May 27, 1969 G. E. AMMERMAN ET AL 3,447,121

ELECTRICAL CONNECTORS PARTICULARLY FOR ELECTRIC RESISTANCE HEATING ELEMENTS

Filed Nov. 7, 1966

Sheet 1 of 2

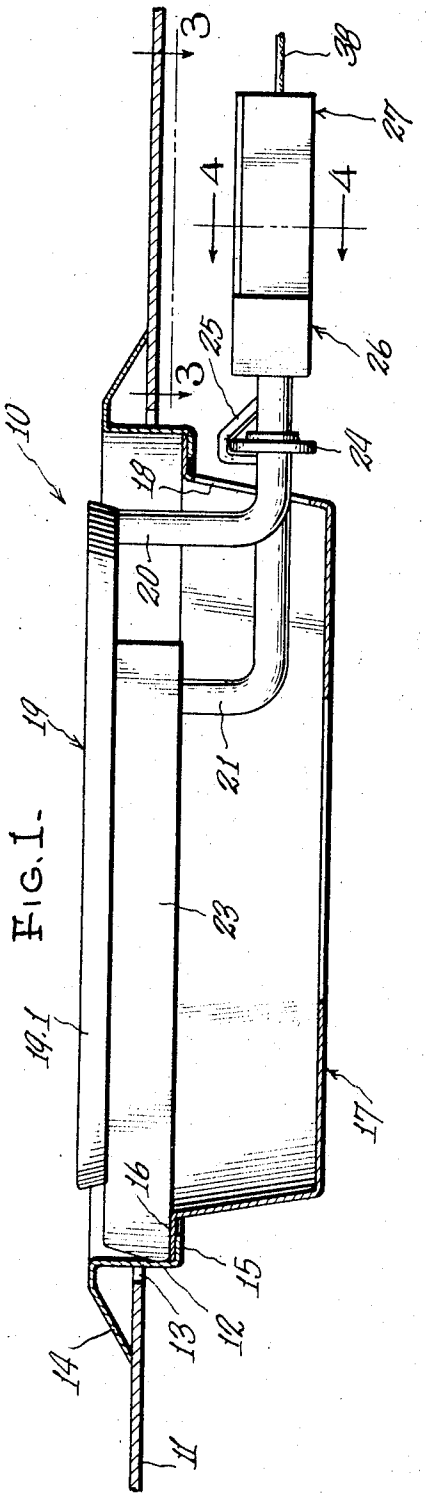


FIG. 1.

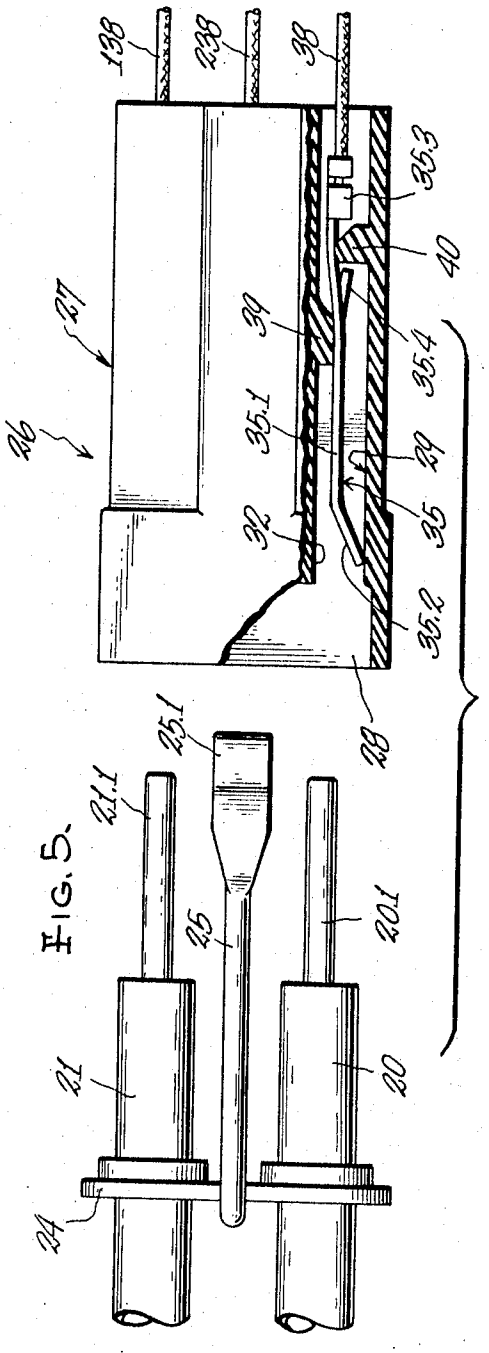


FIG. 5.

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FIG. 3.

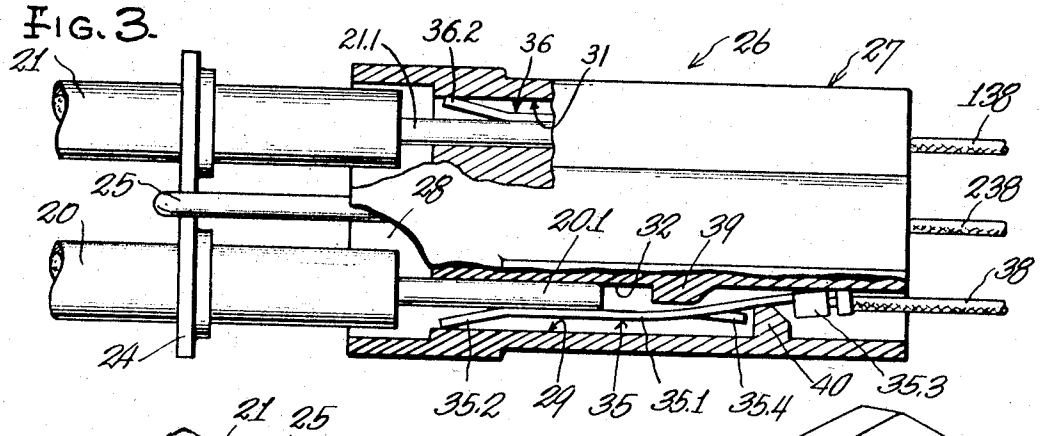


FIG. 2.

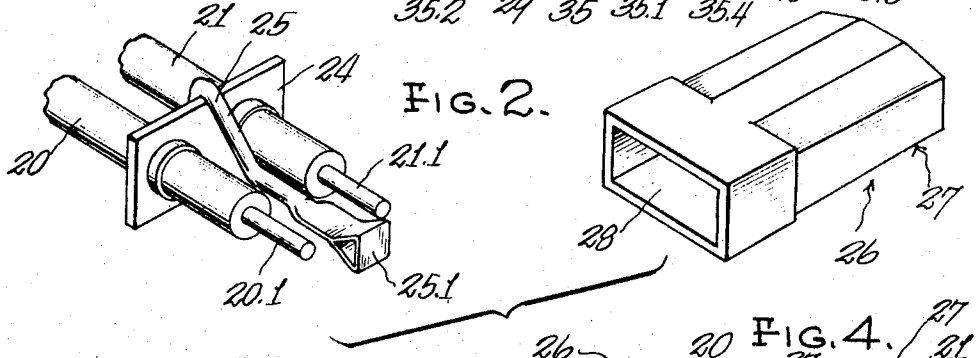


FIG. 4.

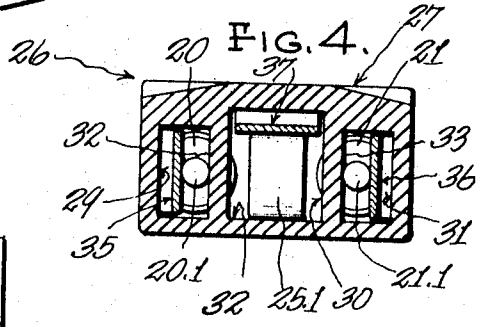


FIG. 6.

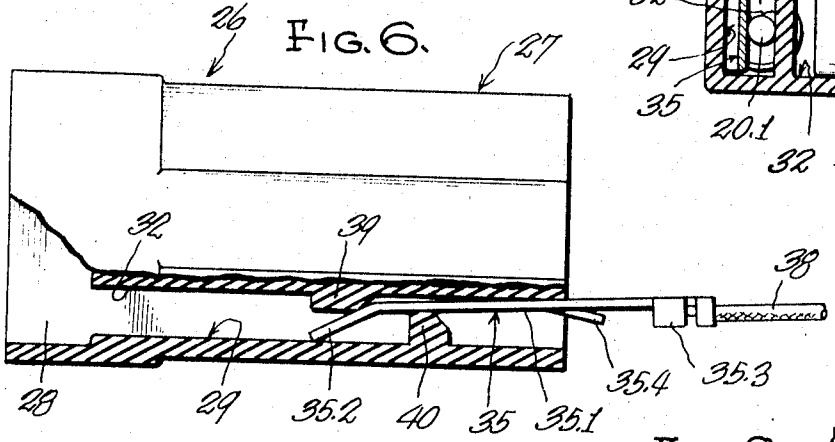


FIG. 8.

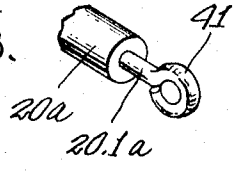
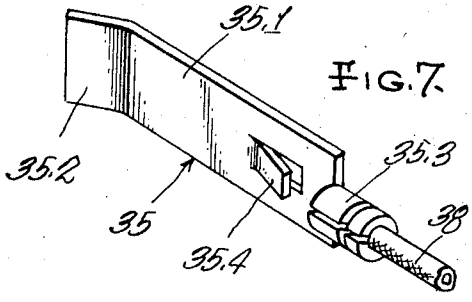


FIG. 7.



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United States Patent Office 3,447,121
Patented May 27, 1969

3,447,121

ELECTRICAL CONNECTORS PARTICULARLY FOR ELECTRIC RESISTANCE HEATING ELEMENTS

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Filed Nov. 7, 1966, Ser. No. 592,484
Int. Cl. H01r 33/72, 9/08; H05b 3/68
U.S. Cl. 339—192 16 Claims

ABSTRACT OF THE DISCLOSURE

An electrical connector assembly in which one or more elongated, resilient electrical contact strips are disposed in respective slots formed in a dielecetric body and wherein each strip has a portion cooperable with one of its slot walls to resiliently receive and grip a respective electrical contact prong therebetween.

Abutments are spaced longitudinally of a body slot to maintain the strip portion aforesaid adjacent its slot wall, such abutments comprising a projection extending toward one slot wall from an opposed slot wall and the other comprising an angularly disposed contact strip end portion resiliently engaged with such opposed slot wall.

The present invention relates to electrical connectors particularly adapted for use with electric resistance heating elements and the principal object of the invention is to provide new and improved devices of the character described.

Heretofore, the connection of electric power and ground leads to electric resistance heating elements of the range, or surface type, has presented a problem in achieving an acceptable balance between manufacturing cost considerations, ease of assembly and disassembly, safety in the hands of a not always careful user, and of course, the basic requirement that any such device must function efficiently for long periods with no attention.

In the past, the leads aforesaid have been attached to the heating element by means of screws; however, such structure has not been satisfactory in that a user of the range could not readily detach the leads from the element to facilitate cleaning of the range and the element assembly. Moreover, factory assembly costs were high since each lead had to be individually fastened.

Going to a near-opposite extreme, the prior art has provided surface elements of the so-called, plug-in type wherein a heating element had its electric terminals inserted into a suitable receptacle in which the electrical connections were automatically made upon element insertion. Many of such plug-in elements have been satisfactory in that a user could readily remove and replace an element; however, such assemblies have not always functioned properly and they have invariably been quite expensive to manufacture and assemble with the range.

The present invention provides a low-cost, simple and efficient device for connecting power and ground leads to a surface-type, electric resistance range element, such device also providing for ready disconnection and reconnection of the element by one of little mechanical aptitude. These and other advantages will readily become apparent from a study of the following description and from the appended drawings.

In the drawings accompanying this specification and forming a part of this application there is shown, for purpose of illustration, an embodiment which the invention may assume, and in these drawings:

FIGURE 1 is a sectional view through a range top in which is mounted a surface-type electric resistance heating element assembly embodying the invention,

FIGURE 2 is a separated perspective view of certain parts seen in FIGURE 1,

FIGURE 3 is a fragmentary, enlarged plan view generally corresponding to the line 3—3 of FIGURE 1, portions on the near side being broken away to show the underlying structure,

FIGURE 4 is an enlarged sectional view generally corresponding to the line 4—4 of FIGURE 1,

FIGURE 5 is a view similar to FIGURE 3, but showing certain parts in separated relation,

FIGURE 6 is a view similar to FIGURE 5 but showing certain parts at an earlier stage of assembly,

FIGURE 7 is an enlarged perspective view of a detail seen in FIGURES 3, 5 and 6, and

FIGURE 8 is a fragmentary, enlarged perspective view of a modified detail.

With reference first to FIGURE 1, there is shown the well-known, surface-type heater assembly **10** mounted on the top panel **11** of an electric range or the like. Briefly, such assembly comprises a trim ring having a tubular portion **12** fitting within an aperture **13** in the range top panel **11**, a radially outwardly projecting flange **14** which rests upon the stove panel top, and a radially inwardly turned flange **15**. Seated upon the flange **15** is a radially outwardly turned flange **16** of a drip pan **17**. The latter has a portion of its wall cut away at **18** for a purpose to appear.

Mounted within the trim ring is the usual enlongated tubular sheathed electric resistance heating element **19** whose intermediate, heat-generating portion **19.1** is convoluted to provide a generally plane heating surface on which a vessel to be heated may be disposed. Terminal ends **20**, **21** of the element **19** are bent to project beneath and to one side of the heating surface provided by the element intermediate portion **19.1**. Element terminal ends **20**, **21**, as best seen in FIGURE 2, are disposed in side-by-side relation for a purpose to appear. Underlying and suitably secured to the convoluted element intermediate portion **19.1** is a metallic supporting member **23** known in the trade as a spider. Spider member **23** provides a plurality of legs which rest upon the upper surface of the flange **16** of pan **17**, such spider in turn supporting the overlying element.

As best seen in FIGURE 2, the element terminal ends **20**, **21** terminate in exially extending, electrically conductive terminal pins **20.1**, **21.1**, respectively, such pins being electrically connected to respective ends of the usual, heat-generating resistor conductor member (not shown) disposed within the intermediate portion of the element **19**. It will be appreciated that pins **20.1** and **21.1** are of relatively low electrical resistance to provide for conduction of electrical energy to the resistor aforesaid at the intermediate element portion.

Still referring to FIGURE 2, an apertured, metal plate **24** extends between the element terminal ends **20**, **21** and is crimped or otherwise affixed to at least one of such ends to maintain the latter in the desired spaced relationship. Welded or otherwise mechanically and electrically secured to the plate **24** is one end of a metal pin **25** whose opposite free end **25.1** is flattened and doubled over on itself to provide a ground prong between the element terminal ends **20**, **21** whose transverse size at its free end is materially greater than the transverse size of the terminal pins **20.1**, **21.1**. It is also to be noted that the free end of prong **25** projects a substantial distance beyond the free ends of the terminal pins for reasons to appear.

A female electrical connector assembly **26** provides a quick attachable-detachable means for connecting the element terminal pins **20.1**, **21.1** into an electrical power circuit and for connecting the ground pin **25** into a ground-

ing circuit. As herein disclosed, assembly **26** comprises a dielectric body **27** having an end with a recess **28** in which the free ends of the element terminal ends **20, 21** may be inserted. As will later appear, electrical connectors within the body **27** make contact with the terminal pins **20.1, 21.1** and the ground pin end **25.1** to place such parts into their respective circuits.

With reference first to FIGURE 4, body **27** is provided with three elongated slots **29, 30** and **31** extending therethrough in side-by-side relation of respectively receiving the terminal pin **20.1**, grounding pin **25**, and terminal pin **21.1**. Slot **29** is in part defined by a side wall **32** while slot **31** is in part defined by a side wall **33**. As herein disclosed, walls **32, 33** are in oppositely facing relation and are disposed adjacent the slot **30**. Similarly, slot **30** is in part defined by a wall **34**; however, wall **34** preferably forms the bottom of slot **30**. As will later be disclosed in greater detail, the terminal pin **20.1** is adapted to be gripped between the wall **32** and a resilient electrical contact member **35**, the terminal pin **21.1** is adapted to be gripped between the wall **33** and another resilient electrical contact member **36**, and the ground pin and **25.1** is adapted to be gripped between the wall **34** and still another resilient electrical contact member **37**. Since the contact members **35, 36** and **37** are preferably identical and function with their respective slots in an identical manner, only the contact **35** and the slot **29** will hereinafter be disclosed in detail.

As best seen in FIGURE 7, contact member **35** comprises a resilient metal strip of a width to closely fit within the slot **29** and having a rectilinear, main portion **35.1** and an integral, angularly disposed end portion **35.2**. At the opposite end of the contact member, the latter is bent transversely at **35.3** to mechanically and electrically connect with a flexible, insulated lead wire **38**. Contact member portion **35.3** forms a lateral extension on the same side of said contact strip as said angularly disposed end portion **35.2** for a purpose to appear. On the same side of the contact strip as the lateral extension **35.3** and the angularly disposed end portion **35.2**, a tongue **35.4** is struck from the contact strip. The free end of tongue **35.4** is directed toward the extension **35.3** but is spaced therefrom, longitudinally of the strip, a short distance for a purpose to be disclosed.

Turning now to FIGURE 6 where the contact strip **35** is shown at an early stage of assembly with the dielectric body **27**, it is to be noted that the slot wall **32** is provided with an integral projection **39** while the opposite wall is provided with a similar projection **40**. Projections **39, 40** are spaced longitudinally of the slot from each other as shown, the former being adjacent the end of the body having the recess **28** and the latter being adjacent the opposite body end.

In assembly of the contact strip **35** with the body **27**, the strip will be inserted in the slot **29** from the right as shown in FIGURE 6 with the strip main portion **35.1** adjacent the slot wall **32** and the angularly disposed strip end **35.2** bearing against the opposite slot wall. To dispose the contact strip in this position, the angularly disposed strip end **35.2**, of course, will have been threaded past the projection **40** and between the latter and the projection **39**, this operation being facilitated by the inclined surfaces on respective projections. Further movement of the contact strip into the body slot **29** will first spring the angularly disposed strip end **35.2** past the projection **39** while continued strip movement will spring the tongue **35.4** past the projection **40** to dispose the latter between the strip lateral projection **35.3** and the free end of the tongue **35.4** as shown in FIGURE 5 to thus retain the contact strip against disassembly form its slot.

With the contact strip **35** completely assembled with the body **27** as shown in FIGURE 5, it is to be noted that the main portion **35.1** of the contact strip is maintained adjacent the slot wall **32** by virtue of it being sprung between the abutments provided by the projection **40** and the angularly disposed strip end **35.2**. The projection **39** functions to maintain a minimum spacing between the contact strip main portion **35.1** and the slot wall **32**, such spacing being somewhat less than the transverse size of the terminal pin **20.1** as shown.

Upon relative movement of the element terminal ends **20, 21** into the body recess **28**, the terminal pin **20.1** will be guided into the slot **29** by means of the angularly disposed contact strip end **35.1**. As the body **28** and the heating element are further forced together to the position seen in FIGURE 3, the terminal pin **20.1** will force the contact strip main portion **35.1** away from the slot wall **32** and the slot projection **39**, the resiliency of the contact strip **35**, however, tightly gripping the terminal pin **20.1** between the contact strip main portion and the wall **32** to establish a low-resistance electrical connection between the terminal pin and the contact strip. To separate the body **27** from the element terminal ends merely require that the body be pulled away from the latter in a reversal of the assembly operation.

While only the contact strip **35** and the associated parts of the dielectric body **27** have been described in detail, it is to be understood that not only are the contact strips **36** and **37** identical therewith and have identical respective leads **138, 238** secured thereto, the contact strip **36** is disposed in the body slot **31** which is identical to slot **29** and has identical projections therein for engagement with the terminal pin **21.1**. As hereinbefore pointed out with respect to FIGURE 4, the wall **33** of slot **31** faces in the opposite direction from the corresponding wall **32** of slot **29**. Additionally, and while the slot **30** in which the contact strip **37** is disposed is considerably wider than the slots **29, 31** to accommodate the greater size of the ground pin **25** and while the wall **34** corresponding to the slot walls **32, 33** is at the bottom rather than at the side, the slot **30** is nevertheless similar to the slots **29, 31** and is provided with similar wall projections for engagement with the contact strip **37** in the manner heretofore disclosed with respect to contact strip **35** and its body slot **29**.

It is an important safety feature of the present invention that the grounding pin end **25.1** is slightly larger than the slots **29, 31** to exclude its disposition therein and engagement with their contained, contact strips. Moreover, since grounding pin **25** projects beyond the projecting ends of element terminal pins **20.1, 21.1**, entry of such terminal pins into engagement with their contact strips can only be effected if grounding pin **25** is first properly entered into its body slot **30**.

While the element terminal pins **20.1, 21.1** have thus far been disclosed as being simple, straight members, it may be desirable to provide them with projecting ends which will increase their area contact with the contact strips.

In the embodiment seen in FIGURE 8 wherein corresponding parts are identified with the same reference characters as before but with the suffix *a* added, only the element terminal end **20***a* is shown in the interest of simplicity. In this embodiment, the terminal pin **20.1***a* has its end formed to provide a loop **41** which is adapted to cooperate with the previously disclosed body slot **20** and contact strip **35** in the same manner as the straight terminal pin. Obviously, loop **41** will be oriented to lie flat along the slot wall **32** upon its insertion into body slot **29**.

In view of the foregoing it will be apparent to those skilled in the art that we have accomplished at least the principal object of our invention and it will also be apparent to those skilled in the art that the embodiments herein described may be variously changed and modified, without departing from the spirit of the invention, and that the invention is capable of uses and has advantages not herein specifically described; hence it will be appreciated that the herein disclosed embodiments are illus-

trative only, and that our invention is not limited thereto.

We claim:

1. An electrical connector assembly comprising a dielectric body having an elongated, internal slot in part defined by opposed walls and one end of said slot being adapted to receive an electrical contact prong,

elongated, resilient electrical contact strip disposed in said slot and having a main portion cooperable with one of said walls to resiliently receive and grip said contact prong therebetween,

and two abutment means spaced longitudinally of said slot for maintaining said contact strip portion adjacent said slot one wall, one of said abutment means being a projection within said slot spaced from said slot one end and connected to and extending from said slot other wall toward said slot one wall, and the other of said abutment means being a contact strip portion resiliently engaged with said slot other wall adjacent said slot one end.

2. The construction of claim 1 wherein a second projection is disposed in said body slot intermediate said first projection and said slot one end for engagement with said contact strip, and wherein such second projection extends from said slot one wall toward said slot other wall to engagement with said contact strip main portion prior to disposition of said contact prong in said body slot to maintain a minimum spacing between said contact strip and said slot one wall that is less than the transverse size of said contact prong.

3. The construction of claim 2 wherein disposition of said contact prong in said body slot biases said contact strip away from said second body projection so that said contact strip is sprung between said first-mentioned body projection and said contact strip portion engaged with said slot other wall.

4. The construction of claim 1 wherein said other abutment means is an angularly disposed contact strip end portion.

5. The construction of claim 4 wherein said body has identical slots formed therein in side-by-side relation,

wherein said slots are arranged with their ends aforesaid the same direction,

wherein said one wall of respective slots are in facing relation,

and wherein identical contact strips are disposed in respective body slots with their angularly disposed end portions turned away from each other.

6. The construction of claim 5 wherein a third slot is formed in said body in coextensive relation with and disposed between said first-mentioned slots,

wherein said third slot has one wall corresponding to the one wall aforesaid of respective first-mentioned slots and lying in a plane normal thereto,

and wherein an identical contact strip is disposed in said third slot for engagement with a grounding contact prong.

7. The construction of claim 4 and further comprising retaining means carried by said contact strip and disposed on opposite sides of said body projection for engagement therewith to retain said strip within said body slot.

8. The construction of claim 7 wherein said retaining means in part comprises a lateral extension formed at an opposite end portion of said contact strip and wherein a lead wire is secured to such strip opposite end portion.

9. The construction of claim 8 wherein the remaining part of said retaining means is a resilient tongue having a free end directed toward but spaced from said lateral extension an amount to closely receive said body projection therebetween.

10. An electric connector assembly, comprising a dielectric body having an elongated internal slot in part defined by opposed body walls, one end of said slot being adapted to receive an electrical contact plug,

a normally generally flat resilient metal contact strip moved to assembled position within said slot by endwise movement of the latter through an opposite end of said slot,

an abutment on one of said slot walls and extending therefrom toward but short of engagement with the other slot wall to form a narrow passageway for said contact strip,

the leading end of said contact strip having a portion laterally off-set from its flat portion in a direction for pressure engagement with said one slot wall after it has been moved through said narrow passageway to thereby resiliently urge that portion of said contact strip between it and said abutment in a direction toward said other slot wall.

11. The construction of claim 10 wherein said contact strip has another offset portion which engages behind said abutment when said contact strip has been moved to fully assembled position to prevent withdrawal of said contact strip from said slot.

12. The construction of claim 10 wherein said electrical contact plug is in the form of a stiff wire-like member having an end of button-hook shape, said end being disposed flatwise between said contact strip and said one slot wall.

13. An electrical connector assembly, comprising a dielectric body having an elongated internal slot, one end of which is adapted to receive an electrical prong,

an elongated resilient contact strip disposed in said slot and having a main portion cooperable with a wall of said slot to resiliently receive and grip said contact prong therebetween,

said contact prong comprising a stiff wire-like member having an end of loop shape, in assembly said loop shape being projected through said slot opening and into said slot to position between said slot wall and said contact strip.

14. The construction of claim 13 wherein said loop is of button hook shape and disposed flatwise between said slot wall and said contact strip.

15. An electrical plug-in connector assembly including the combination of a sheathed electric heating element and a terminal block, said block having an internal cavity opening at an end thereof, a metal contact strip within said cavity and adapted to be connected to a source of electrical energy, said heating element having an internally disposed heating resistor and a terminal pin electrically connected to said resistor and having an exterior portion extending outwardly of an end of the element sheath, the end of said exterior portion being in the form of a loop, said loop being projected through said block opening and into said cavity and having spring engagement with said contact strip to provide for flow of electrical energy from said contact strip to said heating resistor.

16. The construction of claim 15 wherein said loop is button hook-like in shape and has flatwise engagement with said contact strip.

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U.S. Cl. X.R.

219—451; 339—217