April 16, 1963 Q. BERG 3,086,193

ELECTRICAL CONNECTOR

Filed Dec. 8, 1960

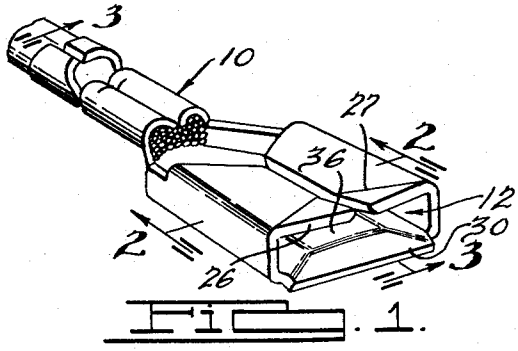


Fig. 1.

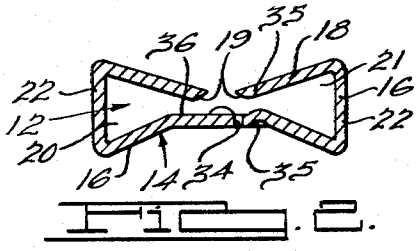


Fig. 2.

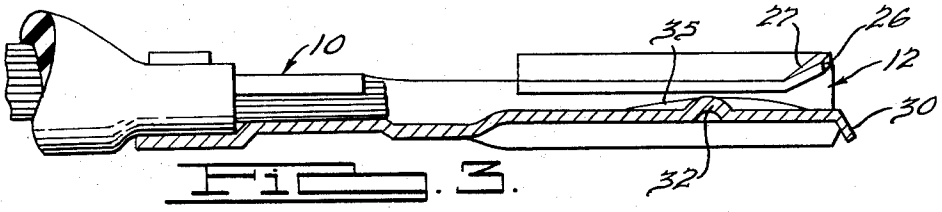


Fig. 3.

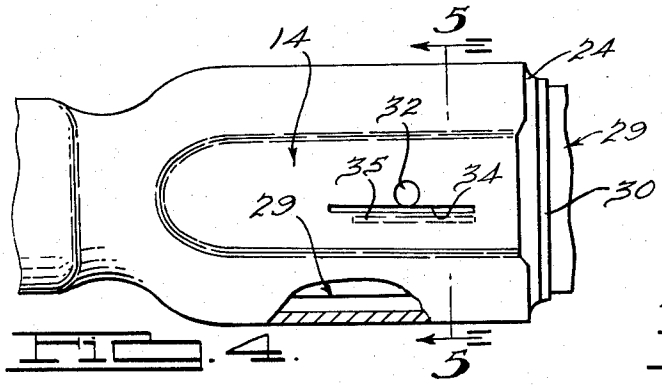


Fig. 4.

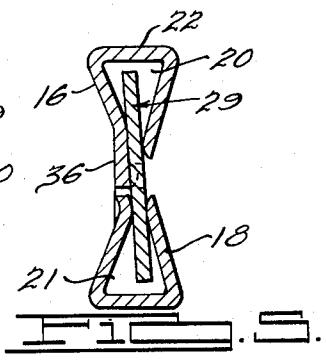


Fig. 5.

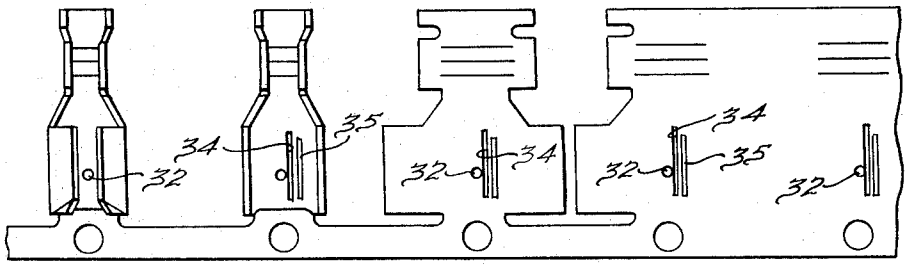


Fig. 6.

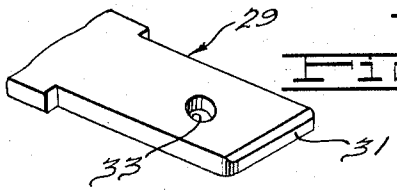


Fig. 7.

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ELECTRICAL CONNECTOR

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3 Claims. (Cl. 339—258)

This invention relates to electrical connectors and particularly to terminals made in the form of socket type disconnects which are adapted for quick make and break connections. Terminals of this kind made from thin sheet metal are extensively used in making an electrical connection in which a spade terminal is inserted and frictionally held in the socket of the disconnect. A socket disconnect terminal of this type is shown in my Patent No. 2,854,648, issued September 30, 1958, for "Electrical Connector." The spade terminals commonly used with such socket disconnects vary in thickness as well as in flatness.

It is often necessary to disconnect and reconnect such terminals a number of times for testing purposes prior to final inspection and shipment of the product on which such terminals are used. It is required that the connection made with such terminals be maintained under conditions of vibration and possible strain in subsequent service. Hence it is imperative that the socket disconnect terminal have the ability to retain its grip on the complete range of mating male or spade terminals used therewith.

A principal object of the invention is to provide a novel and improved socket disconnect terminal and particularly one which is capable of maintaining a more uniform grip on the spade type terminal after repeated insertions and withdrawals of such spade type terminal.

Other and further objects of the invention will be apparent from the following description and claims and may be understood by reference to the accompanying drawings, of which there is one sheet, which by way of illustration show a preferred embodiment of the invention and what I now consider to be the best mode of applying the principles thereof. Other embodiments of the invention may be used without departing from the scope of the present invention as set forth in the appended claims.

In the drawings:

FIGURE 1 is a perspective view of a socket disconnect terminal embodying the invention;

FIGURE 2 is a sectional view taken along the line 2—2 of FIGURE 1;

FIGURE 3 is an enlarged longitudinal sectional view taken along the line 3—3 of FIGURE 1;

FIGURE 4 is an enlarged bottom plan view, partly broken away;

FIGURE 5 is a sectional view along the line 5—5 of FIGURE 4;

FIGURE 6 is a view illustrating steps in the method of making such disconnect terminals in strip form; and

FIGURE 7 is a view of a spade type terminal adapted for insertion in the socket of the disconnect.

An electrical disconnect terminal embodying the invention and as illustrated in the drawings includes an integral ferrule **10** for crimping on an electrical conductor. A piece of thin sheet metal integral with the ferrule **10** is formed to provide a slot type socket **12** for telescopically receiving and yieldably frictionally holding a spade type terminal **29** (FIGURE 7). The disconnect comprises a slotted concavo-convex intermediate portion **14** having integral laterally projecting flexible ears **16**, the ends **18** of which are bent toward each other in spaced converging relation with the concavo-convex portion **14** to form channels **20** and **21** interconnected by the concavo-convex portion **14**. The open sides of the channels **20** and **21** face each other and form the slot type socket **12**.

As shown in FIGURE 2, the channels **20** and **21** are generally triangular in cross section throughout the length of the socket **12** with the portions **22** thereof corresponding with the bases of the triangles disposed parallel to each other and at the opposite edges of the disconnect so as to form the lateral side edges of the socket **12**. Transverse edges **24** of the portion **14** and edges **26** of the ends **18** of the ears **16** define an open entrance to the socket at one end thereof through which a spade type terminal **29** may be inserted in the socket. The edges **26** of the ear which form one side of the entrance opening are bent outwardly at the corners as indicated at **27** so as to facilitate the insertion of the lead end of the spade type terminal **29** (FIGURE 7) into the socket **12**, and a lip or guide **30** integral with the concavo-convex portion **14** projects outwardly and lateraly from the entrance to the socket **12** so as to guide the leading end **31** of the spade terminal during the insertion thereof into the socket.

The central flat portion **36** of the concavo-convex portion is provided with a central detent **32** adjacent the slot **34**, and detent **32** projects into the socket **12**. The detent **32** is positioned to extend into a central hole or dimple **33** in an inserted spade terminal for locating the same in the socket **12** and cooperates with the edges of such hole **33** to provide additional resistance to withdrawal of the spade terminal **29** from the socket **12** so as to substantially increase the disconnect force over that obtainable without this detent arrangement. The burr usually present around one edge of such hole **33** will rapidly scrape off the detent portion, resulting in substantialy lower disconnect forces after repeated withdrawals. This is particularly evident if the male member is made of a spring material, such as beryllium copper. The variations in thickness of the spade metal, as well as in the flatness thereof, also contribute to variation in pull-out resistance.

The ends **18** of the ears **16** which are bent toward each other have their free edges rounded off as at **19** to form longitudinal contact surfaces, and are bent inwardly of the socket toward the center thereof so that the normal clearance between such rounded ends **19** and the contact surface provided by the inwardly offset portion **14** forming the opposite side wall of the socket is less than the thickness of the inserted spade terminal **29**. The clearance between the central portion **36** and the rounded ends **19** of the ears is substantially less than the clearance at the lateral edges of the socket **12** where the clearance is substantially greater than the thickness of the inserted spade terminal **29**, whereby the lateral edges of the latter have substantial clearance with respect to the sides of the socket. This serves to eliminate interference between any burrs or deformation on the lateral edges of the spade terminal **29** and the walls of the socket which would affect the force required for inserting or withdrawing such terminal from the socket.

The concavo-convex portion **14** provides approximately the same flexibility for both sides of each of the channels **20** and **21** and thus provides a better spring action for gripping the inserted spade terminal **29**. The slot **34** in

the portion 14 extends longitudinally of the socket 12 and is disposed immediately below the free edge 19 of the end 18 of one of the ears and is substantially parallel with such edge. The outer edge 35 of slot 34 is coined to form a bowed ridge portion extending inwardly of the socket 12 in channel 21 thereof, which provides a relatively stable gripping effort independent of and in addition to that provided by detent 32 and channel 20. Slot 34 which extends throughout substantially the entire length of the socket 12 allows portion 36 carrying detent 32 to flex independently of the relatively smooth gripping portion 35. Wear of the detent 32 and the edge (and the burr thereon) of the cooperating hole 33 in the spade terminal 29 due to repeated insertions thereof in the socket and withdrawals therefrom will not decrease the grip between bowed portion 35 and adjacent free ear 19 on the terminal 29. Thus, with this arrangement the fall off in the withdrawal force required to withdraw the spade terminal from the socket after repeated withdrawals can be substantially minimized, particularly where the male 29 is of a hard material, such as beryllium copper, and the usual burr is present around the hole 33 used as a detent.

The crimp connection formed between the ferrule 10 and the stranded wire may be of the construction disclosed in my prior Patent No. 2,854,648.

In the formation of the terminal in strip form and as illustrated in FIG. 6, a strip of metal stock 50 is progressively moved through a series of dies which form the blank out of which the socket disconnect is made and then form the disconnect without severing the same from the stock. The disconnect is usually severed from the strip when the ferrule 10 thereof is crimped onto a wire. The coining of edge 35 may be effected when the slot 34 is formed or when the concavo-convex portion 14 is formed, or may be done in a subsequent operation. The displacement of edge 35 is exaggerated as illustrated. The linear areas of contact between spade 29 and the flexible sides of channels 20 and 21 extend the length of the socket and are provided by smooth surfaces. To some extent the construction of socket 12 compensates for variations in the thickness and flatness of spade 29 because the contact area lies near the longitudinal center line of the male 29 and is relatively unaffected by the bow and burr usually present in a stamped sheet metal male spade.

This application is a continuation-in-part of my prior copending application Serial No. 841,112, filed September 21, 1959, now abandoned, for "Electrical Connector." To increase the gripping effect of the channels 20 and 21 on the spade terminal, such channels may be disposed in skewed relation with respect to each other longitudinally of the socket, as disclosed and claimed in my prior copending application Serial No. 646,139, filed March 14, 1957, now Patent No. 2,992,404, granted July 11, 1961, for "Electrical Disconnect."

While I have lilustrated and described a preferred embodiment of my invention, it is understood that this is capable of modification, and I therefore do not wish to be limited to the precise details set forth but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. An electrical connector comprising an integral piece of thin sheet metal formed to provide a slot type socket for telescopically receiving and yieldably frictionally holding a spade terminal, said socket connector comprising a first sheet metal concavo-convex portion forming one side of said socket and having integral laterally projecting flexible ears the ends of which are bent toward each other in spaced converging relation with said first portion so as to form the opposite side of said socket, said sides of said socket at one end thereof being formed to define an entrance opening through which a spade terminal may be inserted into said socket, said first portion along the center of the socket lengthwise thereof being offset inwardly into said socket and cooperating with the ends of said ears which form the opposite side of the socket and extend the full length thereof to grip an inserted spade terminal for yieldably frictionally holding it in said socket, the inwardly offset portion of the side of said socket being provided with a central detent for cooperation with a hole in such an inserted terminal, the ends of said ears which are bent toward each other being rounded off along the inner edges thereof and bent inwardly of the socket toward the center thereof so that the normal clearance between the ends of said ears and the inwardly offset portion forming the opposite side of the socket is less than the thickness of an inserted spade terminal and the clearance between the sides of said socket at the edges thereof is substantially greater than the width of such a terminal whereby the lateral edges of the latter have a clearance with respect to both sides of said socket, said connector socket having provisions for connecting a current conductor thereto, said socket being formed as a pair of opposed laterally spaced channels generally triangular in cross section and the sides of said socket being formed so that both sides thereof have approximately the same flexibility and are disposed essentially symmetrically with respect to a spade terminal frictionally secured in said socket, and means comprising a bowed ridge in the concavo-convex portion projecting into the socket and cooperating with one of said ears to provide a more stable gripping effort thereby on an inserted spade terminal than that provided by the other of said ears and said detent.

2. An electrical connector according to claim 1 wherein said inwardly offset central portion of said socket is provided with a single longitudinally extending slot adjacent said detent and between said detent and said ridge.

3. An electrical connector having a ferrule for crimping on an electrical conductor and comprising an integral piece of thin sheet metal integral with said ferrule and formed to provide a slot type socket for telescopically receiving and yieldably frictionally holding a spade terminal, said connector comprising a concavo-convex metal portion slotted asymmetrically, and forming one side of said socket and having integral laterally projecting flexible ears the ends of which are bent toward each other in spaced converging relation with said slotted portion so as to form the opposite side of said socket, said sides of said socket at one end thereof being formed to define an entrance opening through which a spade terminal may be inserted into said socket, said slotted portion along the center of the socket lengthwise thereof being offset inwardly into said socket and cooperating with the ends of said ears which form the opposite side of the socket and extend the full length thereof to grip an inserted spade terminal for yieldably frictionally holding it in said socket, the inwardly offset portion of the side of said socket being provided adjacent the slot therein with a central detent for cooperation with a hole in an inserted spade terminal, the ends of said ears which are bent toward each other being bent inwardly of the socket toward the center thereof so that the normal clearance between the ends of said ears and the inwardly offset portion forming the opposite side of the socket is less than the thickness of an inserted spade terminal and the clearance between the sides of said socket at the edges thereof is substantially greater than the width of an inserted spade terminal whereby the lateral edges of the latter have a substantial clearance with respect to both sides of said socket, the sides of the ends of said ears forming one side of said entrance opening being formed so as to facilitate insertion of the spade terminal in the socket, said slot in said one side of said socket extending longitudinally alongside said central detent and below the bent-back end of one of said ears, and a ridge formed in said one side of said socket and projecting

into said socket adjacent said slot and opposite the free end of said one of said ears, the sides of said socket being formed in cross section as a pair of opposed laterally spaced channels generally triangular.

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