June 30, 1953 T. W. GLYNN 2,644,066

ELECTRICAL CONNECTOR FOR RESISTANCE ELEMENTS ON GLASS PLATES

Filed July 5, 1951

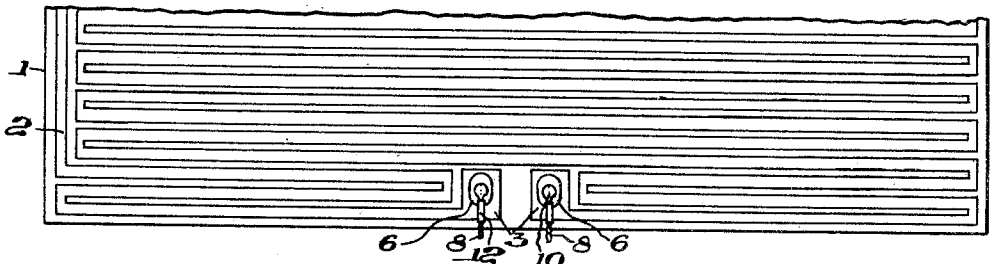

Fig. 1.

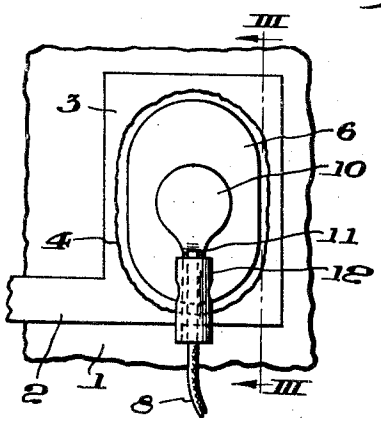

Fig. 2.

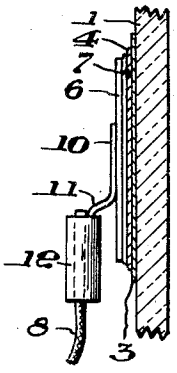

Fig. 3.

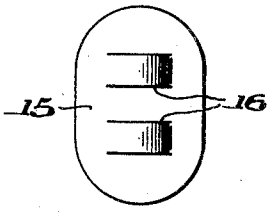

Fig. 4.

Fig. 5.

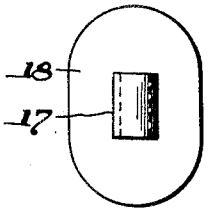

Fig. 6.

Fig. 7.

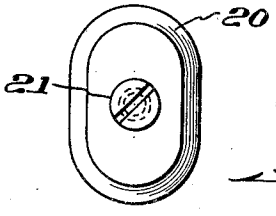

Fig. 8.

Fig. 9.

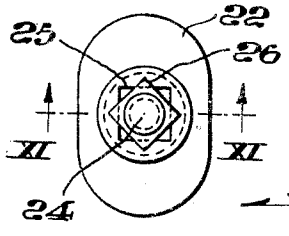

Fig. 10.

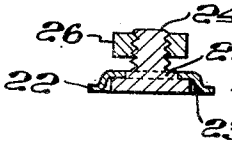

Fig. 11.

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ELECTRICAL CONNECTOR FOR RESISTANCE ELEMENTS ON GLASS PLATES

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3 Claims. (Cl. 201—63)

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This invention relates to electric resistance space heaters in which electrical heating elements cover one side of glass plates, and more particularly to the electrical terminals for such heaters.

In such a heater a very thin layer of a suitable electrical resistance material adhering to a glass plate forms a heating element strip, and wires are fastened to the opposite ends of the element so that it can be connected in an electric circuit. Attachment of the wires to the heating element has provided quite a problem. It is difficult, especially for the customer, to solder the wires to the film-like resistance element. Originally it was the practice to spray a coating of a solderable metal, such as copper or brass or zinc, onto the ends of the resistance element where it was desired to attach wires. This coating was then tinned in the ordinary manner and the wires soldered to it, but the connection was not satisfactory. It was weak structurally, and it was difficult to make a good joint and yet avoid overheating the glass plate. Also, due to the repeated heating and cooling of the glass and copper wires and the resulting expansion and contraction of them, the solder would weaken and the wires would pull loose from the heating element. Other attempts have been made to solve the problem, but they too have not proved very satisfactory.

It is among the objects of this invention to provide in an electric resistance heater of the type described an electrical connector which can be applied easily without injuring the glass plate, which is simple and inexpensive, which is durable and will not pull loose from the plate, and in some forms of which wires can be attached without soldering them.

In accordance with this invention a metal disc is soldered to an end of an electric heater. The disc is made of a low expansion metal that has substantially the same coefficient of expansion as the plate in the temperature range in which the heater operates. When the heated glass plate expands, the heated disc expands at the same rate. Expansion of the thin layer of solder between the disc and plate is restrained by them and it does not pull loose. Although an electric wire can be soldered directly to the disc, it is preferred to provide the disc with a connecting element for the wire to mechanically connect the wire to the disc. This may take various forms, such as an integral loop struck out of the disc, an opening for a screw, or a wire-receiving sleeve connected to the disc.

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The preferred embodiment of the invention is illustrated in the accompanying drawings, in which Fig. 1 is a fragmentary view of one side of an electric resistance heater utilizing my electrical connectors; Fig. 2 is an enlarged detail showing a connector; Fig. 3 is a vertical section taken on the line III—III of Fig. 2; Figs. 4 and 5 are front and end views of a modification of the connector; Figs. 6 and 7 are front and end views of another modification; Figs. 8 and 9 are front and end views of a further modification; Fig. 10 is a front view of an additional form; and Fig. 11 is a cross section taken on the line XI—XI of Fig. 10.

Referring to Figs. 1, 2 and 3 of the drawings, a rectangular panel of plate 1 of tempered glass, of the type generally used for an electric resistance type of space heater, is adapted to be mounted in a frame or other support of well-known form which can be set on the floor or hung on a wall. Since the frame forms no part of the invention, it is not disclosed. Mounted on one side of the glass plate is an electric heating element 2 which is formed from at least one electrical conductor that has its ends 3 enlarged and located close to each other, preferably at the bottom of the plate substantially midway between its ends. The conductor is formed from suitable electrical resistance material, generally aluminum or aluminum alloy, sprayed on the surface of the plate in a very thin strip. On the larger terminal areas 3 of the heating element an additional coating 4 of a solderable metal, such as copper or brass or zinc, has been sprayed because it is very difficult to solder directly to the thin aluminum areas. A pair of metal discs 6 are joined to the coatings 4 by an ordinary high melting point lead-tin solder 7 (Fig. 3). This was done by first tinning the coatings 4 and the backs of the discs with the solder and then clamping the discs against the tinned areas of the resistance element. The entire assembly then was heated to the melting point of the solder to make a sweat joint between the discs and plate. With both the plate and the discs at the same temperature at the time of fusion of solder 7, and with both being cooled down together, the final joints are free from shrinkage stress and will remain that way in service.

The material of which the discs are made is a low expansion metal having substantially the same coefficient of expansion as the glass plate in the temperature range in which the heater operates, which is from about 32° F. to about 300° F.

Consequently, the discs will expand and contract with the plate at the same rate. Examples of metal alloys having the proper coefficient of expansion are those formed from 48 to 51 per cent nickel and 52 to 49 per cent iron, or from 42 per cent nickel, 52 per cent iron and 6 per cent chromium, or from 14 to 18 per cent chromium and the balance iron. An alloy composed of 48 per cent nickel and 52 per cent iron is preferred. Although the solder **7** has a much greater coefficient of expansion than the plate and discs, it does not pull loose because it is a very thin layer and has low tensile strength. The film of solder is simply stretched or compressed by the glass plate and the metal discs on its opposite sides as they become hot or cold. The same thing is true of the thin tinned areas of the resistance element, which also are sandwiched in between the discs and plate. A wire, by which the heating element can be connected in an electric circuit, can be soldered directly to each metal disc **6** without any difficulty. However, to permit the customer to attach wires without soldering, other means may be provided.

The preferred manner of fastening a wire **8** to each metal disc **6** is to join an electric terminal to the center of the disc. The terminal has a flat tongue **10** considerably smaller than the discs, which should be made of the same metal as the discs so that it will have subtantially the same coefficient of expansion. The tongue is brazed or spot welded to the center of a disc, but has a lateral projection **11** that is not joined to the disc directly. Rigidly mounted on this projection is a sleeve **12** which receives the end of a wire **8** and is compressed tightly against it, such as by indenting the sleeve. This arrangement is better than soldering the tongue directly to the tinned spot on a terminal area of the heating element, because the pull of the wire on the tongue is concentrated in a small space at one edge of the tongue. Since a stronger connection can be made between the tongue and the center of the disc than can be made between the disc and the heating element, it is better to have the pull of the wire on the member that is soldered directly to the element exerted at the center of that member than at its edge so that the pull will be distributed uniformly throughout the area of the member.

Another way of fastening a wire to such a metal disc as shown in Figs. 4 and 5, is to use a thinner disc **15**, and provide it with one or more out-struck loops **16** through which the wire can be inserted. Then the loops are pressed down against the wire to clamp it in place.

As shown in Figs. 6 and 7, a similar connection is formed by joining, by soldering, welding or brazing, a short copper tube **17** to a disc **18**. A wire is inserted in this tube, which then is compressed on the wire to hold it. Or, the wire can be soldered in the tube.

A somewhat different way of fastening a wire is provided, as shown in Figs. 8 and 9, by tapping a hole **19** in the center of a disc **20**, and then inserting a screw **21** in it to clamp the wire against the disc.

Another way is shown in Figs. 10 and 11. The central portion of the disc **22** is offset outwardly to form a rearwardly opening recess **23**. The

center of the disc is provided with a square opening, in which a short screw **24** is inserted with its head in the recess. At the base of the head there is a square collar **25** that fits in the square hole in the disc so that the screw will not turn. The threaded shank of the screw projects from the discs and can be provided with a nut **26** for holding a wire on it.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. The combination with an electric resistance element adhering to a glass plate, of an electrical connector comprising a low expansion metal disc solderered to said element and having substantially the same coefficient of expansion as the plate in the temperature range where the plate operates, and a terminal having a tongue joined to the central portion of said discs and having a lateral projection adapted to be connected to an electric wire, the coefficient of expansion of the tongue being substantially the same as that of the disc.

2. The combination with an electric resistance element adhering to a glass plate, of an electrical connector comprising a low expansion metal disc soldered to said element and having substantially the same coefficient of expansion as the plate in the temperature range where the plate operates, a low expansion metal tongue welded to the central portion of said disc and having a lateral projection, and a sleeve carried by said projection for receiving an electric wire, the coefficient of expansion of the tongue being substantially the same as that of the disc.

3. The combination with an electric resistance element adhering to a glass plate, of an electrical connector comprising a low expansion metal disc soldered to said element and having substantially the same coefficient of expansion as the plate in the temperature range where the plate operates, a metal projection having one end adjacent the center of the disc and joined thereto, the major portion of said projection being substantially parallel to the disc and offset therefrom, and a metal sleeve rigidly mounted on said offset portion of the projection for receiving an electric wire.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,097,073	Long	Oct. 26, 1937
2,163,409	Pulfrich	June 20, 1939
2,407,251	Christensen	Sept. 10, 1946
2,418,460	Buehler	Apr. 8, 1947

FOREIGN PATENTS

Number	Country	Date
461,275	Great Britain	Feb. 15, 1937