Sept. 24, 1963 R. D. CARGILL ET AL 3,104,927

ELECTRICAL CONNECTOR

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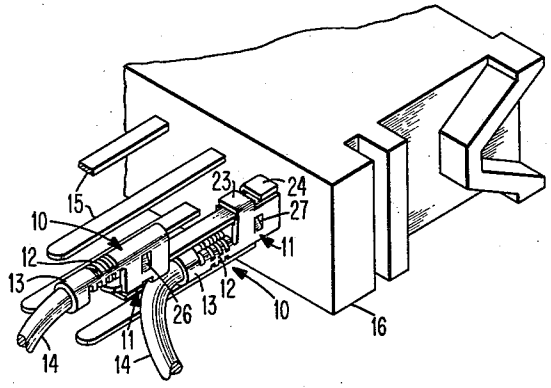
FIG. 1



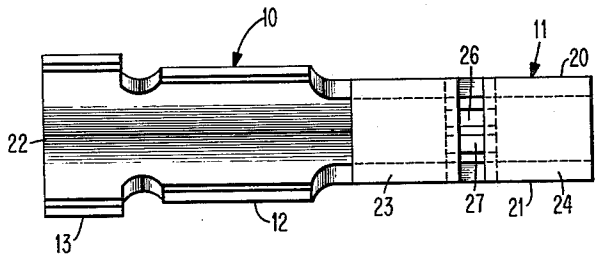
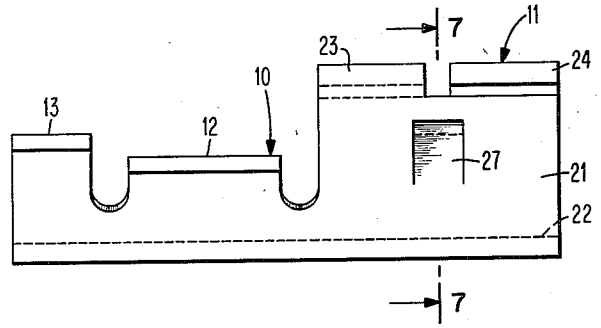


FIG. 2

FIG. 3



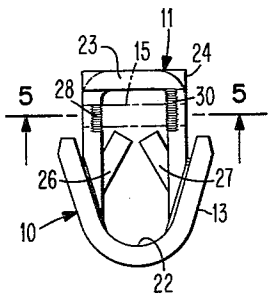


FIG. 4

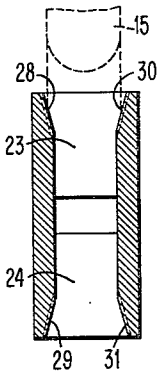


FIG. 5

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ELECTRICAL CONNECTOR

Filed Nov. 25, 1960 2 Sheets-Sheet 2

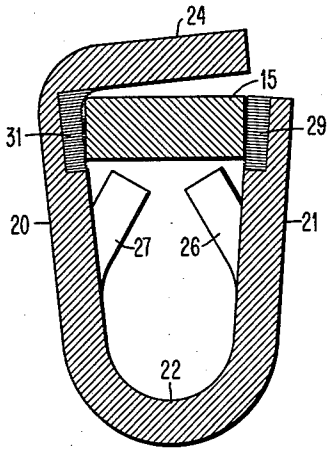

FIG. 6

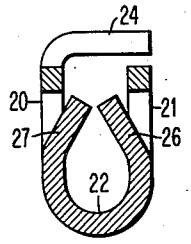

FIG. 7

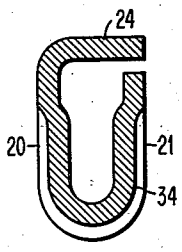

FIG. 13

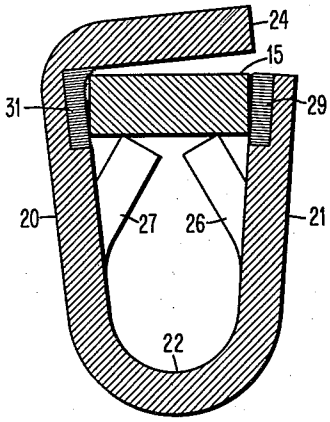

FIG. 10

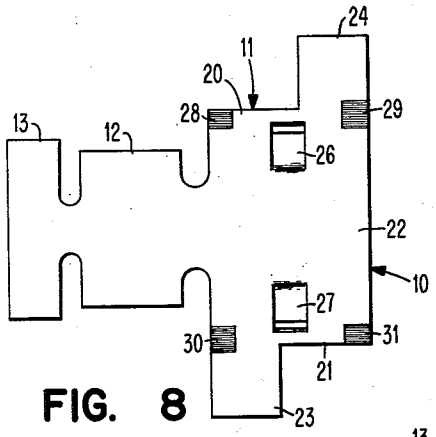

FIG. 8

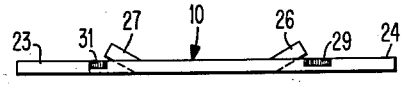

FIG. 9

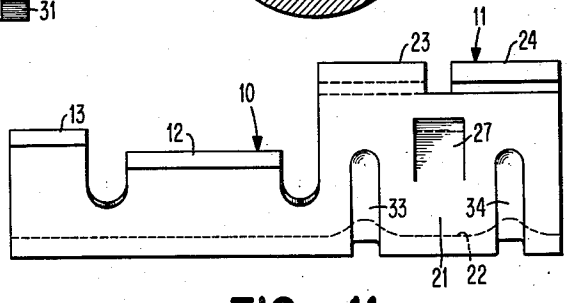

FIG. 11

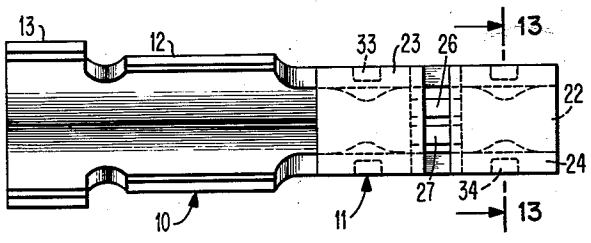

FIG. 12

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ELECTRICAL CONNECTOR

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Filed Nov. 25, 1960, Ser. No. 71,818
3 Claims. (Cl. 339—256)

This invention relates to electrical terminals or connectors of a type adapted to slip into a contact element projecting from a receptacle and, more particularly, to electrical connectors which are crimped onto the end of electrical conductors and are adapted to slip onto projecting contact elements in a manner that the projecting contact element extends through the gripping portion of the associated connector so as to accommodate one or more connectors.

The connector of the present invention is particularly useful for connecting electrical conductors to contact elements projecting from receptacles for receiving pluggable units. Heretofore, a rather common practice for connecting electrical conductors to projecting contact elements was to wrap the electrical conductors in a spiral fashion about the projecting contact elements. While the wrapped wire connection generally produces a satisfactory connection, it requires a special tool for making the connection and another special type of tool for disconnecting the wire from the associated contact element. Further, the wrapped wire connection is a rather permanent type of connection and does not lend itself to use in those areas where the electrical connections, for example, within a data processing machine, must be changed quite frequently.

The connector in the present invention is mechanically and electrically reliable and is specially adapted for use where the electrical connections with the projecting contact elements must be changed quite frequently. A type of projecting contact element for which the connector of the present invention is particularly suitable is that type shown and described in copending application Serial No. 752,038 to A. H. Johnson, filed July 30, 1958, Patent No. 3,008,113, granted November 7, 1961. In that application, the electrical conductors are connected to the projecting contact elements by wrapping the electrical conductors about the contact elements. The contact elements project sufficiently to permit several electrical conductors to be wrapped about a single contact element, and are of the type of contact elements commonly known as the spade type.

The connector of the present invention has a contact element gripping portion spaced from the central axis of the electrical conductor to which the connector is attached. By this arrangement, several connectors may be slipped onto a single projecting contact element and without resorting to a piggyback type of arrangement. The facility of having the connectors in line on a single contact element permits contact elements to be closely spaced relative to each other.

Accordingly, the prime object of the invention is to provide an electrical connector of the slip-on type which is mechanically and electrically reliable.

Another object of the invention is to provide an improved electrical connector which is adapted to slip onto a contact element with the contact element extending through the contact portion of the connector so as to permit additional connectors to be inserted thereon in line.

Another object of the invention is to provide an improved electrical connector which is effectively of the closed entry type.

The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of preferred embodiments

of the invention, as illustrated in the accompanying drawings.

In the drawings:

FIG. 1 is a perspective view showing several connectors slipped onto a contact element projecting from a receptacle;

FIG. 2 is a plan view of the connector prior to being attached to an electrical conductor;

FIG. 3 is a side elevational view of a connector detached from an electrical conductor;

FIG. 4 is a left-end elevational view of the connector;

FIG. 5 is a sectional view taken along the line 5—5 in FIG. 4 and looking in the direction of the arrows;

FIG. 6 is a sectional view showing a contact element inserted into the connector;

FIG. 7 is a sectional view taken along the line 7—7 in FIG. 3 and looking in the direction of the arrows;

FIG. 8 is a plan view of the blank from which the connector is formed;

FIG. 9 is a right-end elevational view of the blank from which the connector is formed;

FIG. 10 is a sectional view of another embodiment of the connector;

FIG. 11 is a side elevational view of a preferred embodiment of the connector;

FIG. 12 is a plan view of the connector shown in FIG. 11; and,

FIG. 13 is a sectional view taken along the line 13—13 and looking in the direction of the arrows in FIG. 12.

With reference to the drawings and particularly to FIG. 1, the invention is illustrated by way of example as a connector **10** having a contact element gripping portion **11**, a conductor embracing furrow **12** and an insulation embracing furrow **13** attached to a conductor **14**. The connector **10** is shown with the contact element gripping portion **11** in position and embracing or clasping the contact element **15** of a receptacle **16**. The receptacle **16** is of the type having a plurality of contact elements **15** projecting therefrom and each including a portion within the receptacle for making contact with the terminals on a pluggable element, not shown, which is insertable into the receptacle **16**.

The connector **10** is formed from a blank shown in FIG. 8. The blank from which the connector **10** is formed may be of any suitable electrically conducting material such as phosphor bronze and is sufficiently hard and resilient to give a spring quality to the contact element gripping portion **11**. The insulation embracing furrow **13** and the conductor embracing furrow **12** are formed in the usual manner to take the configuration of a U, as seen in FIG. 4. When the connective end is to be attached to the conductor **14**, the furrows **12** and **13** are cold forged or crimped onto the conductor **14** so that the furrow **12** makes a mechanical and electrical connection with the conductor and the furrow **13** mechanically embraces the insulation surrounding the conductor **14**.

The contact element gripping portion **11** consists of opposed sides **20** and **21** integral with and extending from a base portion **22**, as seen in FIGS. 6 and 7. Each side **20** and **21** is provided with a tab or arm **23** and **24** extending substantially at right angles from the associated side to overlie the upper face of the opposed side, as seen in FIGS. 2 and 7. Guide lances **26** and **27** are formed from the sides **20** and **21**, respectively. The lances **26** and **27** function to restrict the contact element from traveling inwardly toward the base **22**. If the contact element **15** were permitted to travel toward the base **22**, the connector **10** would be subjected to an overstressed condition resulting in a loss of mechanical and electrical contact qualities. Additionally, it is seen in FIG. 10 the lances **26** and **27** are also adapted to function to make contact

with the contact element **15**. The width of the contact element **15** is greater than the distance between the sides **20** and **21**, as seen in FIG. 4 and FIG. 5. To facilitate insertion of the connector **10** over the contact element **15** from either end, the upper corners **28** and **29** of side **20** and upper corners **30** and **31** of side **21** are beveled sufficiently and, in this example, approximately 15°. As the connector **10** is inserted over the contact element **15**, forces are developed to deflect sides **20** and **21** away from each other. The insertion pressure is reduced by the gradual deflection of sides **20** and **21**. Contact is established between the contact element **15** and connector **10** as shown in either FIG. 6 or FIG. 10, depending upon the formation of the lances **26** and **27**. In FIG. 6, the lances **26** and **27** function to guide the contact element **15** into the contact gripping portion **11** and prevent the contact element **15** from traveling toward the base **22**. The lances **26** and **27** in FIG. 10 perform the same function as lances **26** and **27** in FIG. 6 but, additionally, they make contact with the contact element **15**.

The arms **23** and **24** prevent the contact element **15** from sliding off the sides **20** and **21** during and/or after insertion of the contact element **15** into connector **10**. By forming the arms **23** and **24** so as to extend in opposite directions and to overlap the corresponding sides **20** and **21**, respectively, a closed entry-type of connector is effectively achieved, thereby resulting in good mechanical and electrical qualities.

The connector shown in FIGS. 11, 12 and 13 is a preferred embodiment. In order to aid the arms **23** and **24** from taking a permanent set due to any overstressing which might occur when the contact is slipped onto the terminal **15**, stabilizing ribs **33** and **34** are provided as shown in FIG. 11. The ribs **33** and **34**, which stabilize and strengthen the sides **20** and **21**, are spaced from each other and are formed in the base portion **22** and the opposed sides **20** and **21**. The ribs **33** and **34** are formed as the connector **10** is formed from the blank shown in FIG. 8. The ribs **33** and **34** project or extend inwardly of the sides **20** and **21** and base **22**. The ribs **33** and **34** extend up the sides **20** and **21**, as seen in FIG. 13, to the line of contact of the contact element **15** with the connector **10**. Thusly, the ribs **33** and **34** provide additional resilience in the sides **20** and **21** to increase the contact and withdrawal forces of the connector **10**.

From the foregoing, it is seen that a connector is provided which is adapted to slip onto a contact element in a manner to permit a like or another type of slip-on connector to be also inserted onto the same contact element. The contact gripping portion of the connector is out of the plane of the connector furrow portion, which attaches onto the electrical conductor. Hence, the contact element gripping portion of one connector can be positioned to overlie the furrow portion of another connector positioned to embrace the same contact element.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that the foregoing and other changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. An electrical connector for connecting a conductor to a single spade-type contact element of predetermined length, said contact element having two major and minor contacting surfaces along the length thereof, comprising:

a base member;

a pair of opposed side members extending from said base member, said side members

(*a*) having a longitudinal dimension less than half of said predetermined length of said contact element, whereby said contact element can extend through said connector and protrude therefrom over more than one-half of its length, and

(*b*) being normally separated a distance less than the width of said spade-type contact element so as to clasp said spade-type contact element along the minor contacting surfaces thereof by the resilient spring force of said side members;

a pair of guide lances projecting angularly from said side members toward each other and away from said base member to prevent said contact element from traveling toward said base member;

a pair of arms spaced along the longitudinal axis of said connector and extending from said opposed side members beyond a center plane drawn perpendicular to said base member half-way between said opposed side members, whereby said pair of arms and said pair of guide lances cooperate to define a longitudinal channel for receiving and cradling said spade-type contact element; and

axially offset means connected to said base member for holding said conductor, said offset means being spaced from the longitudinal axis of said channel so as to leave space for a second connector to be slipped onto said protruding contact element.

2. An electrical connector as in claim 1 wherein said guide lances project in a manner to abut against said contact element.

3. An electrical connector as in claim 1 wherein a pair of continuous ribs longitudinally spaced from each other are formed in said base and side members, said ribs being disposed in line with said pair of arms and extending upwardly of said side members to the line of contact made between said side members and said contact element.

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