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[54] **TERMINAL CLAMP**
7 Claims, 4 Drawing Figs.

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 339/223
 [51] Int. Cl..... H01r 11/00,
 H01r 15/12
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 223, 250, 256—258, 276; 24/81.3, 81.35, 81 CC,
 115.1, 129 W, 265.1, 265.3

ABSTRACT: A terminal connector for conducting electrical current from a source of power to a resistance heating element. The connector comprises a flexible braided conductor with a terminal at one end for attachment to a power source and a spring clamp attached to the other end to intimately clamp the conductor directly against a resistance heating element and maintain the intimate contact as the heating element expands and contracts with changes in its temperature.

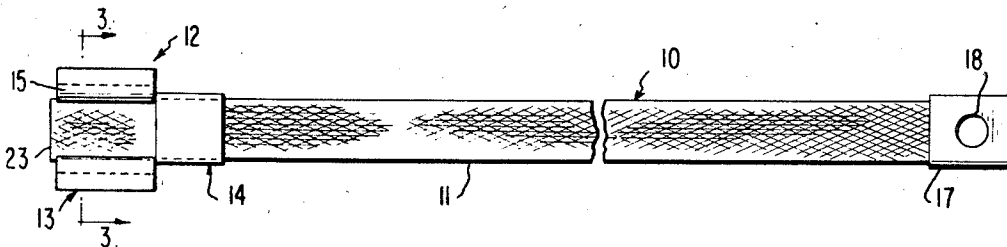


FIG. 1

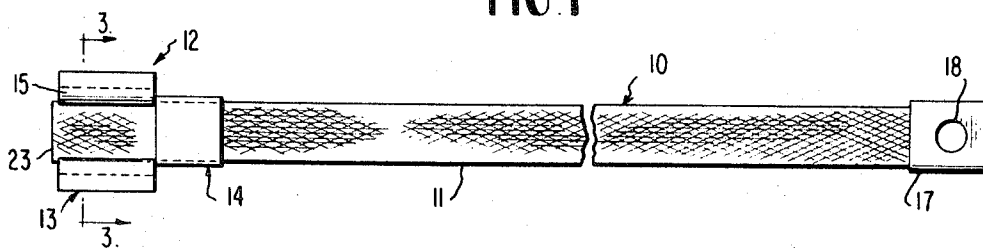


FIG. 2

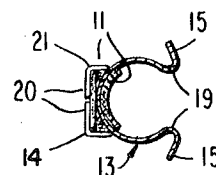
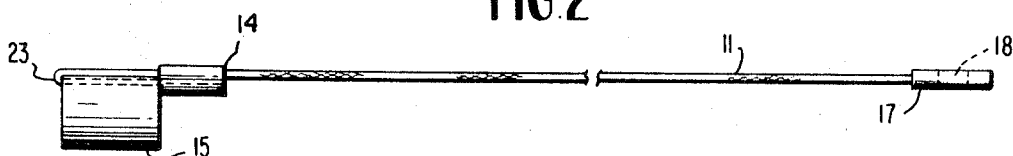


FIG. 3

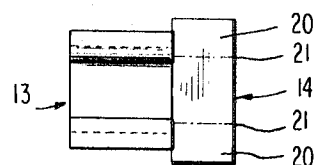


FIG. 4

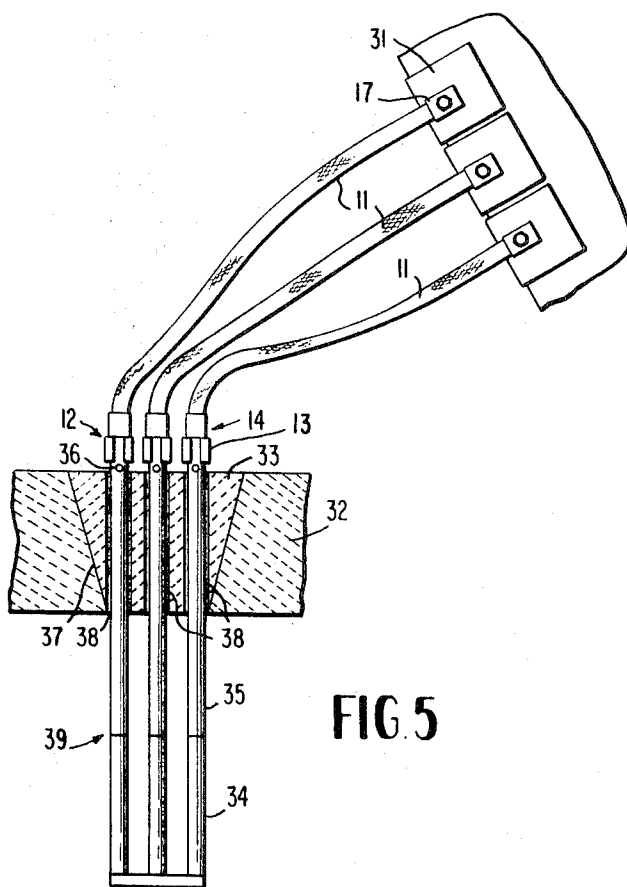


FIG. 5

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TERMINAL CLAMP

BACKGROUND OF THE INVENTION

This invention relates to an improved means of electrically connecting a resistance heating element in an electrical kiln or furnace to a source of power.

Furnaces or kilns used to fire or bake ceramic articles are frequently heated by silicon carbide resistance elements. These elements are generally tubular in shape and extend for the main part perpendicularly into the core of a kiln. However, one end of the elements extend from the furnace and are frequently metallized to provide a connection terminal to a remote source of power.

In the past various means have been devised to connect heating elements of the type described above to a source of power. One means has been to wrap a conductor around the metallized end of the heating element and fixedly attach it thereto by means of a conventional threaded C-clamp.

Another priorly known electrical connector comprises a clip which is clamped around the exposed end of a heating element and a heating element and a cable member then clamped or soldered thereto.

Although electrical connectors of the type described above are often adequate, they may sometimes prove unsatisfactory for a number of reasons. For example, a threaded C-clamp is bulky and unsuitable in situations where the resistance rods are closely spaced together. It will readily be appreciated that a short circuit at this terminal would be intolerable.

Another disadvantage of the above described connector is the inflexibility of attachment to a resistance member. A circular clip may be compact enough to avoid a short circuit, but because of the inflexibility of this clip as it surrounds the heating element, which expands and contracts with its temperature variations, it will invariably develop into a loose connection which will precipitate potential buildups and clamp destroying discharges.

A further disadvantage is the cumbersomeness and time required to assemble two separate elements, a conductor and a clamp, and insure that an intimate electrical connection is maintained.

SUMMARY OF THE INVENTION

It is therefore a general object of the present invention to provide an improved electrical connector that substantially eliminates one or more of the disadvantages of the prior connectors.

It is a further object of this invention to provide an electrical connector with compact attachment structure.

Another object of this invention is to provide an electrical connector which permits a braided conductor to be readily and effortlessly connected in direct engagement with a resistance heating rod.

A further object of this invention is to provide an electrical connector which maintains intimate electrical contact between a conductor and a heating rod regardless of the expansion and contraction of the heating rod.

A still further object of this invention is to provide an electrical connector which maintains intimate contact between a terminal portion of a heating element and an electrically conductive braid and will not damage the metallic coating of the terminal portion of the heating element when it is coupled thereto.

The above and other objects are accomplished according to the present invention by providing a generally C-shaped spring clip having flaring opening edges with a flexible braid conductor looped around the back thereof and held thereto by tabs integral with the clip whereby the braid will be continuously biased directly against the terminal portion of a heating element.

DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the invention is illustrated in the accompanying drawings wherein:

FIG. 1 is a bottom plan view of the electrical connector shown in FIG. 2 according to this invention;

FIG. 2 is a side elevational view of the connector;

FIG. 3 is a cross-sectional end view of the connector taken along line 3-3;

FIG. 4 is a detail view of the clip showing the tab portions prior to folding in phantom lines; and

FIG. 5 is a side elevational view, partially in cross section, of electrical connectors fastened to conductors according to a preferred embodiment of the invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings, and in particular to FIG. 1, there is depicted an electrical connector 10 which represents a preferred embodiment of the invention.

A flexible electrically conductive element 11 is connected at one end to a clip member 12. At the other end of connector 11 is attached an apertured terminal 17. The electrical conductor 11 is composed of cables braided together wherein each cable contains a plurality of individual conductive wires. Such a braided strap combines flexibility and ease of manipulation with a high degree of tensile strength. Any electrically conductive material is suitable for use in the cables of the invention, such as copper, aluminum, brass or stainless steel.

The clip member 12 of the invention, as shown in FIGS. 1 to 4, comprises a generally cylindrical portion 13 with an opening formed in one side thereof so that the clip cross-sectionally appears C-shaped. The lips 15 of the clip are gradually bent, as shown at 19, presenting a smooth edge to a member forced therebetween. The clip 12 also includes a clamp portion 14 at one end of the cylindrical portion 13. This clamp portion 14 is provided with a pair of tabs 20 which initially project outwardly on opposite sides of the clip, as shown in FIG. 4 and when folded generally along phantom lines 21 tabs 20 are formed which will serve to retain in embracing relationship a conductor 11 passing therethrough.

In the preferred embodiment, as shown in FIGS. 1 and 2, it is seen that the conductor 11 first extends along the outside of clip 12 and then is folded over at 23 and terminates within the clip conforming to the curvature thereof, as best seen in FIG. 3. The bend 23 in the conductor 11 resists displacement of the conductor relative to the clamp when the conductor is accidentally pulled axially. The tabs 20 are folded away from the axis of the cylinder 13 to clamp the conductor against the remainder of the clamp portion 14.

The clip can be fashioned from any material that will remain resilient within the working temperatures of the metallized end of the heating element to which it is attached.

A terminal 17 is provided at one end of the conductor 11. The terminal may be formed by clamping a sheet material over one end of the conductor or by dipping the end in molten metal. The terminal is provided with an aperture 18 for ready connection to another member by a conventional threaded fastener arrangement.

While it should be realized that the electrical connector as described above can be used in a multitude of locations, it is particularly applicable to connecting a three-phased, silicon carbide, electrical resistance element to a potential source, as shown in FIG. 5.

The top of an electric furnace or kiln wall 32 contains a frustoconical opening 37 into which a frustoconical plug 33 rests. This plug is provided with three passages 38 through which the electrical resistance rods 39 extend. These rods comprise two sections, a high resistance section 34 and a low resistance section 35. Each low resistance section extends above the plug 33 and is held in place by a pin 36. The ends of these rods that protrude above the furnace wall 32 have been metallized or coated with an electrically conductive material

such as aluminum to reduce electrical resistance at the junction between the conductor 11 and the resistance rod 39.

The cylindrical portion 13 of the clip 12 at least partially surrounds each of the metallized heating rod ends in a resilient relationship. One end of the conductor 11 is positioned between the resilient clip and the metallized end of each heating rod. Therefore, the resiliency of the clip will conform the flexible conductor to the contour of the heating rod and maintain therebetween an intimate electrical contact. Further, as the rod expands and contracts with variations in its temperature, the resiliency of the clip will allow the conductor to follow this size variation and simultaneously maintain a uniform electrical contact.

It will be apparent that the smooth entrant portions 19 of the clip 12 will allow an operator to connect and disconnect the clips to the metallized end of the silicon carbide rods without scraping, scratching or otherwise deterring from the theretofore sound electrical contact base coat.

The opposite ends of the conductors 11 are securely bolted or otherwise attached either directly to a three-phase generator (not shown) or to a conventional connection as generally depicted by conductor pads 31.

Although the invention has been described with reference to a preferred embodiment, it will be appreciated by those skilled in the art that additions, modifications, substitutions, deletions and other changes not specifically described may be made which will fall within the spirit of the invention as defined in the following claims.

We claim:

1. An electrical heating element connector comprising a clip member having a generally cylindrical resilient portion, a connector member having tab portions to connect a flexible conductor to said cylindrical portion of the said clip member, and a flexible electrical conductor, said conductor being formed of a plurality of conductive strands and having a substantially greater width than thickness, one end of said conductor being positioned within said cylindrical portion, said conductor extending over one end of said clip along the outside of said cylindrical portion, and said conductor being fixedly held against said clip member by said tab portions of the connector member.
2. A heating element electrical connector as defined in claim 1 wherein: said connector member includes a substantially flat base, said tab portions projecting outwardly from opposite edges of said base and extending across said base toward

each other, said tab portions ends being spaced from each other and from said base, said conductor extending between said tab portions and said base.

3. An electrical heating element connector as defined in claim 1 wherein:

said generally cylindrical portion is provided with flaring lip portions thereby providing a smooth entrant for an object forced therebetween.

4. An electrical connection between a cylindrical rod heating element and a multiple strand conductor comprising:

a biasing clip having a generally cylindrical resilient portion,

a connector member having tab portions to connect a flexible conductor to said cylindrical portion of the said clip member, said tabs being bent in a direction away from said cylindrical portion, and a flexible electrical conductor comprising, a substantially flat strap one end of which extends within said tab portions and is clampingly retained thereby and also within said generally cylindrical portion for electrically conductive attachment by said biasing clip to said cylindrical rod heating element.

5. An electrical connector as defined in claim 4 wherein:

said conductor is formed of a plurality of conductive strands and having a substantially greater width than thickness, one end of said conductor being bent and positioned within said cylindrical portion.

6. An electrical connector as defined in claim 4 wherein:

said connector member includes a substantially flat base, said tab portions projecting outwardly from opposite edges of said base and extending across said base toward each other, the ends of said tab portions being spaced from each other and from said base, said conductor extending between said tab portions and said base.

7. An electrical connection between a cylindrical rod heating element and a multiple strand conductor comprising:

a biasing clip having a generally cylindrical resistant portion, said generally cylindrical portion being provided with flaring lip portions thereby providing a smooth entrant front for an object forced therebetween,

a connector member having tab portions to connect a flexible conductor to said cylindrical portion of the said clip member, and

a flexible electrical conductor comprising, a substantially flat strap one end of which extends within said tab portions and is clampingly retained thereby and also within said generally cylindrical portion for electrically conductive attachment by said biasing clip to said cylindrical rod heating element.