Dec. 17, 1957 M. E. PARADISE 2,817,067

ELECTRICAL CONNECTOR

Filed June 24, 1953

FIG. 1

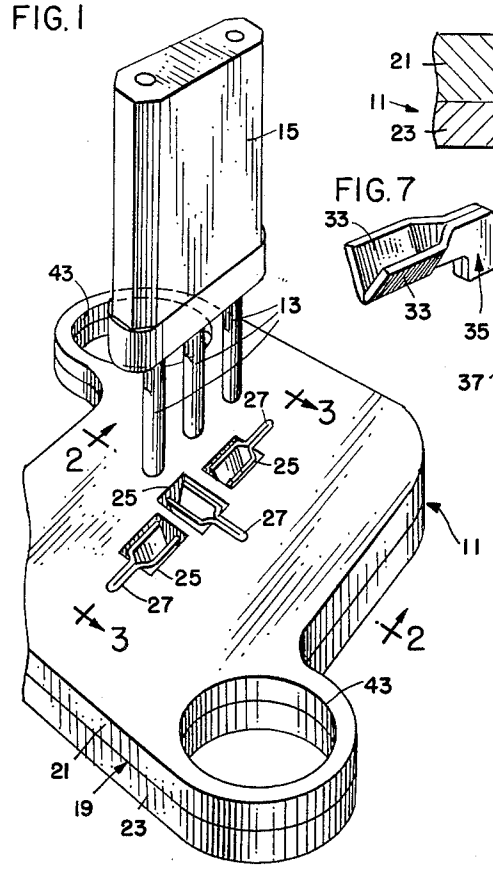


FIG. 2

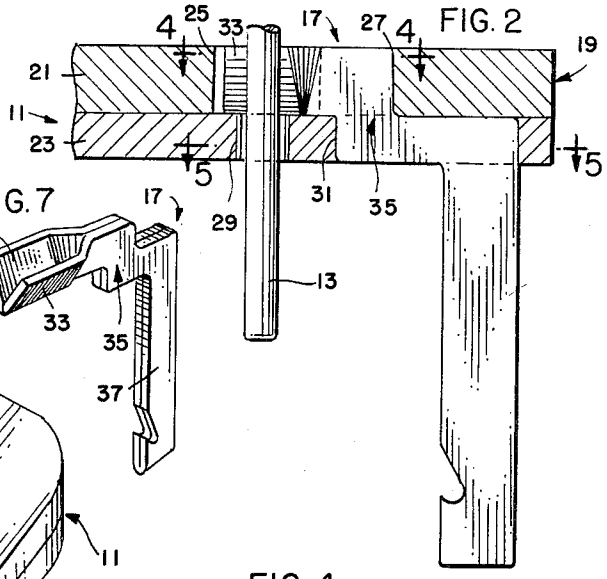


FIG. 7

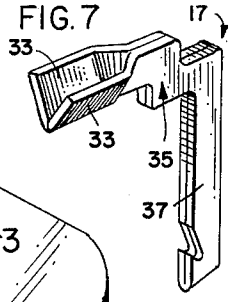


FIG. 4

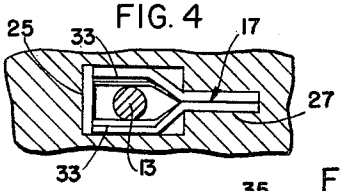


FIG. 5

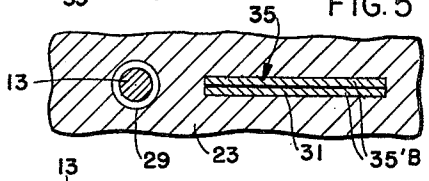
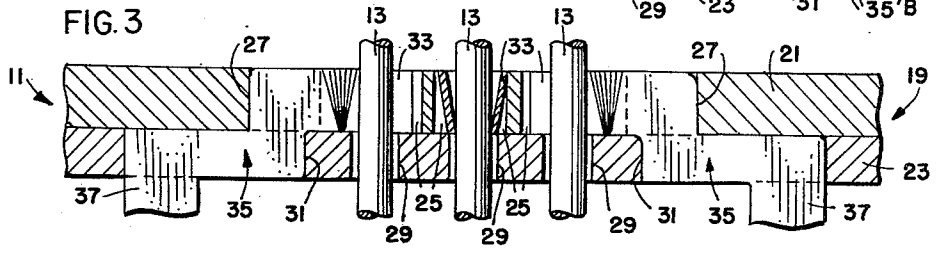


FIG. 3



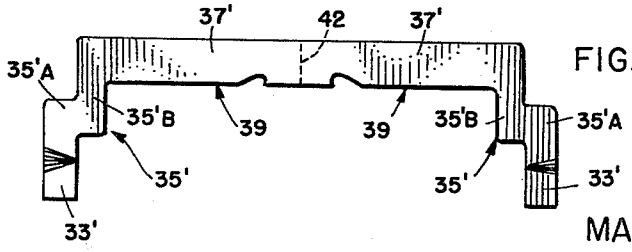


FIG. 6

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ELECTRICAL CONNECTOR

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3 Claims. (Cl. 339—192)

The present invention relates in general to electrical circuit forming means, and has more particular reference to an improved electrical connection device, more particularly a connection making socket receptacle.

The invention, more specifically, pertains to a socket receptacle especially adapted to receive and support subminiature electrical elements of the sort recently developed for use in translation systems for signal detecting and amplifying purposes and as oscillators, such elements comprising relatively tiny units embodying a small piece of semi-conductor material enclosed in a suitable casing having projecting connection prongs of wire-like character, electrically connected with the piece of semi-conductor material and disposed in relatively closely spaced relationship on the casing for electrically connecting the unit in an electrical translation system.

Germanium, by way of example, is an electrical semiconductor metal which has recently been developed as a means for performing many of the functions of an electron flow tube in electronic systems, germanium elements for such service being of relatively tiny size and being embedded in usually plastic housings from which extend electrical connection prongs of diametral size of the order of 0.03 inch, said prongs being usually disposed in parallel spaced relationship on centers spaced apart distances of the order of 0.1 inch.

An important object of the present invention is to provide an electrical connection socket structure particularly adapted to receive, support, and make firm and adequate electrical contact with the connection prongs of subminiature devices of the character mentioned.

A further object of the invention is to provide a socket structure embodying prong engaging contact electrodes of a sort adapted to removably receive prongs having a diameter of the order of 0.03 inch; a further object being to provide a receptacle structure having prong engaging electrodes spaced on centers of the order of 0.1 inch, such contact electrodes being formed to provide resilient prong wiping action whereby to assure satisfactory positive electrical engagement between the contact and a prong in mounted position therein.

Another important object resides in providing a receptacle of the character mentioned embodying a prong engaging contact comprising thin gauge sheet metal strip means forming cooperating half sections, said sections being preferably integrally united and folded together to provide resilient yieldingly spreadable arms for wipingly engaging and electrically contacting the opposite sides of a prong inserted therebetween; a further object being to provide mounting means for supporting the contact member in operating position.

Another important object is to provide a receptacle of the character mentioned embodying one or more prong engaging contacts comprising sheet metal means providing resilient yieldingly spreadable arms for wipingly engaging and electrically connecting a prong inserted therebetween, and a mounting portion for interlockingly mounting the contact on a support panel structure; a further object

being to form a contact of the character described with a pair of relatively offset mounting portions adapted respectively for interfitting reception in relatively offset slits in a pair of overlying plates secured together to form a mounting panel structure on which the contact element is retained by interlocking interfitment thereof in said relatively offset slits of said plates.

Another important object is to provide a receptacle of the character mentioned embodying a pair of relatively stacked plates secured together in stacked relationship to form a panel structure, one of said plates having a contact blade receiving opening and a relatively narrow slot connected at its inner end with and extending outwardly of said opening, the other plate having a perforation therethrough in registration with said opening and a slit spaced from and extending radially of said perforation, said slit extending in alinement with said lateral slot and having its perforation adjacent portions in communication therewith, said slit having its perforation remote end portions disposed outwardly of the outer end of said lateral slot, and a sheet metal prong engaging contact element having mounting portions extending in said slot and slit and prong engaging portions disposed in said opening in position to make wiping contact with a prong inserted therebetween; a further object being to form said contact element with relatively offset mounting portions extending snugly and interlockingly within said lateral slot and said radial slit, whereby to interfittingly secure said contact element in said panel structure.

Another important object is to form the lateral slot, the radial slit and the relatively offset element mounting portions in fashion permitting the contact element to move floatingly in said slot and slit and thereby adjust itself, within limits, with respect to said blade receiving opening.

Another important object is to provide a receptacle of the character mentioned in which the contact supporting panel structure comprises a pair of plates secured together in facing engagement, whereby the plates may be sealed, as by means of adhesive or by integrating the material thereof at the contacting surfaces of said plates, to thereby exclude the possibility of moisture penetration and consequent formation of electrical leakage paths between the plates.

The foregoing and numerous other important objects, advantages, and inherent functions of the invention will become apparent as the same is more fully understood from the following description, which, taken in conjunction with the accompanying drawings, reveals a preferred embodiment of the invention.

Referring to the drawings:

Fig. 1 is an enlarged perspective view of a socket receptacle embodying the present invention;

Figs. 2 and 3, respectively, are enlarged sectional views taken substantially along the lines 2—2 and 3—3 in Fig. 1;

Figs. 4 and 5, respectively, are sectional views taken substantially along the lines 4—4 and 5—5 in Fig. 2;

Fig. 6 is a plan view of a sheet metal stamping or blank from which may be made an electrode of the sort embodied in the structure shown in Figs. 1–5; and

Fig. 7 is an enlarged perspective view of an electrode element made from the blank shown in Fig. 6.

To illustrate the invention, the drawings show a connection making socket receptacle 11 adapted to removably receive the contact prongs 13 of an electrical element 15, whereby to support the element in the receptacle and to electrically connect the prong or prongs 13 each with a corresponding contact structure 17 mounted in and forming a part of the socket receptacle, said contact structures 17 being adapted for electrical connection in external circuits in which it may be desired to electri-

cally connect the element 15 through the prongs 13 thereof.

While some of the aspects of the present invention may be applied to advantage in socket receptacles of any size, its several novel features are particularly well suited for incorporation in receptacles for receiving and supporting so-called sub-miniature electrical elements 15 in which the mounting prongs 13 are of small dimension and are relatively closely spaced apart. As an example of a sub-miniature element recently developed for signal detecting and amplifying purposes, reference may be made to semi-conductor elements comprising a small piece or crystal of a desired semi-conductor material, such as germanium, such piece of material being enclosed in a suitable, usually plastic, container and electrically connected with contact prongs formed on and extending outwardly of the container. Elements of the character mentioned, recently available on the market, comprise a piece of germanium metal, of size of the order of that of a grain of wheat, encased in a container, of size of the order of 5/8 inch x 5/16 inch x 1/8 inch, with contact prongs projecting outwardly of the casing, at one end thereof, said prongs having a projecting length of the order of 3/16 inch and being disposed with the axes of the pins extending in a common flat plane and spaced apart a distance of the order of 0.1 inch, the prongs having diameter of the order of 0.03 inch.

In order to provide a suitable receptacle for detachably receiving and making electrical connection with the prongs 13 of such a sub-miniature element 15, the present invention provides a socket base comprising a panel structure 19 in which is mounted one or more of the contact structures 17, three contact structures 17 being embodied in the socket structure shown in the drawings. Each contact element is disposed in the structure in position to receive and electrically connect with a corresponding one of the contact prongs 13 of the element 15.

The panel structure 19 preferably comprises a pair of cooperating panel elements or plates 21 and 23, said plates and said contact structures 17 being formed for interfitting engagement to interlockingly secure the contact elements in the panel structure when the plates 21 and 23 thereof are secured together in stacked relationship. To this end the plate 21 may be provided with an opening 25 for each of the prongs 13. The openings 25 are preferably of rectangular configuration and of size of the order of 0.1 inch x 0.07 inch. The openings 25 are spaced apart in the plate 21 in accordance with the spacement of the prongs 13 in the element 15 to be accommodated in the receptacle. The openings 25 are each preferably elongated in one direction and each opening, at one end thereof, communicates with the inner end of a slot 27, formed in the plate 21 as a lateral extension of the opening 25 with which it connects, each slot 27 being centered upon and in alinement with the longitudinal axis of the elongated opening 25. If desired, the longitudinal axes of the openings 25 and of the slots 27 may be mutually parallel, although it is preferable that the several slots 27 extend in planes radiating from a common center for a reason hereinafter more fully explained. As shown in the illustrated embodiment, wherein there are three openings 25 disposed in alinement in the plate 21, the extension slots 27 of the two outermost openings 25 extend in a common plane and mutually outwardly in opposite directions and on opposite sides of the longitudinal axis of the medial opening 25. The extension slot 27 of the medial opening, however, extends in a plane at right angles with respect to the common medial plane of the other two openings.

The plate 23 is provided with a perforation 29 in alinement with each of the openings 25, the perforations 29 being sized and disposed in the plate in position to snugly receive the prongs 13 for axial movement therein after the same shall have been inserted through the openings 25 and into the porforations 29. The plate 23 is also formed with slits 31, there being one slit for each perforation 29, each slit extending outwardly of its associated perforation and having an inner end spaced from the adjacent perforation. The several slits 31 are disposed each in a common plane with the slot 27 of its associated opening 25, whereby the inner or perforation adjacent end portions of each slit 31 will be in overlapping registration with the outer portions of the slot 27. The outer or perforation remote portion of each slit 31, however, extends outwardly of the outer end of its corresponding slot 27.

Each contact structure 17 comprises cooperating prong engaging blades 33 adapted for assembly in an opening 25 of the plate 21, mounting portions 35 adapted for interlocking engagement in the slot and slit 27 and 31, which are associated with the opening 25, in which the blades 33 are mounted, and a connection portion 37 formed on said mounting portion 35 in position extending outwardly of the panel structure 17 preferably from the outwardly facing surface of the plate 23, that is to say, the side of the panel structure opposite from the side at which the blade containing openings 25 are exposed.

It will thus be seen that the prongs 13 of the element 15 may be inserted into the openings 25 and between the blades 33 and thence through the perforations 29 to thereby mount the element 15 in the receptacle 11 and electrically connect the element prongs 13 each with the blades 33 of a corresponding contact structure 17, to thereby electrically interconnect the prongs 13 each with electrical circuit conductors that may be connected upon the leg portion 37 of the contact structure 17 with which such prong 13 is in engagement.

Each of the contact structures 17 may comprise a pair of sheet metal strips 39 of relatively thin gauge material, said strips being of substantially identical configuration and adapted to be supported in facing engagement to provide a contact structure 17. The strips 39, to this end, may each comprise a blade portion 33', a mounting portion 35' comprising relatively offset carrying and locking zones 35'A and 35'B, respectively adapted to extend in the slot 27 and slit 31 of the panel structure in which mounted, and an arm portion 37'. The blade portions 33' of a cooperating pair of strips 39 are preferably mutually inclined upwardly and outwardly to form an upwardly opening prong receiving pocket therebetween when the strips are supported in facing engagement. The blade portions 33' of a cooperating strip pair so supported in facing engagement may extend in an opening 25. The carrying portions 35'A of the strip pair may extend in the slot 27, which is connected with said opening. The locking portions 35'B of said strip pair may extend in the slit 31, while the arm portions 37' thereof may extend in side-by-side engagement outwardly of the panel portion on which mounted. The cooperating strips 39 are preferably integrated at the remote ends of the portions 37', as shown more particularly in Fig. 6, so that each contact structure 17 may be formed from a unitary stamping or blank as shown in Fig. 6, merely by folding the blank, on a line of bend 42, in order to produce the contact structure 17, in form as shown in Fig. 7.

The receptacle 11 of the present invention may be fabricated by preforming the panels 21 and 23 with the required number of openings 25, slots 27, perforations 29 and slits 31 therein, and by preforming the requisite number of contact structures 17. Thereupon the locking portions 35'B of the contact structures 17 may be assembled in the slits 31 of the panel 23. The panel 21 may then be applied upon the panel 23 in position receiving the blades 33 of the contact structures, in the openings 25, the blade carrying portions 35'A of said several contact structures being received in side-by-side relation in the slots 27. The panels 21 and 23 may then be secured together in facing engagement by any suitable or preferred plate fastening means. To this end, if de-

sired, the plates **21** and **23** may be riveted together, or the plates may be secured by cementing the contacting faces thereof, or the facing surfaces may be integrally united in any suitable or preferred fashion in order to retain the contact elements interlockingly in assembled position in the panel structure.

Where contact prongs **13** are of sufficient diameter and exhibit a reasonable amount of rigidity and a less secure contact with external circuitry can be tolerated contact structure **17** may comprise a single blade **33** with associated mounting, locking and connecting portions having the same configuration as the half of the contact structure shown to the right of folding line **42** in Figure 6. A contiguous relation between one side of mounting portion **35** and cooperating sides of slot **27** and slit **13**, respectively, provides the requisite rigidity to assure a pressure contact between blade **33** and prong **13** of an external component.

It will be seen that the structure inherently applies the inwardly facing surfaces of the plates **21** and **23** in tight intimate contact, the one with respect to the other, thereby minimizing the possibility of moisture penetration between the plates, such penetration affording the possibility of formation of electrical leakage paths between the contact elements **17**, especially in structures wherein the contact elements **17** are mounted in closely spaced relationship in the panel structure. The present invention thus provides a structure in which the establishment of electrical leakage paths between adjacent contact elements is effectively inhibited, even where the plates **21** and **23** are secured together merely by means of fastening members such as rivets. The construction, however, also affords the possibility of sealing the contacting surfaces of the plates **21** and **23** either by integrally uniting the same or by joining the plates with an intermediate layer of cement. In such case, the establishment of electrical leakage paths between adjacent contact elements by moisture penetration is positively and entirely prevented. Suitable openings **43** may be provided in the panel structure in any suitable preferred or convenient location in order to accommodate fastening members, such as rivets, for mounting the receptacle on a support base.

It will be seen that the connection arms **37** of the contact elements extend at the end of the slits **31**, in line with and outwardly of the slots **27** and remote from the contact blade openings. The distance between the blades **33** and the connection arm **37** of each contact structure may be of the order of twice the spacement between adjacent prongs of the unit to be accommodated in the receptacle. Accordingly by disposing the slots **27** and cooperating slits **31**, of a receptacle structure in planes radiating outwardly of a common center, the connection arms **37** of the several prong contact structures may be sufficiently widely spaced apart to allow electrical connection thereof with external conductors to be made with comparative ease. In the arrangement shown in Fig. 1, for example, when sized to accommodate prongs **13** having diameter of the order of 0.03 inch and spaced on 0.1 inch centers, the connection prongs of the two outermost contact structures will be spaced apart a distance of the order of 0.6 inch, and each will be spaced a distance of not less than 0.3 inch from the contact arm of the medial contact structure **17**, such spacements being entirely ample to allow for the easy attachment of conductors on the arms **37**.

It is thought that the invention and its numerous attendant advantages will be fully understood from the foregoing description, and it is obvious that numerous changes may be made in the form, construction and arrangement of the several parts of the electrical connector without departing from the spirit or scope of the invention, or sacrificing any of its attendant advantages, the form herein disclosed being a preferred embodiment for the purpose of demonstrating the invention.

The invention is hereby claimed as follows:

1. An electrical socket receptacle embodying a contact structure comprising a pair of juxtaposed strips of sheet metal, each having a blade carrying portion and an adjacent relatively offset locking portion, a prong engaging blade formed integrally on each of said carrying portions and a pair of panel elements forming support means for said contact structure, one of said panel elements being formed with an opening therethrough providing a pocket for the reception of said prong engaging blades and a slot connected with and extending outwardly of said pocket to snugly receive and firmly support the blade carrying portions of said strips in facing engagement, to thereby support said blades in said pocket, the other of said panel elements being formed with a prong receiving perforation therethrough and a slit spaced from and extending radially of said perforation, said panel elements being secured in stacked relation with said perforation disposed in alignment with said pocket and said slit extending in end overlapping registration with respect to said slot in position snugly receiving the locking portions of said strips to anchor the same in said panel elements.

2. An electrical socket including a contact structure comprising a strip of sheet metal having a blade carrying portion and an adjacent relatively offset locking portion, a prong engaging blade formed on said carrying portion, and a pair of panel elements forming support means for said contact structure, one of said panel elements being formed with an opening therethrough providing a pocket for the reception of said prong engaging blade and a slot connected with and extending outwardly from said pocket to snugly receive and firmly support the blade carrying portion of said strip to thereby support said blade in said pocket, the other of said panel elements being formed with a prong receiving perforation therethrough and a slit spaced from and extending radially from said perforation, said panel elements being secured to each other in stacked relation with said perforation disposed in alignment with said pocket and said slit extending in end-overlapping registration with respect to said slot and snugly receiving the locking portion of said strip to anchor the same in said panel elements.

3. An electrical receptacle including a plurality of contact structures each contact structure comprising a pair of juxtaposed strips of sheet metal, each such strip having a blade carrying portion and an adjacent relatively offset locking portion, a prong engaging blade formed integrally on each of said carrying portions and a pair of panel elements forming support means for said contact structures, one of said panel elements being formed with a plurality of openings therethrough equal to the plurality of said contact structures providing a pocket for each pair of prong engaging blades, and a slot connected with and extending outwardly from each of said pockets to snugly receive and firmly support the blade carrying portions of each pair of said strips in facing engagement, to thereby support each pair of said blades in its respective pocket, the other of said panel elements being formed with a plurality of prong receiving perforations therethrough in number corresponding to the number of said pockets, each such perforation having a slit spaced from and extending substantially radially from its associated perforation, said panel elements being secured in stacked relation with each of said perforations disposed in alignment with respective ones of said pockets and each of said slits extending in end-overlapping registration with respect to its associated slot and snugly receiving the locking portions of associated strips to anchor the same in said panel elements.

(References on following page)

References Cited in the file of this patent

UNITED STATES PATENTS

2,120,396	Domaleski	June 14, 1938
2,206,799	Barton	July 2, 1940
2,318,650	Penfold	May 11, 1943
2,443,706	Jansen	June 22, 1948
2,514,562	Stickney	July 11, 1950
2,595,188	Del Camp	Apr. 29, 1952
2,694,799	Del Camp	Nov. 16, 1954

FOREIGN PATENTS

550,922	Great Britain	Feb. 1, 1943