April 9, 1957 S. N. BUCHANAN 2,788,508

ELECTRIC CONNECTOR

Filed Jan. 6, 1953 3 Sheets-Sheet 1

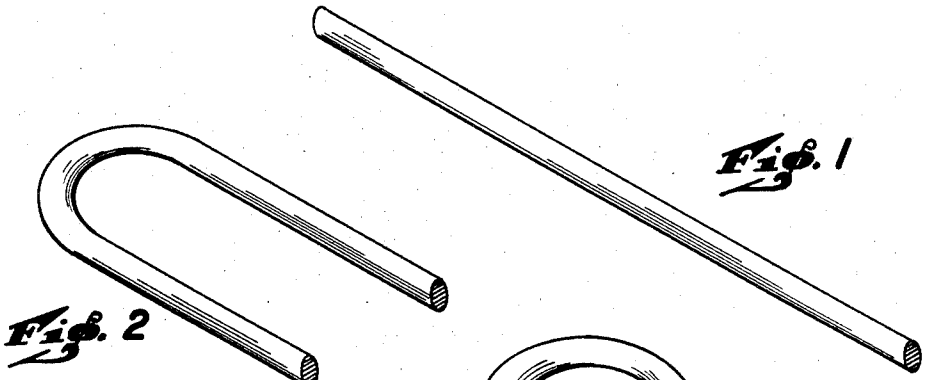


Fig. 1

Fig. 2

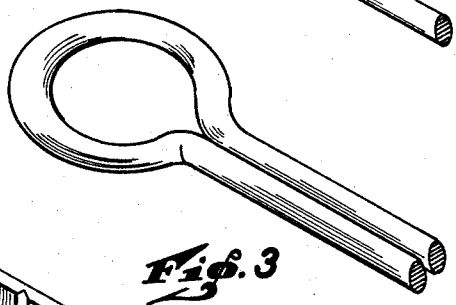


Fig. 3

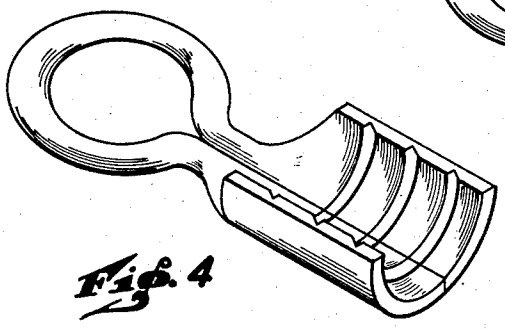


Fig. 4

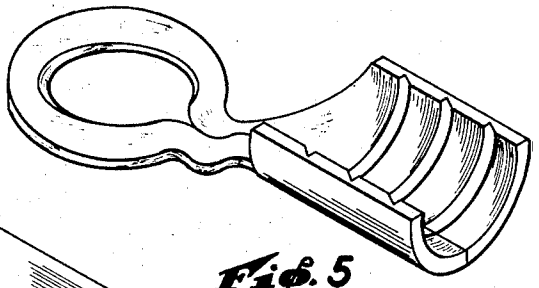


Fig. 5

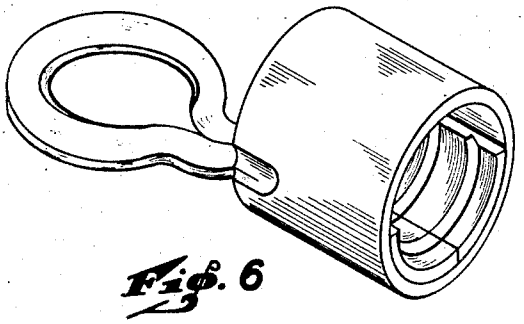


Fig. 6

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ELECTRIC CONNECTOR

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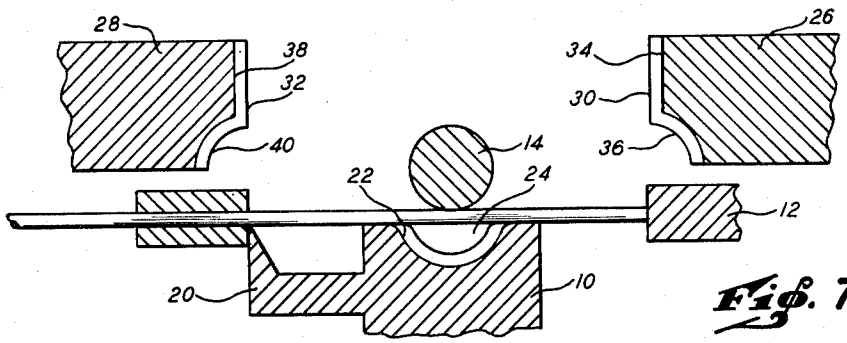


Fig. 7

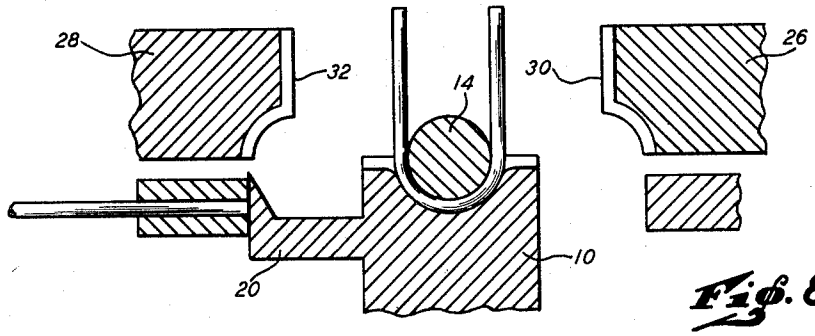


Fig. 8

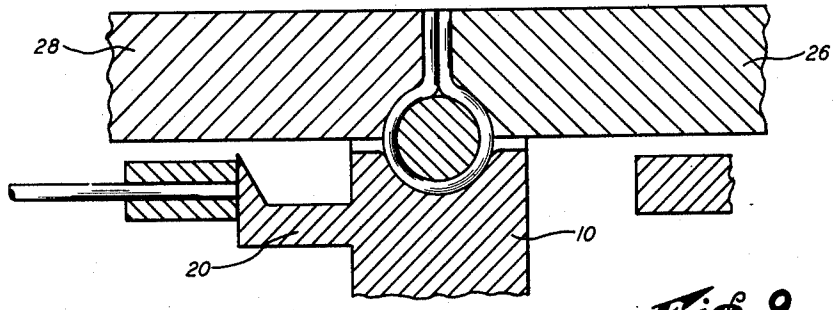


Fig. 9

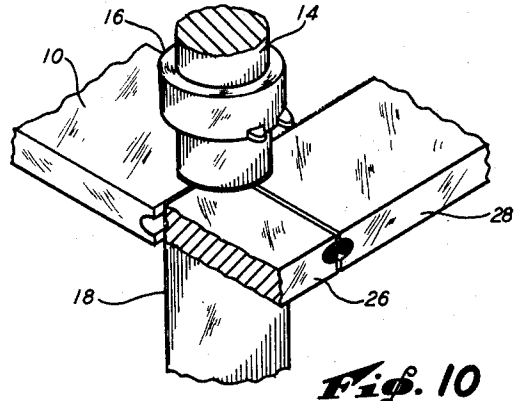


Fig. 10

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ELECTRIC CONNECTOR

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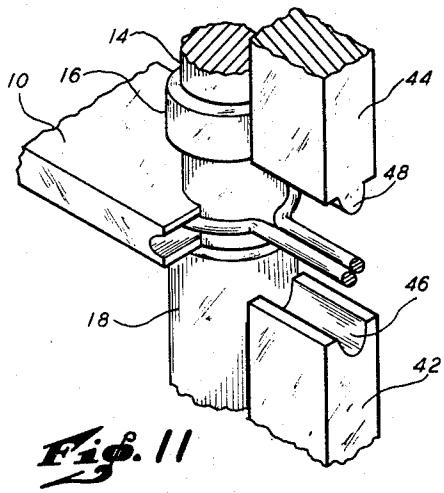


Fig. 11

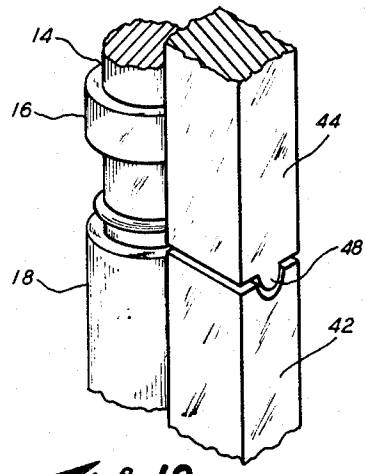


Fig. 12

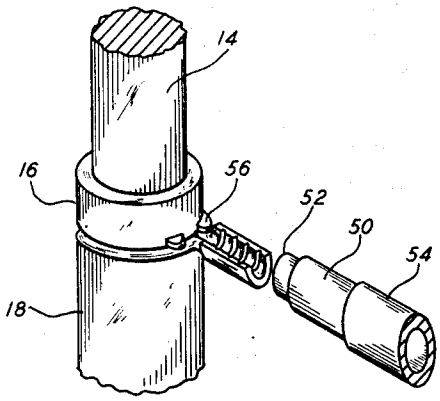


Fig. 13

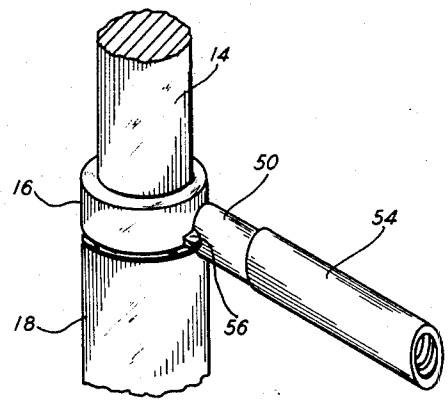


Fig. 14

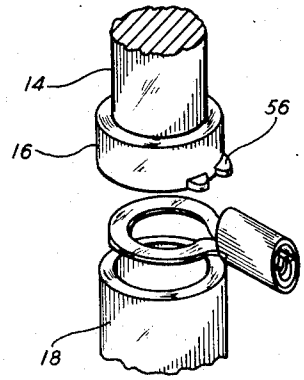


Fig. 15

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ELECTRIC CONNECTOR

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Application January 6, 1953, Serial No. 329,867

3 Claims. (Cl. 339—276)

This invention relates to electrical equipment and more particularly to electric connectors of the type that are secured to electrical conductors by crimping a conductor-receiving portion of the connector onto the bared wires of a conductor.

Connectors of this general classification usually have extending from the conductor-receiving portion, a terminal engaging portion for attaching one end of the connector to a terminal, binding post or the like, and are known to those versed in the art as terminal lugs. The connectors, when they are mechanically attached to a conductor in the manner mentioned above, provide a path for the flow of current between the conductor and a terminal or binding post that may be connected to the terminal engaging portion of the connector. Because the connector must conduct current from the conductor to the binding post, it is necessary that they be manufactured from a material having a high thermal conductivity. Copper and copper base alloys are two such materials that exhibit this characteristic.

An important object of this invention is to provide an improved electric connector of the crimp-on type, which connector is of inexpensive and simple construction.

Various other objects of the invention will be apparent from the ensuing description and an inspection of accompanying drawings, in which:

Figs. 1 through 5 illustrate the stock at successive stages of fabrication of the connector;

Fig. 6 illustrates the completed connector;

Figs. 7 through 9 are plan views in section showing the relative position of the forming slides during the first operation;

Fig. 10 is a perspective view of the forming slides and arbor during the first operation;

Figs. 11 and 12 are views in perspective of the second operation wherein the conductor engaging portion of the connector is fabricated;

Figs. 13 and 14 illustrate in perspective the relative position of the forming members as the terminal engaging portion of the connector is fabricated and as the restraining sleeve is assembled on the connector; and

Fig. 15 is a perspective view of the assembled connector in completed form, as it leaves the last operation.

Briefly, the invention comprises a novel electric connector that includes a conductor-receiving portion and a terminal engaging portion integral therewith. These connectors are adapted to be secured upon an electrical conductor by crimping the conductor-receiving portion into intimate contact with the conductor. The terminal engaging portion may then be attached to a binding post or any other connector. The three elements, conductor, connector and binding post, are then joined mechanically and electrically. A method for manufacturing such a connector involves fabricating a length of common wire by bending the wire into a conductor engaging portion and a terminal engaging portion and inserting a hollow

sleeve over the conductor engaging portion to form an enclosure for the conductor.

One manner of practicing the method of making a terminal lug type of connector from a strip of copper wire involves the use of a multi-slide wire forming machine including a plurality of reciprocating slides that act upon a strip of copper wire in a predetermined timed sequence so as to form the wire into the connector. A quantity of wire is preferably disposed on a spool (not shown) adjacent a conventional feeding device. The wire is fed by the feeding device into the wire forming machine and into the path of a first reciprocating slide member 10 as clearly shown in Fig. 7. As the foremost end of the wire engages the pressure-sensitive surface of stop member 12, the first of a series of forming steps is initiated when arbor member 14 having a movable sleeve 16 mounted thereon moves axially downward to a position contiguous to the wire and is received in a movable ring 18. The reciprocating slide member 10 then moves from its inoperative position as shown in Fig. 7 to its extended position as shown in Figure 8. As slide member 10 moves forward, cutter bar 20 attached to one side of member 10 severs a predetermined length of wire from the continuous strand being fed into the machine. The leading edge of slide 10 has a recess 22 of a depth equal to the diameter of the wire and adapted to accommodate the wire as the slide moves forward. Slide member 10 is also provided with a notch 24 for receiving the arbor 14. As the reciprocating slide member moves through one cycle of its operation, a length of wire is severed and bent or formed into a U-shape about the arbor member 14 as shown in Fig. 8.

The next forming step is accomplished by a pair of reciprocating slides 26 and 28, moving in opposed directions or to and from each other. These latter slides move in a path normal to the direction of movement of slide member 10 and are provided in their leading edges with wire receiving recesses 30 and 32 similar to and coplanar with recess 22. The recess 30 is of a depth equal to the diameter of the wire and comprises a straight portion 34 which is normal to the directions of movement of the slide member 26 and a connected arcuate portion 36 which at its bottom subtends slightly less than 90 degrees. The recess 32 is a mirror image of the recess 30. Corresponding portions 38 and 40 are disposed on complementary slide member 28. As the slides move toward each other, they engage the parallel legs of the U-shaped wire and force them into a juxtaposed relation with portions of the legs forced into intimate contact with the arbor member, as shown in Fig. 9. Attention is also directed to Fig. 10 which illustrates in perspective the relative position of the forming members at this stage of the process.

The wire now has been formed into two portions, one circular, the other rectilinear and extending radially from the circular portion. The rectilinear portion cooperates (after further fabrication), in a manner to be later described, with a hollow sleeve member to form a conductor engaging enclosure while the circular portion normally is attached to a terminal, binding post or like electrical connection.

The configuration of the wire as produced by the above forming operation is in general maintained throughout the remaining operations. The next step involves coining the connector and offsetting the terminal engaging portion from the conductor engaging portion. Prior to this forming step the complementary slides 26 and 28 retract to their inoperative positions as illustrated in Fig. 8, with the wire and slide member 10 as shown in Fig. 9. A section 42 of the base member, upon which the complementary slides 26 and 28 are supported is ver-

tically movable and cooperates with a vertically movable punch member **44** to perform the next step. A notch **46**, semi-circular in section, is located in the surface of member **42** in alignment with the conductor engaging portion of the connector. On the face of the punch **44** is a boss **48**, also in alignment with the conductor, and adapted to complement the notch as the members **42** and **44** forcibly converge upon the connector. As a result of the engagement of punch member **44** and the die block **42**, the conductor engaging portion of the connector becomes semi-circular in section. It may also be desirable to provide the outer surface of the boss **48** with a series of ridges so that the inner surface of the connector will more readily grip a conductor when the connector is united therewith.

The next step involves offsetting the arcuate or terminal engaging portion of the connector from the rectilinear or conductor engaging portion as mentioned above. During this step the reciprocating slide **10** reverts to its inoperative position and the connector is held between members **42** and **44**. Sleeve members **16** and **18** are then moved downwardly and upwardly respectively. The circular portion of the connector is engaged by the sleeve **16** and forced against the upper surface of the sleeve **18** in a plane parallel to but slightly below the plane of the conductor engaging portion held between members **42** and **44**. The connector now has the configuration illustrated in Fig. 5.

In order to apply the metallic restraining sleeve **50** to the conductor engaging portion of the connector, the members **42** and **44** separate while the sleeves **16** and **18** "dwell" in the position shown in Fig. 13. The purpose of the restraining sleeve **50** is to form an enclosure for the conductor and prohibit the juxtaposed legs of the connector from separating. One manner of assembling the sleeve and the connector comprises placing the sleeve onto a spring loaded pin **52** affixed in a bore in the end of a travelling arbor **54**. The sleeve **50**, having been hopper-fed onto the pin **52**, has an inside diameter substantially equal to the outside diameter of the conductor engaging portion of the connector and has its leading edge slightly flared. As the fore end of the pin strikes the connector, continued movement of the arbor strips the sleeve from the pin and moves it into a frictional fit with the outer surface of the conductor engaging portion of the connector. To prevent sleeve **50** from thereafter becoming separated from the remainder of the connector, sleeve **16** and ring **18** may be provided with stop elements **56** so shaped as to distort portions in the leading edge of the sleeve **50** into contact with the conductor receiving portion of the connector, as shown in Fig. 6.

After the sleeve **50** has been placed on the connector, arbor **14**, with sleeve **16** thereon, retracts to its inoperative position clear of sleeve **18** as shown in Fig. 15 and the assembled connector is removed by a blast of air from a conventional air hose (not shown).

Other connectors, varying in shape, may be produced by the same method as described above.

As many changes will occur to those skilled in the art, the details of the disclosed connector are not to be taken as limitations upon the invention except as those details may be included in the appended claims.

I claim:

1. An electric connector adapted to be crimped onto an electric conductor, comprising a first piece including a trough-like part having first and second coaxial cylindrical segments having adjacent edges abutting each other parallel to said axis, said segments together being less than 360 degrees in circumferential extent and a loop for engaging a terminal, said loop having first and second ends integral respectively with said first and second segments, and a second piece including a sleeve embracing and in frictional engagement with said trough-like part and holding said adjacent edges together, said sleeve and said trough-like part together providing a conductor-receiving opening.

2. The invention set forth in claim 1 in which said sleeve has an indentation providing an area of increased frictional engagement with said trough-like part.

3. The invention set forth in claim 1 in which said sleeve has first and second indentations providing areas of increased frictional engagement with said trough-like part, said first and second indentations located at the end of said trough-like part adjacent said loop and spaced the same circumferential distance from said abutting edges.

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