

Feb. 28, 1950

S. N. BUCHANAN
ELECTRIC CONNECTOR

2,499,296

Filed July 2, 1948

3 Sheets-Sheet 1

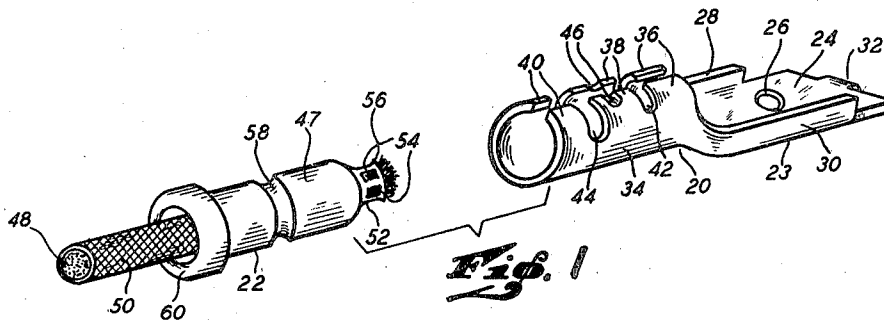


Fig. 1

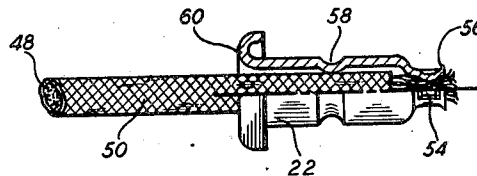


Fig. 2

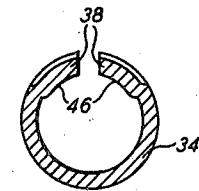


Fig. 4

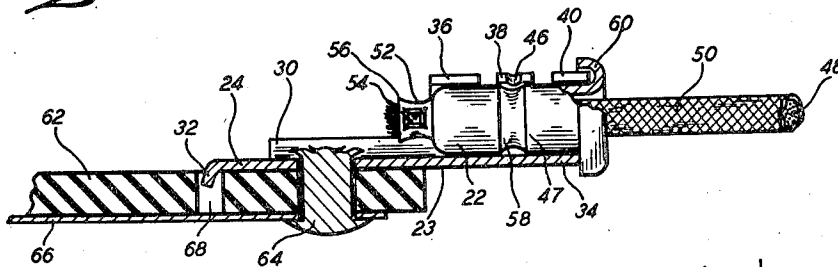


Fig. 6

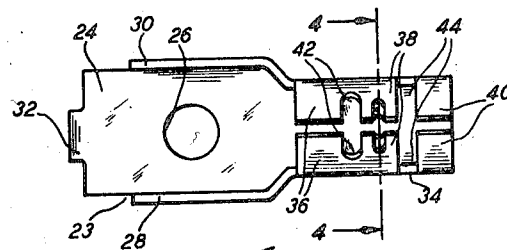


Fig. 3

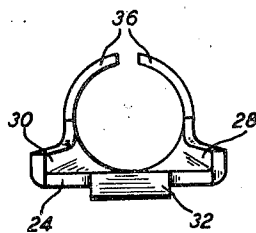


Fig. 5

INVENTOR.
STEPHEN N. BUCHANAN
BY *Arthur J. Rangle*
ATTORNEY.

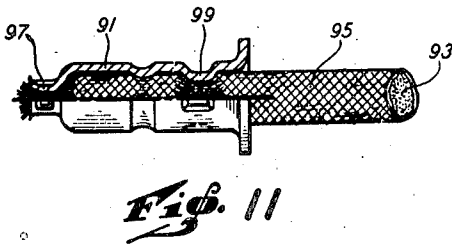
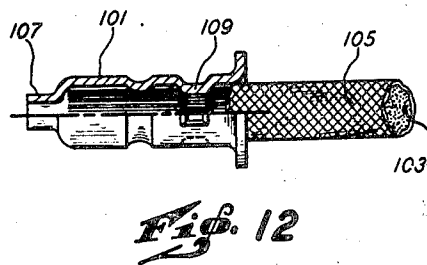
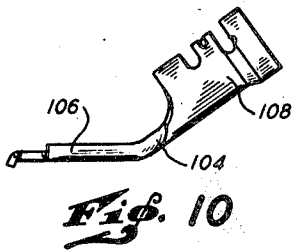
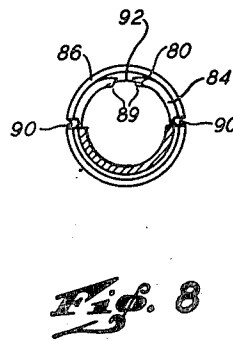
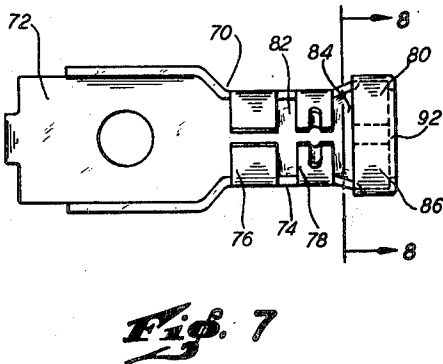
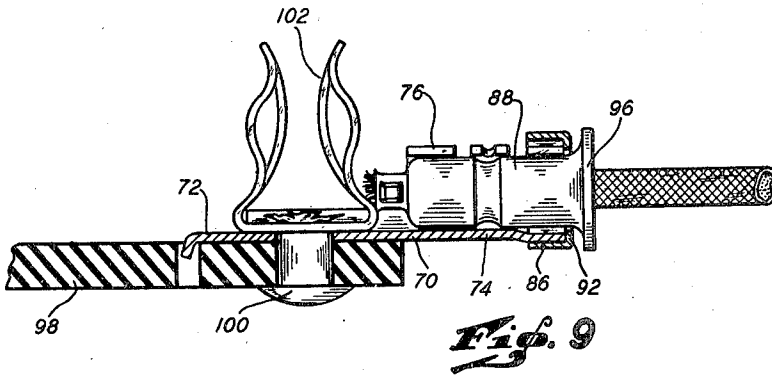
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INVENTOR.
STEPHEN N. BUCHANAN
BY *Arthur G. Pringley*
ATTORNEY.

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ELECTRIC CONNECTOR

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3 Sheets-Sheet 3

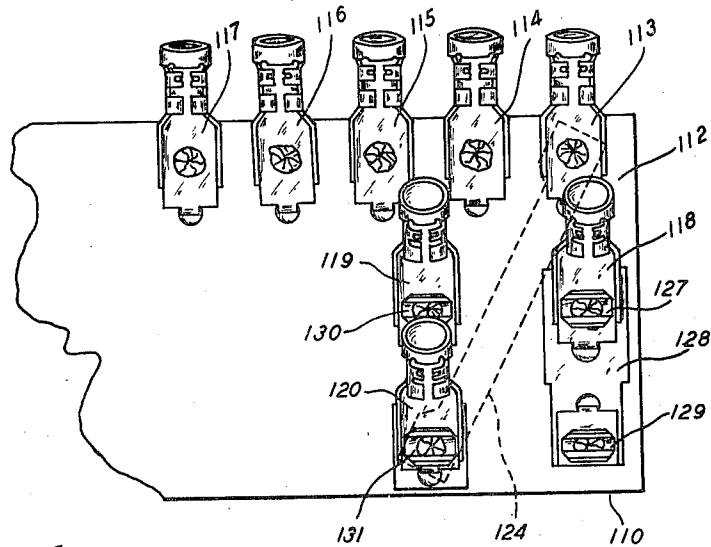


Fig. 13

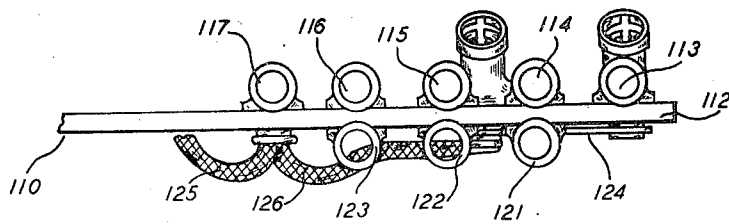


Fig. 14

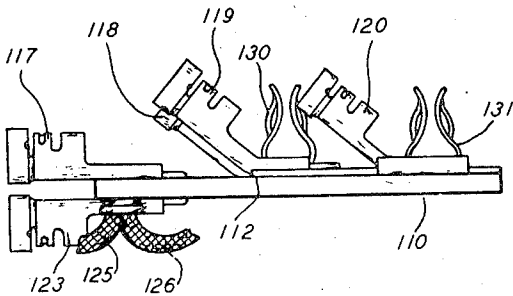


Fig. 15

INVENTOR.
STEPHEN N. BUCHANAN
BY
Arthur E. Pringley
ATTORNEY.

UNITED STATES PATENT OFFICE

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ELECTRIC CONNECTOR

Stephen N. Buchanan, Westmoreland Hills, Md.,
 assignor to Buchanan Electrical Products Cor-
 poration, Elizabeth, N. J., a corporation of New
 Jersey

Application July 2, 1948, Serial No. 36,565

10 Claims. (Cl. 173-328)

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This application is a continuation-in-part of application Serial Number 750,054, filed May 23, 1947, for Electrical connector, now abandoned.

This invention relates to electrical connectors and has special reference to connectors for automotive wiring installations. One of the objects of the invention is to provide a detachable connector especially adapted for use in connecting electrical conductors to terminals. Plug and socket connections have been used to a limited extent in various circuits in automotive wiring. An object of this invention is to provide an improved plug and socket connection in combination with a terminal lug so that in wiring an automobile the terminal lug may be connected to a terminal block or a particular part of the apparatus and subsequently the conductors may be connected thereto by plugging into the socket incorporated in the terminal lug. Another object of the invention is to provide an improved detachable connector which will maintain adequate electrical contact notwithstanding the effects of rough usage, vibration and mechanical strain.

The wiring of automobiles has become very complex due to the large number of electrical devices used on the car and the many accessories that are available. It is the usual practice to lay out the wiring of the car and form all of the conductors into a harness which is prefabricated and then installed in the car during the assembly operation. Plugs and receptacles have been used to a limited extent where it is necessary to make connections at intermediate points in the wiring circuit. However, plugs and receptacles have not been used to a greater extent because difficulty has been experienced in loose connections as a result of vibration, or mechanical strain. In accordance with my invention an improved combined terminal lug and receptacle is provided which, together with an improved plug, provide a readily detachable connection that may be made at any point in the wiring circuit and at the terminals which will withstand considerable vibration and mechanical strain.

Other objects and advantages will appear from the description and drawings, in which

Fig. 1 is a perspective view showing a terminal lug and receptacle and a plug for insertion into said receptacle;

Fig. 2 is a view partly in section of a plug and an electrical conductor connected thereto;

Fig. 3 is a plan view of a terminal lug and receptacle;

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Fig. 4 is a sectional view along lines 4-4 of Fig. 3;

Fig. 5 is an end view of the terminal lug and receptacle shown in Fig. 3;

Fig. 6 is a side view partly in section showing a terminal lug and receptacle mounted on a terminal block and a plug connected to the receptacle;

Fig. 7 is a plan view of a modified form of terminal lug and receptacle having a reinforcing ferrule secured to the end of the receptacle;

Fig. 8 is a section on line 8-8 of Fig. 7;

Fig. 9 is a side view partly in section of the modified form of terminal lug and receptacle shown in Fig. 7 mounted on a terminal block with a plug connected to the receptacle;

Fig. 10 is a side view of a modified form of terminal lug and receptacle in which the receptacle extends at an angle to the terminal lug;

Fig. 11 is a view partly in section of a plug and an electrical conductor connected thereto;

Fig. 12 is a similar view of a plug connected to a larger size electrical conductor;

Fig. 13 is a plan view of a terminal block assembly showing a plurality of terminal lugs and receptacles secured thereto;

Fig. 14 is an end view of the terminal block assembly shown in Fig. 13; and

Fig. 15 is a side view of the terminal block assembly shown in Fig. 13.

Referring to the drawings, Figs. 1 to 5 show a combined terminal lug and receptacle 20 and a plug 22. Combined terminal lug and receptacle 20 has a terminal lug or support 23 including a flat contact portion 24 with an opening 26, upstanding shoulders 28 and 30 extending along the sides, and a depending tongue 32 as best indicated in Fig. 5. A cylindrical receptacle 34 is integrally connected to the terminal lug 23 and has three pairs of resilient fingers 36, 38 and 40 separated laterally by slots 42 and 44. The central pair of fingers 38 are provided with detents 46 that extend inwardly as best indicated in Fig. 4. The inner pair of fingers 36 are less resilient than the two pairs of fingers 38 and 40 because they are wider and of shorter length. The pairs of fingers 40 and 38 being more resilient interpose less resistance to the insertion of plug 22 into receptacle 34 whereas fingers 36 being more rigid provide a greater contact pressure and so a better electrical contact.

As indicated in Figs. 1 and 2, plug 22 has a cylindrical barrel portion 47 that surrounds a stranded electrical conductor 48 covered by insulation 50. A reduced end 52 is crimped or

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compressed into intimate contact and engagement with the bared end of conductor 48. As better indicated in Fig. 2, the connection of plug 22 to the electrical conductor 48 is preferably accomplished by a crimping operation in which a plurality of indentations 54 are produced which may be four in number, at points spaced from the opening of reduced end 52. Beneath the indentations 54 the strands of conductor 48 are compressed and a good electrical connection obtained between plug 22 and conductor 48. Due to the spacing of the indentations 54 from the opening of end 52 a bell-mouthed opening 56 is produced which provides a space for the reception of solder, if desired, to insure a better electrical connection between the strands of conductor 48 and plug 22. Barrel 47 is provided with an annular groove 58 intermediate its ends for cooperation with the detents 46 of fingers 38 to secure plug 22 in receptacle 34 against accidental removal as may be seen by reference to Fig. 6. A skirt 60 is formed at the end of barrel 47 which overlies a portion of the barrel and forms an annular space therearound for the reception of the end fingers 40 when plug 22 is located in receptacle 34 as shown in Fig. 6. Skirt 60 limits the radial expansion of fingers 40 and prevents damage to receptacle 34 by an angular pull on conductor 48 upon removal of plug 22 from receptacle 34. Should plug 22 be removed at an angle to the center line of receptacle 34 it might expand some or all of the three pairs of fingers 36, 38 and 40 beyond their elastic limit permanently deforming the receptacle 34.

Referring to Fig. 6, combined terminal lug and receptacle 20 is shown mounted on a terminal block 62 of insulating material. A rivet 64 serves to secure the combined terminal lug and receptacle 20 to terminal block 62 and also connects terminal lug or support 23 to a connecting strip 66 which may be connected at its opposite end, not shown, to another terminal or an electrical device. Tongue 32 of terminal lug or support 23 extends into an opening 68 provided in terminal block 62 and prevents lateral movement of combined terminal lug and receptacle 20.

In Figs. 7 to 9, a modified form of combined terminal lug and receptacle 70 is shown having a terminal lug or support portion 72 and a receptacle portion 74. Terminal lug or support 72 corresponds in construction to the form of terminal lug or support shown in Figs. 1 to 5. Receptacle 74 is provided with three pairs of resilient fingers 76, 78 and 80, separated laterally by slots 82 and 84, respectively. Receptacle 74 is enlarged at its free end over which is provided a ferrule 86. Ferrule 86 surrounds fingers 80 and limits their radial expansion to prevent an angular pull on a plug 88 connected to receptacle 74 deforming the pairs of fingers 76, 78 and 80 upon the removal of plug 88. Fingers 80 are larger in diameter than fingers 76 and 78 and, as indicated in Fig. 8, are turned in at their free ends 89 to resiliently engage plug 88. Ferrule 86 is secured to receptacle 74 by means of two detents 90 extending into slot 84 at the base of fingers 80 as indicated in Fig. 8. A shoulder 92 of ferrule 86 abuts the end of receptacle 74. Detents 90 may be formed in ferrule 86 after it is located in position over the end of receptacle 74 of means of a crimping operation. By the provision of ferrule 86 on receptacle 74 the necessity for the skirt 60 as provided on plug 22 shown in Figs. 1 to 6 is eliminated and instead plug 88 of Fig. 9 is provided with a shoulder 96 which serves

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to stop plug 88 on its insertion into receptacle 74.

Referring to Fig. 9, a combined terminal lug and receptacle 70 of the form shown in Figs. 7 and 8 is mounted on a terminal block 98. A rivet 100 serves to secure terminal lug or support 72 to terminal block 98 and to connect it to a fuse clip 102.

In Fig. 10 a modified form of combined terminal lug and receptacle 104 is shown similar in construction to the form shown in Figs. 7 to 9 except that the terminal lug or support portion 106 extends at an angle to the receptacle 108 to permit closer spacing of receptacles as will be better understood upon reference to Figs. 13 to 15.

In Fig. 11, plug 91 is connected to electrical conductor 93 provided with insulation 95. The electrical connection is made by crimping or compressing at the small end 97 and, additionally, the plug 91 is crimped at 99 engaging the insulation 95 and providing a strain relief at the point of connection of the plug 91 to the conductor 93 at 97, the strain of removing a plug being taken at the point 99.

In Fig. 12, a plug 101 is connected to a larger size conductor 103 provided with insulation 105. The conductor 103 is too large to enter the reduced end 107 of the plug 101 and is connected by compressing or crimping at 109.

In Figs. 13 to 15, a portion of a terminal block assembly 110 is shown with a plurality of combined terminal lugs and receptacles mounted thereon of the forms shown in Figs. 7 to 10. Obviously the form shown in Figs. 1 to 6 could be substituted therefor. On the top of terminal block 112 five straight terminal lugs and receptacles 113, 114, 115, 116 and 117 are secured along the edge and three angular terminal lugs and receptacles 118, 119 and 120 are secured in a second and third row spaced from the edge. By using angular terminal lugs and receptacles, any desired number of terminals can be mounted in successive rows on the same terminal block without danger of creating short circuits. Terminal lugs and receptacles 114, 115 and 116 are connected respectively to three straight terminal lugs and receptacles 121, 122 and 123 mounted on the under side of block 112. Terminal lug and receptacle 113 is connected by means of a contact strip 124 to another terminal mounted on block 112. Terminal lug and receptacle 117 is connected to two electrical conductors 125 and 126 which may be connected to other terminals or directly to electrical devices. Angular terminal lug and receptacle 118 is connected directly to a fuse clip 127 by means of a contact strip 128 to a second fuse clip 129. Angular terminal lug and receptacle 119 is connected to a fuse clip 130 and angular terminal lug and receptacle 120 is connected to fuse clip 131 and by means of contact strip 124 to straight terminal lug and receptacle 113. Fuse clips 127 and 130 and similarly fuse clips 129 and 131 are so positioned as to be adapted to receive between them a fuse for interconnecting the circuits connected thereto.

What is claimed is:

1. An electrical connector comprising in combination a receptacle provided with a supporting portion having a central web whereby said receptacle may be securely fixed on a support, a plug receiving portion having an inner, outer and intermediate pair of resilient fingers separated by transverse slots and a longitudinal slot, the transverse slot separating said inner and intermediate pair of fingers being of less extent than

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the transverse slot separating said outer and intermediate pair of fingers whereby said outer pair of fingers is relatively more flexible than said inner pair of fingers, said intermediate pair of fingers being provided with inwardly extending detents and a plug having tubular portion for surrounding an electrical conductor, a reduced end on said tubular portion for intimately engaging a bared end of said conductor whereby said plug may be securely fixed thereon, a groove in said tubular portion intermediate the ends thereof and a skirt extending from the opposite end of said tubular portion and overlying a part thereof to provide a recess whereby upon engagement of said plug with said receptacle said inner pair of fingers will tightly grip said tubular portion, said detents will engage said groove to prevent inadvertent separation of said plug and said receptacle and said outer pair of fingers will be disposed in said recess whereby excessive radial movement and permanent deformation of said outer pair of fingers will be prevented.

2. An electrical connector comprising in combination a receptacle provided with means for securing the same to a support, a plug receiving portion having an inner, outer and intermediate pair of resilient fingers separated by transverse slots and a longitudinal slot, the transverse slot separating said inner and intermediate pair of fingers being of less extent than the transverse slot separating said outer and intermediate pair of fingers whereby said outer pair of fingers is relatively more flexible than said inner pair of fingers, said intermediate pair of fingers being provided with inwardly extending detents and a plug having a tubular portion for surrounding an electrical conductor, means for fixing said plug on said conductor, a groove in said tubular portion intermediate the ends thereof and a skirt extending from the opposite end of said tubular portion and overlying a part thereof to provide a recess whereby upon engagement of said plug with said receptacle said inner pair of fingers will tightly grip said tubular portion, said detents will engage said groove to prevent inadvertent separation of said plug and said receptacle and said outer pair of fingers will be disposed in said recess whereby excessive radial movement and permanent deformation of said outer pair of fingers will be prevented.

3. An electrical connector comprising in combination, a receptacle provided with means for securing the same to a support, a plug receiving portion having an inner, outer and intermediate pair of resilient fingers separated by transverse slots and a longitudinal slot, said intermediate pair of fingers being provided with inwardly extending detents and a plug having a tubular portion for surrounding an electrical conductor, means for fixing said plug on said conductor, a groove in said tubular portion intermediate the ends thereof and a skirt extending from one end of said tubular portion and overlying a part thereof to provide a recess whereby upon engagement of said plug with said receptacle said detents will engage said groove to prevent inadvertent separation of said plug and said receptacle and said outer pair of fingers will be disposed in said recess whereby excessive radial movement and permanent deformation of said outer pair of fingers will be prevented.

4. An electrical receptacle comprising a support having a central web, longitudinally extending upturned side flanges, a downwardly extending tongue at one end and an aperture in

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said web whereby said receptacle may be securely fixed on a support, a plug receiving portion integral with said support portion having an inner, outer and intermediate pair of resilient fingers separated by transverse slots and a longitudinal slot, the transverse slot separating said inner and intermediate pair of fingers being of less extent than the transverse slot separating said outer and intermediate pair of fingers whereby said outer pair of fingers is relatively more flexible than said inner pair of fingers, said intermediate pair of fingers being provided with inwardly extending detents and a ferrule surrounding said outer pair of fingers to limit radial expansion thereof.

5. An electrical receptacle comprising a support having a central web, longitudinally extending upturned side flanges, a downwardly extending tongue at one end and an aperture in said web whereby said receptacle may be securely fixed on a support, a plug receiving portion integral with said support portion having an inner, outer and intermediate pair of resilient fingers separated by transverse slots and a longitudinal slot, the transverse slot separating said inner and intermediate pair of fingers being of less extent than the transverse slot separating said outer and intermediate pair of fingers whereby said outer pair of fingers is relatively more flexible than said inner pair of fingers, and said intermediate pair of fingers being provided with inwardly extending detents.

6. An electrical receptacle comprising a support portion having a central web and an aperture in said web whereby said receptacle may be securely fixed on a support, a plug receiving portion integral with said support portion having an inner, outer and intermediate pair of resilient fingers separated by transverse slots and a longitudinal slot, the transverse slot separating said inner and intermediate pair of fingers being of less extent than the transverse slot separating said outer and intermediate pair of fingers whereby said outer pair of fingers is relatively more flexible than said inner pair of fingers and said intermediate pair of fingers being provided with inwardly extending detents.

7. An electrical receptacle including a plug receiving portion having an inner, outer and intermediate pair of resilient fingers separated by transverse slots and a longitudinal slot, the transverse slot separating said inner and intermediate pair of fingers being of less extent than the transverse slot separating said outer and intermediate pair of fingers whereby said outer pair of fingers is relatively more flexible than said inner pair of fingers and said intermediate pair of fingers being provided with inwardly extending detents.

8. An electrical plug comprising a tubular portion having an annular groove intermediate the ends thereof, a reduced end for engaging a conductor and securing said plug thereto and a skirt extending from the opposite end of said tubular portion and overlying a part thereof to provide an annular recess.

9. An electrical plug comprising a tubular portion having a groove intermediate the ends thereof, a reduced end for engaging a conductor and securing said plug thereto and a skirt extending from the opposite end of said tubular portion and overlying a part thereof to provide a recess.

10. An electrical plug comprising a tubular portion having an annular groove intermediate the ends thereof, a second annular groove the

inner wall of which is adapted to engage a conductor to secure said plug thereto and a skirt extending from one end of said tubular portion and overlying a part thereof to provide an annular recess.

STEPHEN N. BUCHANAN.

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Disclaimer

2,499,296.—*Stephen N. Buchanan*, Westmoreland Hills, Md. ELECTRIC CONNECTOR. Patent dated Feb. 28, 1950. Disclaimer filed Dec. 18, 1951, by the inventor; the assignee, *Buchanan Electrical Products Corporation*, consenting.

Hereby enters this disclaimer to claims 4, 5, 6, and 7 of said patent.
[*Official Gazette January 15, 1952.*]