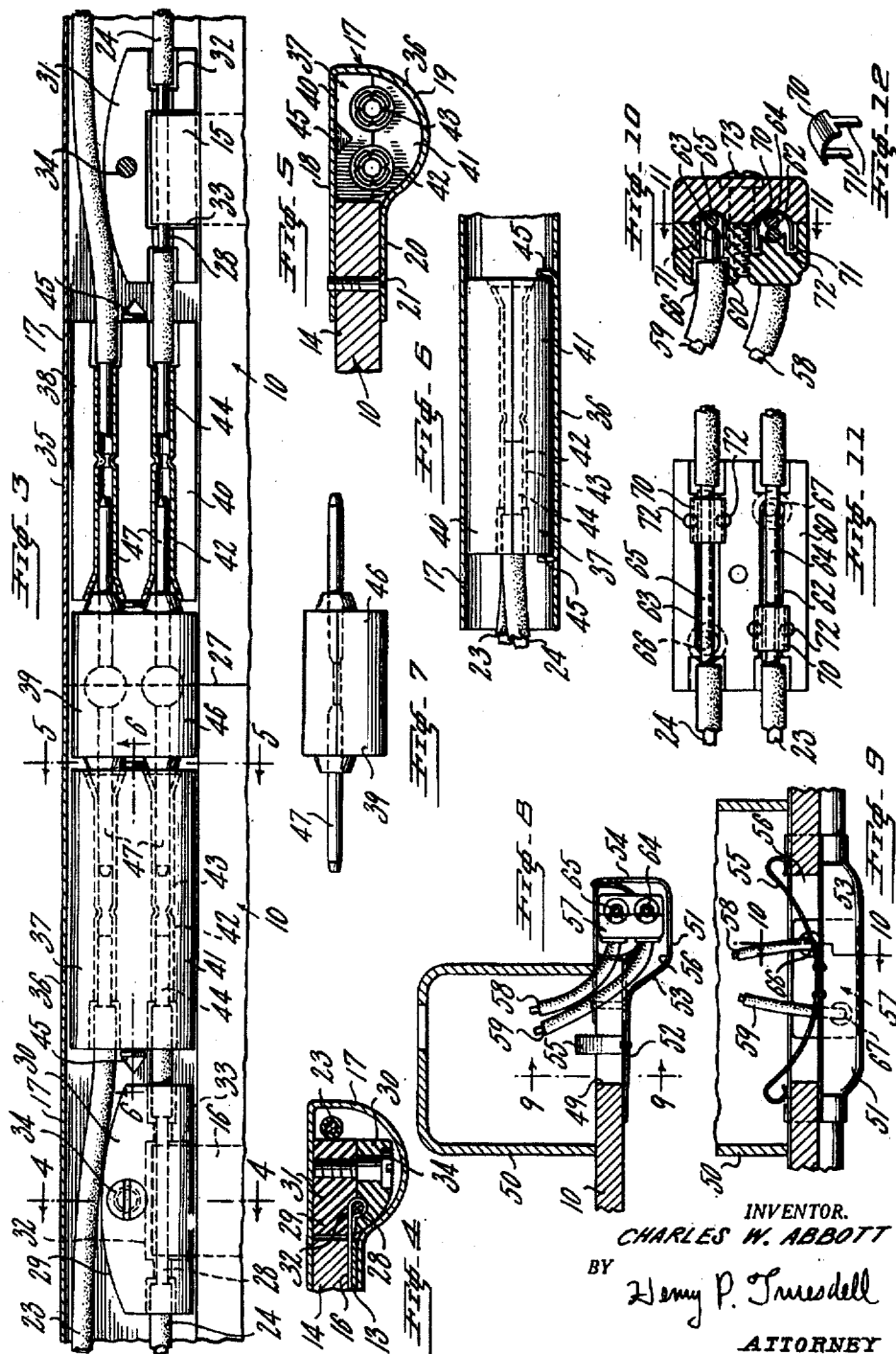


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RADIANT HEATING INSTALLATION

2 SHEETS—SHEET 2



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RADIANT HEATING INSTALLATION

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6 Claims. (Cl. 219—19)

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

The invention has for its principal object the provision of electrical heating panels which may be installed in a room surface with a minimum of electrical connections and wiring.

Another object of the invention is to provide electrical heating panels which can be conveniently connected in parallel in a room surface.

Still another object is the provision of electrical heating panels including protectively enclosed power supply wiring which may be installed in the panel at the factory.

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 plan view, with certain parts broken away, of a portion of a ceiling of a room (viewed from below) formed of a plurality of electrical heating panels assembled with a protective enclosure along one marginal edge for wiring and connecting the panels in accordance with the present invention;

Fig. 2 is a perspective view of one of the panels of Fig. 1 before installation in the ceiling;

Fig. 3 is a view of certain parts of the panel assembly of Fig. 1 on a larger scale showing details of the enclosed wiring and connections;

Fig. 4 is a transverse sectional view taken along the line 4—4 of Fig. 3, showing a means for attachment of electrical wiring to the heating element of the panels;

Fig. 5 is a transverse sectional view taken along the line 5—5 of Fig. 3, showing a portion of the means for electrically connecting adjoining panels;

Fig. 6 is a longitudinal sectional view of a connecting means taken along the line 6—6 of Fig. 3;

Fig. 7 is a detailed view of a plug for electrically connecting adjoining panels;

Fig. 8 is a sectional view taken along the line 8—8 of Fig. 1, showing how electrical power connections are made to the wiring within the marginal protective enclosure of the panel.

Figs. 9, 10 and 11 are detailed views of the power connections taken along lines 9—9, 10—10 and 11—11 of Figs. 8, 9 and 10 respectively; and

Fig. 12 is a perspective view of a saddle for holding the power connections in place.

Referring to Fig. 1 of the drawings, the room ceiling represented therein comprising two rows

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of electrical radiant heating panels 10, arranged adjacently and extending from one side of the room to the other so as to cover the entire ceiling and display an unobtrusive flush appearance.

Each of the heating panels 10, as represented most clearly in the perspective view, Fig. 2, is composed of a base of insulating material, such as a composition building board 11, (e. g., cement board, gypsum board, etc.) covered over its central area with an electrically conductive heating element 12. Superimposed on the front surface of the base 11 there is an insulating layer or facing 13 of plastic, cloth, or other suitable material, so that the heating element is embedded within the panel assembly and protected from electrical contact with the surroundings. The heating element 12 may be composed of a film or layer of conductive rubber. Heating panels of this general character are disclosed in U. S. Patent 2,314,766 to A. W. Bull et al. and are of a type now available on the market. The conductive rubber layer 12 is disposed only over the central area of the panel 10, leaving non-conducting marginal areas 14 around the periphery of the panel through which nails or screws may be driven without fear of grounding or shorting the heating circuit. To supply current to the conductive layer 12, the panel assembly includes two embedded feeding tapes 15 and 16 of electrically conductive material, such as copper or aluminum tapes, engaging opposite lateral edges of the conductive rubber layer 12 in electrical contact therewith.

For the purpose of protectively enclosing the panel wiring and connections, a metal raceway or enclosure 17 embraces one marginal edge of the panel. As shown most clearly in the sectional view Fig. 5, the flat rear wall 18 of the raceway engages the rear surface of the panel. A front curved wall 19 defines with the rear wall 18 and the marginal edge of the panel a passageway of generally semi-circular cross-section along the edge of the panel. A flat extension 20 extends from the curved portion 19 and overlaps the front face of the panel. Retaining screws 21 pass through the overlapping front portion 20 and through the non-conducting marginal area 14 of the panel, and are threaded through the rear wall 18 of the raceway to maintain it in place on the panel. The raceway is thus essentially integral with the marginal edge of the panel and is co-extensive therewith, forming an essentially complete pre-fabricated unit.

When the panels 10 are assembled in place in the ceiling as shown in Fig. 1, the ends of the

raceway 17 of adjacent panels abut each other, thereby forming an essentially continuous raceway disposed along the longitudinal wall 22 of the room. Insulated electric wires 23 and 24 feeding power to the panels are enclosed in the raceway 17. The panels may be secured to the ceiling beams 25 of the room by means of screws 26 passing therethrough. If desired, the exposed joint 27 between adjacent panels may be concealed, as by suitable decorative moldings, or by slightly recessing the marginal edges of the panel and applying thereto a covering tape, or the entire ceiling may be covered with wallpaper, cloth, or other suitable decorative covering.

Considering now the means by which the embedded feeding tapes 15 and 16 in the heating panel are connected to the supply wires 23 and 24, and referring particularly to Figs. 3 and 4, the feeding tapes pass out of the panel and are wrapped around a stripped section of the supply wire, such as stripped section 28 of the wire 24. In order to cover this electrical connection and protect the exposed parts of the feeding tape and wire from contact with the walls of the raceway, there is provided thereon a two-part cap or cover assembly 29 made of insulating material. Such cover comprises a lower member 30 and a cooperating member 31, each member having on their parting faces recesses defining a passageway 32 through the assembly suitably shaped for accommodating a section of the insulated wire 24 containing the stripped section 28. The feeding tape enters the cap assembly 29 through a recess 33 (Fig. 3) provided in the parting face of the upper member 31 for this purpose. A screw 34 passing through the lower member 30 and threaded into the upper cap 31 holds these two parts firmly together. The whole joint assembly 29 fits neatly into the raceway 17. To give access to these connections, the end lengths 35 and 36 (Fig. 2) of the raceway section of each panel are preferably made separate from the remainder of the raceway, so that they may be removed if desired without disturbing the remainder of the raceway. This construction also facilitates assembling the panel wiring in the factory.

Turning now to the means by which adjoining panels are electrically connected together, and referring particularly to Figs. 3, 5 and 6, each panel is provided with female socket assemblies 37 and 38 located in end sections 35 and 36, respectively, of the raceway, such socket assemblies being spaced inwardly somewhat from the end of the raceway. A male plug assembly 39 (Figs. 3 and 7) interposable in the ends of the raceways serves to connect the female sockets of adjoining panels.

Each of the female socket assemblies is composed of an upper member 40 (Fig. 6) of insulating material and a cooperating lower member 41, defining longitudinal passageways 42 adapted to receive metallic socket members 43, to the ends of which stripped lengths 44 of the supply wires 23 and 24 are suitably attached, as by crimping the socket members. The external contour of the socket assemblies 37 and 38 corresponds to the internal contour of the raceway passage and fits snugly therein. The socket assemblies are prevented from moving longitudinally by small spurs 45 struck up from the back wall 18 of the raceway.

The male plug assembly 39 (Figs. 2 and 7) also has the same external contour as the interior of the raceway, and is composed of a molded in-

sulated body 45 in which are embedded two longitudinal prongs or connecting pins 47, the opposite ends of which extend out of each side of the plug body 46. The plug is adapted to slide snugly into the ends of the raceway, with the prongs on each side of the plug engaging the female sockets of adjoining panels as indicated most clearly in Fig. 3, thereby electrically bridging the joint 27 between panels. The central portions 48 of the prongs are flattened out, as indicated, in the interior of the molded body 45 in order that the prongs may more adequately resist longitudinal stresses thereon.

In order to connect power supply lines from the building wiring system to the panel wiring 23, 24 within the raceway 17, a small opening 49 (Figs. 1, 8 and 9) is cut in the lower face of the raceway and through the marginal edge of one of the panels at a point convenient to a junction box of the building wiring system. A standard appliance box 50 (Figs. 8, 9) is applied to the rear face of the panel so as to cover the rear of the opening 49. The front of the opening 49 is covered by a removable metal cap 51 having a flat portion 52 engaging the front of the panel and having a downwardly extending portion 53 adapted to engage the raceway at its marginal edges, as well as an upwardly extending back wall 54 which engages the rear wall of the raceway. The cap 51 is removably secured in place by means of a suitably curved spring strip 55 attached to the inner surface of the cap and frictionally engaging the rear face of the panel on either side of the opening 49.

The cap 51 is shaped so as to form an enclosing chamber 56 of somewhat larger size than the interior of the raceway 17 in order to accommodate a connector assembly 57 made of insulating material, by means of which power wires 58 and 59 may be connected to the panel wiring 23, 24. The connector assembly 57 is comprised of a base member 60 and a cooperating cap member 61 which enclose two longitudinal passageways 62 and 63 formed by recesses in the parting faces of the members 60 and 61 as indicated most clearly in Figs. 10 and 11. The passageways 62 and 63 are adapted to accommodate stripped lengths 64 and 65 of the panel wires 23 and 24 respectively. The base member is provided with transverse holes 66 and 67 for receiving the power supply wires 58 and 59. Stripped ends 68 and 69 of the supply wires 58 and 59 within the interior of the assembly 57 are applied to the stripped lengths 64 and 65 of the panel wires. In each case the joined supply wire and panel wire are surmounted by a small metallic saddle 70 (Fig. 12) having a pair of small extending legs 71 which fit into small holes 72 (Fig. 11) provided in the connector member 60. The saddles 70 thereby aid in maintaining the supply wire and panel wire in contact, when the cooperating cap member 61 is fastened to the base member 60 by means of a screw 73 threaded therethrough for this purpose as indicated most clearly in Fig. 10.

In operation, the heating panel 10 may have the marginal raceway 17 and wiring 23, 24 installed in the factory, the insulating connecting cap assemblies 29 for connecting the wires 23, 24 to the embedded panel feeding tapes 15, 16 also being installed at this time. After the first of such individual pre-wired panels is attached to the ceiling of the room, as by screws 26, the connector plug 39 is inserted in the female socket 37 contained in the end of the raceway 17. The second panel may then be interfitted with the

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protruding end of the plug 39, thereby connecting the two panels in electrical parallel. This procedure may be followed until an entire row of panels is installed.

For making the necessary power connections to the row of panels 10, a panel located conveniently to a terminal box of the building wiring system is selected, and before attaching such panel to the ceiling, the opening 49 is cut in the marginal edge thereof, and the appliance box 50 is attached to the rear face of the panel covering this opening. Alternatively, the appliance box 50 may be installed previously in the ceiling of the room, and the opening 49 may be cut in the panel to correspond to the location of the box 50. Power leads 58 and 59 passing from the box 50 and through the opening 49 are attached to stripped lengths of the panel wires 23 and 24 within the raceway by means of the connector assembly 57. The panel may then be raised to the ceiling and secured in place, with a length of the building supply wiring (not shown) extending into the box 50. The supply leads 58 and 59 are then spliced to the building supply wires within the box 50, this being the only electrical splice that need be made after the panels are installed in the ceiling. The cover 51 is snapped over the opening 49 after such connection is made. This procedure is repeated for each individual row of panels.

Electric power passes from the power leads 58 and 59 into the panel wires 23 and 24 connected thereto within the connector assemblies 57. The current passes from the panel wires 23 and 24 into the feeding tapes 15 and 16 which are connected to the wires by means of the cap assemblies 29. The embedded feeding tapes 15 and 16 distribute the current along the edges of the embedded layer of conductive rubber 12 which completes the electrical circuit. Heat is generated within the conductive rubber layer 12 by virtue of the resistance of such layer to the passage of the current. The heat so produced is radiated from the surface of the panel and absorbed by occupants and objects in the room.

From the foregoing, it is evident that the invention provides a pre-wired heating panel assembly that can be installed in the wall or ceiling of a room with a minimum of electrical connections.

The wiring of each panel is enclosed and protected by a raceway that is co-extensive with the marginal edge of the panel and that can be installed at the factory to become essentially an integral part of the panel, thereby simplifying subsequent installation in the ceiling or wall of a room.

The manner in which one panel is electrically connected to the adjoining panel by a plug and socket arrangement facilitates installation of any suitable desired number of panels in the wall or ceiling of a room. Such panels may be installed against the existing ceiling or wall in old structures or may be installed directly over the wall studs or ceiling beams in new buildings.

The various insulating connector parts provided within the panel raceway makes assembling the panel wiring particularly convenient, and results in a safe, enclosed installation. The thin, fragile conductive feeding tapes are effectively maintained in electrical contact with the feed wiring within the raceway by the insulated connector block assemblies without danger of damaging the tapes.

Having thus described my invention, what I

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claim and desire to protect by Letters Patent is:

1. A pre-wired electrical heating panel comprising a composition board of electrically insulating material, an electrical heating element embedded in said board, conductive feeders extending from said heating element and extending out of a sole marginal edge of said panel, an integral metal raceway carried by said marginal edge of said panel, wiring within said raceway attached to said feeders, and connecting means attached to said wiring at the ends of said raceway for electrically connecting said panel to adjacent panels.

2. In a heating panel containing an embedded electrical heating element, the combination of conductive feeding tapes extending from said element to the exterior of a sole edge of said panel, insulated supply wires extending along said panel edge, each of said feeding tapes being in engagement with a bare portion of one of said supply wires, insulating caps covering the exposed portions of said feeding tapes and wires, and an integral metal raceway secured on said sole panel edge and co-extensive therewith for enclosing said wires and caps.

3. In a heating panel containing an embedded electrical heating element, the combination of an integral metal enclosure attached along, and co-extensive with, a sole marginal edge of said panel, insulated supply wiring within said enclosure connected to said heating element, and plug and socket connectors in the ends of said enclosure attached to said supply wiring for plugging one of said panels into a similar adjoining panel to electrically connect said panels together.

4. Means for connecting to a power supply an electrical heating panel having an integral marginal raceway containing insulated electrical wiring for the panels comprising an insulating block having two separable parts disposed in said integral raceway, a passageway through said block for insertion of a stripped section of one of the panel wires when the said block parts are separated, an additional opening in one of said parts in communication with said passageway for bringing a power supply wire into direct electrical contact with said stripped section, and means for securing said block parts together to maintain said panel wire and supply wire in contact.

5. A heating panel for application to a room surface comprising a composition board of electrically insulating material, an electrical heating element embedded in said board, said board carrying an integral metal raceway along one edge, insulated electrical wiring in said raceway attached to said heating element, said board having an opening extending through the board adjacent the raceway said opening passing from the front surface of the board to the rear surface thereof, and said raceway also having an opening for passage of power supply wires from behind the board into the raceway, means within said raceway for connecting said power supply wire to said raceway wire, a terminal box covering said opening on the rear surface of said board for enclosing a connection to said power supply wires, and a removable cover on the front of said board over said board and raceway openings to enclose the electrical connections while giving access to same.

6. Means for making an electrical connection between a thin, relatively fragile conductive feeding tape for a heating panel and an electrical supply wire, comprising an insulating block

having a longitudinal passageway therethrough for passage of a length of said supply wire, said block also having a transverse slit passing from the outside of the block and intersecting said passageway for passage of said feeding tape into engagement with said supply wire, the said insulating block being made in two parts separable along a plane intersecting said transverse slit and said longitudinal passageway for insertion of said tape and wire, and means for securing the two separable parts together to clamp the tape and wire in electrical contact with each other.

CHARLES W. ABBOTT.

REFERENCES CITED

The following references are of record in the file of this patent:

Number	
1,173,099	
1,179,872	
1,818,884	5
1,840,536	
1,925,283	
1,987,127	
2,018,293	
2,148,392	10
2,175,144	
2,314,766	
2,475,184	
2,502,147	
2,502,148	15
2,521,540	

Number	
20	337,897

UNITED STATES PATENTS

Number	Name	Date
1,173,099	Davis	Feb. 22, 1916
1,179,872	Stromquist	Apr. 18, 1916
1,818,884	Eckstein	Aug. 11, 1931
1,840,536	Shore	Jan. 12, 1932
1,925,283	Searles	Sept. 5, 1933
1,987,127	Rice	Jan. 8, 1935
2,018,293	Williams et al.	Oct. 22, 1935
2,148,392	Ransone	Feb. 21, 1939
2,175,144	Davison	Oct. 3, 1939
2,314,766	Bull et al.	Mar. 23, 1943
2,475,184	Hudson	July 5, 1949
2,502,147	Grothouse	Mar. 28, 1950
2,502,148	Grothouse	Mar. 28, 1950
2,521,540	Richardson	Sept. 5, 1950

FOREIGN PATENTS

Country	Date
Germany	June 9, 1921