

Sept. 24, 1963

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3,104,925

ELECTRICAL CONNECTOR ASSEMBLY

Filed Jan. 16, 1962

2 Sheets-Sheet 1

FIG. 1

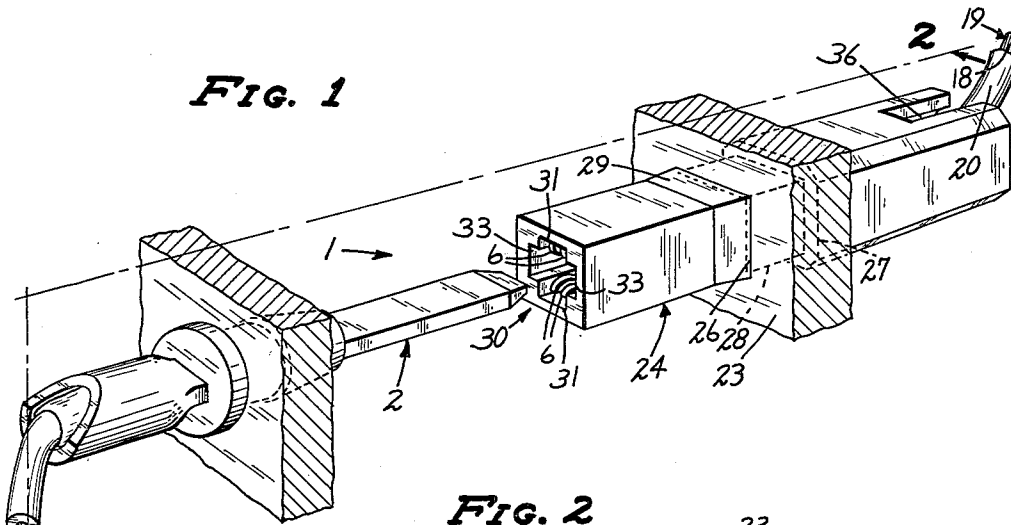


FIG. 2

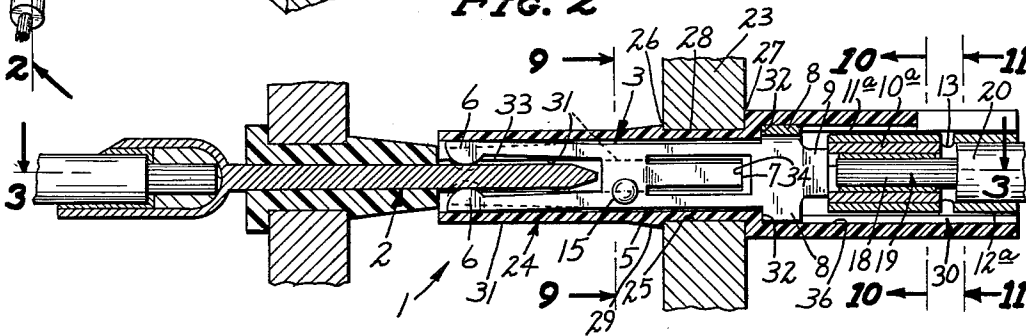


FIG. 3

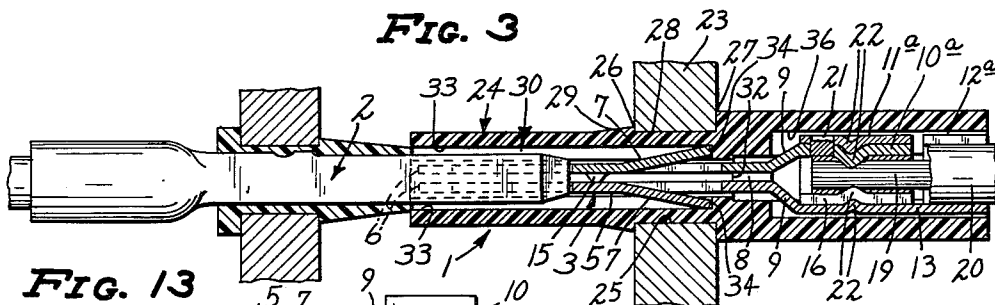
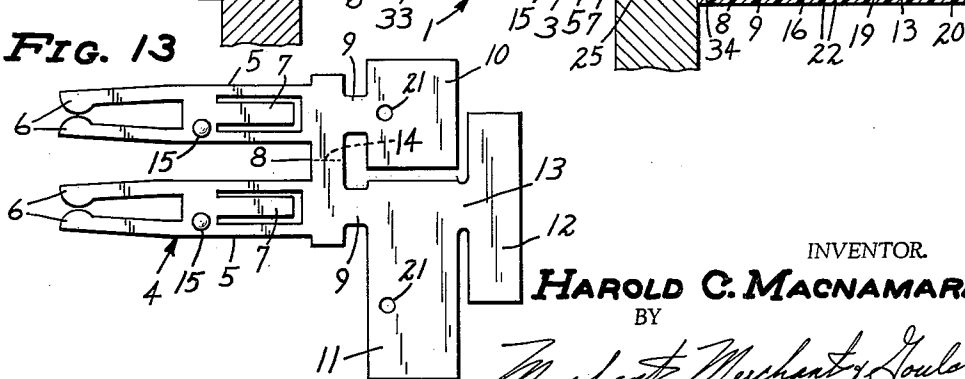


FIG. 13



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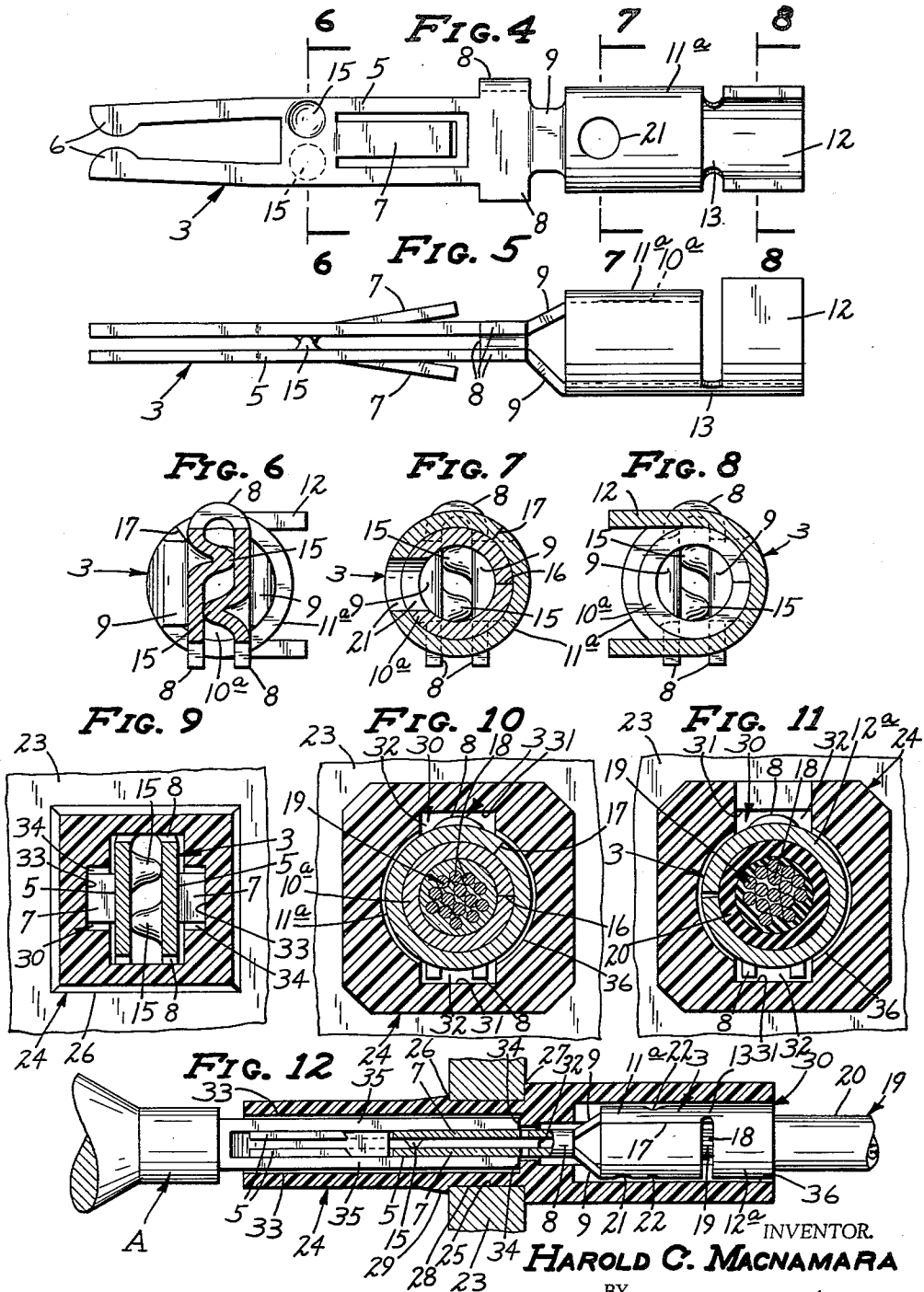
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6 Claims. (Cl. 339-217)

My invention relates generally to electrical terminal connectors for use in the electrical and electronics industries.

More particularly my invention relates to electrical terminal connectors of the type adapted for use with terminal baseboards adapted for receiving a plurality of such terminals, whereby a plurality of components of a complicated electronic device or system may be connected or disconnected as desired.

More specifically, my invention relates to connectors of the male-female type wherein the female element is bifurcated for the reception of the other thereof.

Connectors of the above type are normally connected to the terminal baseboards by bushings, and it is the primary object of my invention to provide means whereby a terminal connector may be detachably secured in its cooperating bushing, and may thus be removed from said bushing, without removing the bushing from the baseboard, for the purpose of repairing the connector, or alternatively, for purpose of changing circuitry, etc.

A further object of my invention is the provision of novel means whereby said connector is automatically releasably locked into place upon insertion of the same into the bushing, and in further combination with means for rendering the locking means inoperative with a minimum of effort and skill, for the purposes of removal of the connector from the bushing. Connectors of this type are conventionally formed from sheet metal, the enlarged head-forming upper ends of which are crimped about connecting electrical conduit. Where such conduits are of the multiple strand type, it is not uncommon for one or more strands to escape through the seam formed by the crimping of the metal thereabout. Another important object of my invention is the provision of novel means for positively eliminating this obviously undesirable condition.

A further object of my invention is the provision of a cooperating terminal connector and bushing which can be manufactured with automatic machinery at a minimum of cost.

A further object of my invention is the provision of a device of the class above described which is rugged and durable in construction, easy to operate, and which has an extremely high degree of reliability.

The above and still further objects of my invention will become apparent from the following detailed specification, appended claims and attached drawings.

Referring to the drawings wherein like characters indicate like parts throughout the several views.

FIG. 1 is an exploded view in perspective showing my novel connector;

FIG. 2 is a view in axial section taken on the line 2-2 of FIG. 1;

FIG. 3 is a view in axial section taken on the line 3-3 of FIG. 2;

FIG. 4 is a view in plan of the female connector element of my invention;

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FIG. 5 is a view in side elevation of the structure of FIG. 4;

FIG. 6 is a view in transverse section on an enlarged scale taken on the line 6-6 of FIG. 4;

FIG. 7 is a view in transverse section taken on the line 7-7 of FIG. 4, also on an enlarged scale;

FIG. 8 is a view in transverse section taken on the line 8-8 of FIG. 4, also on an enlarged scale;

FIG. 9 is a view in transverse section taken on the line 9-9 of FIG. 2;

FIG. 10 is a view in transverse section taken on the line 10-10 of FIG. 2;

FIG. 11 is a view in transverse section taken on the line 11-11 of FIG. 2;

FIG. 12 is a view in axial section of the female portion of my connector, illustrating means of removal of the same from its cooperating insulator bushing; and

FIG. 13 is a view in top plan of the blank from which my female connector element is formed.

Referring with greater particularity to the drawings, the numeral 1 indicates in its entirety my novel connector which is comprised of a tongue-like male connector element 2 and a bifurcated tongue-like female connector element 3. Connector elements 2, 3 are formed from any suitable metal, such as copper or an alloy thereof, having high electrical conductivity.

As shown in FIG. 13 my novel female connector element 3 is stamped from sheet material to form a blank 4 to provide a pair of elongated tongue-like terminal portions 5 that are bifurcated at their inner ends to provide pairs of cooperating jaws 6. Longitudinally outwardly of the jaws 6, the terminal portions 5 are pierced to provide stop fingers 7, for a purpose which will hereinafter be described. An elongated generally rectangular tab 8 extends transversely of the terminal portions 5 at the outer ends thereof and has extending outwardly therefrom a pair of spaced parallel arms 9 that terminate at their outer ends in elongated generally rectangular wings 10, 11 extending in directions parallel to the tab 8 and each disposed longitudinally outwardly of a different one of the terminal portions 5. A third wing 12, of generally rectangular shape, is shown as being connected to the wing 11 by means of an arm 13, the wing 12 extending in a direction parallel to the wings 10, 11.

In forming the female connector element 3 from the blank 4, the arms 9 are bent angularly outwardly from the plane of the blank 4 to dispose the wings 10 and 11 in offset parallel relation to the plane of the terminal portions 5 and tab 8. The wing 10 is then rolled to form a split tubular element 10a, the axis of which extends parallel to the longitudinal dimension of the terminal portions 5. The tab 8 is folded upon itself on a transverse fold line shown by dotted lines in FIG. 13 and indicated by the reference character 14 to dispose the terminal portions 5 in face to face relationship. As shown particularly in FIG. 6, the terminal portions 5 are provided with inwardly projecting dimples 15 which tend to maintain the terminal portions 5 in closely spaced relationship. With the tab 8 thus folded, the wing 11 is rolled about the tubular element 10a to provide an outer split tubular element 11a concentric with the tubular element 10a. It will be noted with reference to FIG. 13 that the wing 10 projects laterally from both sides of its respective arm 9, whereas the wing 11 projects laterally in one direction

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from its respective arm 9 for substantially its entire length. Hence, when the wings 10 and 11 are formed to provide the split tubular elements 10a and 11a, respectively, the split portions or seams 16 and 17 respectively thereof are circumferentially offset with respect to each other. This is an extremely important factor in positively preventing any given strand or strands 18 of a multi strand conductor wire 19 from projecting outwardly through the seams subsequent to the reception of the conductor 19 within the tubular element 10a. In other words, should a strand 18 escape through the seam 16 it could not escape through the circumferentially offset seam 17.

It will be further noted, that when the wing 11 is formed around the tubular element 10a, the third wing 12 is formed into U-shape, as shown particularly in FIG. 8. Then, when the conductor 19 is inserted into the tubular element 10a, the wing 12 is formed into circular shape about the insulation 20 of the conductor 19, as shown in FIGS. 11 and 12, the fully formed wing 12 being indicated therein by the reference character 12a.

The wings 10 and 11 are provided with apertures 21 that are axially aligned when the wings 10 and 11 are rolled to provide the tubular elements 10a and 11a, as shown in FIG. 7, to provide a passageway for solder to the interior of the inner tubular element 10a. To further anchor the strands 18 of the conductor 19 within the tubular element 10a, both tubular elements 10a and 11a are crimped, as indicated at 22, see particularly FIG. 3. During the forming of the blank 4, the fingers 7 are bent angularly outwardly from the plane of their respective terminal portions 5 in directions to cause said fingers to diverge longitudinally outwardly, as shown in FIG. 5, and for a purpose which will hereinafter be described.

Adapted to cooperate with my novel connector element 3, above described, in securing same to a mounting panel 23, is a novel bushing identified in its entirety by the numeral 24. Under conditions where it is necessary or desirable that the insulator bushing 24 be formed from insulating material, I have found that "Zytel" or "Fiberfil" plastics are suitable. Preferably, the bushing 24 is of cross-sectionally rectangular shape and is adapted to fit into a similarly shaped opening 25 in the mounting panel 23, whereby to prevent rotation of the bushing with respect to the panel. The exterior of the bushing 24 is formed intermediate its ends to provide opposed axially spaced laterally outwardly projecting shoulders 26, 27 that define opposite ends of a transversely reduced seat 28 for engagement with the opening 25 in the mounting panel 23. Portions of the bushing 24 adjacent the shoulders 26 taper toward the inner end of the bushing 24, as indicated at 29, to facilitate insertion of the bushing into said opening 25 to bring about engagement of the seat 28 therewith.

The interior of the bushing 24 defines a cross-sectionally rectangular passage 30 that extends longitudinally through the bushing 24, one opposed pair of side walls 31 of the passage 30 being formed to provide a cooperating pair of longitudinally outwardly facing stop shoulders 32, see particularly FIG. 2, for engagement with laterally spaced portions of the folded tab 8 of the female connector element 3, when the female connector element is inserted longitudinally inwardly into the bushing 24, to limit inward movement of the former with respect to the latter. The other opposed side walls of the passage 30 are formed to provide opposed side channels 33 that extend longitudinally from the bushing 24 and terminate in longitudinally inwardly facing shoulders 34 that are adapted to engage the laterally outwardly projected ends of the fingers 7 to limit longitudinally outward movement of the female connector element 3 with respect to the bushing 24. It will be noted that the material of the female connector element 3 is sufficiently resilient to permit the free ends of the fingers 7 to be moved into the planes of their respective terminal portions 5 during movement of the connector element longitudinally inwardly into the bush-

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ing 24. When the free ends of the fingers 7 move beyond the inwardly facing shoulders 34, the resilient nature of the connector material urges the free ends of the fingers 7 outwardly into the channels 33 so that the free ends of the fingers 7 are adapted to abut the shoulders 34 and thus lock the female connector element 3 within the bushing 24 against accidental removal.

Removal of the female connector element 3 from the bushing 24, for purposes of modification of circuitry or repair, may be accomplished by moving the fingers 7 laterally inwardly, preferably through the medium of a tool A provided for the purpose and shown in FIG. 12. Tool A is provided with a pair of laterally spaced parallel legs 35 that are adapted to be inserted longitudinally into the opposed channels 33 and have camming engagement with the outer surfaces of the fingers 7 to move the same within the planes of their respective terminal portions 5.

As shown, the tongue-like male element 2 has a generally rectangular cross-section, opposite side portions being generally flat and opposite edge portions thereof adapted to be received in the opposed channels 33. Preferably, the thickness of the male connector element 2 is slightly greater than the normal space between the jaws 6, so that the jaws 6 are spread apart to receive the connector element 2 and make positive electrical contact therewith. It will be further noted that the planes of the opposite flat sides of the connector element 2 are normal to the planes of the terminal portions 5 of the female connector element 3.

It will be noted, with reference to FIGS. 2, 3 and 12, that the outer end portion of the passage 30 is enlarged, as indicated at 36, to receive the split tubular elements 11a and 12a, so that all of the metallic portions of the connector element 3 are encompassed by the bushing 24.

My invention has been thoroughly tested and found to be completely satisfactory for the accomplishment of the above objects, and while I have shown a preferred embodiment thereof, I wish it to be understood that same may be capable of modification without departure from the scope and spirit of the appended claims.

What I claim is:

1. A one piece electrical connector element comprising:
 - (a) a terminal portion for engagement with a cooperating electrical connector element,
 - (b) an elongated generally rectangular tab extending from one end of said terminal portion and folded upon itself intermediate its ends on a line extending transversely of said tab,
 - (c) a pair of opposed arm portions extending transversely from said tab and diverging in a direction away from said tab,
 - (d) and a pair of concentric tubular elements each integral with a different one of said arm portions for reception of the uninsulated end portion of a conductor wire within the inner one of said tubular elements,
 - (e) said tubular elements being axially split each at a point in circumferentially spaced relation to the split in the other thereof.
2. An electrical connector element formed from a blank of flat sheet metal, said blank comprising,
 - (a) a terminal portion for engagement with a cooperating electrical connector element,
 - (b) an elongated generally rectangular tab extending in a direction transversely of said terminal portion and adapted to be folded upon itself intermediate its ends on a line parallel to the longitudinal dimension of said terminal portion,
 - (c) a pair of arms extending transversely from a side edge of said tab opposite said terminal portion and in spaced parallel relation to each other,
 - (d) and a pair of elongated generally rectangular wings at the outer ends of said arms in parallel relationship to said tab,

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(e) said wings being adapted to be formed into concentric inner and outer split tubular elements one within the other for reception of the uninsulated end portion of a conductor wire within the inner one of said tubular elements.

3. The structure defined in claim 2 in which the outer split tubular element is formed to provide an axially outwardly projecting wing which is adapted to be formed into a tubular clamp about the insulated end portion of said conductor wire.

4. The structure defined in claim 2 in which said terminal portion is female in nature and comprises a pair of laterally spaced parallel tongue-like portions integral with said tab, said tongue-like portions being bifurcated at their outer ends to provide cooperating jaws which overlie each other to provide laterally spaced pairs of cooperating jaws when said tab is folded upon itself.

5. The structure defined in claim 4 in which one of said tongue-like portions intermediate said jaws and said tab is formed to provide a resilient stop finger which extends generally axially in a direction away from said jaws and is yieldingly biased laterally outwardly from the plane of said tongue-like portion.

6. The structure defined in claim 5 in which the other

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of said tongue-like portions is similarly formed to define a second resilient stop finger which normally diverges with respect to said first mentioned stop finger in the direction of said tab.

References Cited in the file of this patent

UNITED STATES PATENTS

1,019,423	Case	Mar. 5, 1912
2,129,725	Alden	Sept. 13, 1938
2,374,413	Carlson	Apr. 24, 1945
2,401,430	Lake	June 4, 1946
2,711,522	Goodwin	June 21, 1955
2,840,792	Herrold	June 24, 1958
2,872,655	Damon	Feb. 3, 1959
2,891,103	Swengel	June 16, 1959
2,903,670	Sitz	Sept. 8, 1959
2,995,617	Maximoff et al.	Aug. 8, 1961
3,027,537	Hess et al.	Mar. 27, 1962
3,031,640	McKee	Apr. 24, 1962
3,070,772	Olsson et al.	Dec. 25, 1962

FOREIGN PATENTS

25,053	Great Britain	Nov. 3, 1900
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