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## ADAPTOR CONNECTOR

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This invention relates to wire terminal connectors and refers more particularly to an adaptor for providing a good mechanical and electrical connection between a pair of male connector terminals of unlike types.

Until recently it was customary to supply electrical instrumentalities of the type used on household appliances and the like, such as solenoids and switches, with female terminal connectors of a substantially cylindrical type adapted to receive a more or less bullet shaped male wire terminal. There has now come into relatively widespread use, however, a type of terminal connector for such instrumentalities comprising essentially a straight strip of metal which is receivable in a relatively simple, substantially channel shaped socket. The parts of this newer type of connector can be made more cheaply when the female member is designed to be mounted on the wire while the male member is mounted on the body of the instrumentality, and they are therefore ordinarily so formed as to enable them to be installed in this manner.

Because of its relative simplicity and cheapness this newer "spade" connector, as it is sometimes referred to, is rapidly supplanting the older "bullet" terminal, and therefore it often happens that an electrical instrumentality having cylindrical female sockets adapted to receive "bullet" terminals of the older type is removed from a device in the field and is replaced with a recently manufactured counterpart having male terminals of the flat strip or "spade" type. The serviceman then finds himself confronted with the necessity for establishing a good mechanical and electrical connection between a pair of male terminals of unlike types. Heretofore it has been customary to clip the bullet type of male terminal off of the wire to be connected with the instrumentality and to replace it with a female terminal capable of accommodating the spade type terminal on the instrumentality. This procedure is obviously inconvenient, and indeed it may be virtually impossible where the wiring harness does not provide an adequate amount of wire to permit the bullet terminal to be cut off and the spade receptacle to be attached to the shortened wire, or where the situation of the installation is such as to make the ends of the wires inaccessible to the tools required for effecting this change.

With the foregoing in mind, it is an object of this invention to provide an extremely simple and inexpensive device for establishing a good mechanical and electrical connection between a male terminal of the bullet shaped type and a male terminal of the flat strip or spade type, which device will not necessitate the removal or replacement of either of these terminals.

Another object of this invention resides in the provision of an adaptor for coupling a male terminal of the spade type with a male terminal of the bullet shaped type, which adaptor may be very simply and inexpensively fabricated as a unitary stamping.

Still another object of this invention resides in the provision of a universal connector whereby a secure mechanical and electrical connection may be established between two male terminals of the spade type or two male terminals of the bullet type or one of each type.

With the above and other objects in view, which will appear as the description proceeds, this invention resides in the novel method and apparatus hereinafter described and more particularly defined by the appended claims, it being understood that such changes in the precise embodiment of the hereindisclosed invention may be made as come within the scope of the claims.

The accompanying drawing illustrates one complete

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example of the physical embodiment of the invention constructed according to the best mode so far devised for the practical application of the principles thereof, and in which:

5 Figure 1 is a side elevational view of the adaptor of this invention having a spade and a bullet type of terminal connected therein;

Figure 2 is a group perspective view showing the adaptor of this invention in position to be assembled with a spade type terminal and a bullet shaped terminal;

10 Figure 3 is a sectional view of the adaptor taken on the plane of the line 3—3 in Figure 2;

Figure 4 is a side elevational view of a modified embodiment of the adaptor of this invention having a pair of bullet shaped terminals connected therein; and

15 Figure 5 is a bottom view of the Figure 4 adaptor.

Referring now more particularly to the accompanying drawing, in which like numerals designate like parts throughout the several views, the numeral 5 designates generally the case of an electrical instrumentality (which may be of any known type, such as a switch, solenoid or the like) having a terminal 6 of the flat strip or spade type mounted thereon and by means of which the instrumentality may be connected with a wire conductor 7. The terminal 6 comprises essentially a flat strip of metal adapted to be received in a substantially channel shaped female receptacle (not shown, but of well known type) with its side edges 8 snugly held between the flanges of the channel and its bottom surface 9 flatwise overlying the web of the channel. A lug-like projection 10 on one side edge of the strip cooperates with an end of one of the flanges on the channel to define the limit of axial insertion of the terminal into the channel.

The cylindrical or bullet shaped male terminal 12 on the conductor is also of a well known type adapted to be received in a substantially cylindrical socket (likewise not shown but of well known type). The terminal end portion of the wire is secured in a rearwardly opening well in the enlarged rear portion 14 of the terminal and the rearmost portion of the terminal is crimped, as at 13, to securely clamp the terminal onto the conductor.

The adaptor of this invention, designated generally by 16, provides for the secure mechanical and electrical connection of these two unlike types of male terminals to one another, and is a unitary stamping of relatively lightweight sheet metal.

The adaptor comprises generally a channel shaped base portion 17 adapted to receive a spade type of terminal and an upper cylindrical socket 18 for receiving a cylindrical or bullet shaped terminal. The base portion of the adaptor holds a male spade type connector in the same way as it would be held by the female connector ordinarily used therewith, that is, with the lower flat face 9 of the male terminal flatwise overlying the web 19 of the channel and with the side edges of the strip closely embraced by the flanges 20. The male terminal is snugly held in surface-to-surface engagement with the web by opposing inturned ledges 21 on the adaptor, comprising lateral extensions of the flanges 19 and which overlie the web and are spaced therefrom a distance substantially equal to the thickness of the spade terminal strip. The male terminal is ordinarily provided with a medial dimple 22 in each face thereof which cooperates with a corresponding "pimple" 23 bumped upwardly out of the base portion to provide a detent which engages when the terminal is inserted all the way into the base portion of the adaptor and thus prevents accidental withdrawal of the terminal from the socket. Since the depressions or dimples 22 are formed in both faces of the male terminal, it will be seen that the adaptor of this invention may be installed on the spade terminal with its web opposing either face of the terminal, to suit the requirements of the installation. A pair of spaced longitudinal slots 24 in the web enable the medial portion of the web, containing the "pimple" 23, to flex slightly during insertion of the spade terminal and thereby render the detent operative.

The upper portion 18 of the adaptor is provided by integral upward extensions 25 of the ledges 21 which extend substantially the entire length of the ledges and are substantially semi-circular in cross section, being

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curved in opposite directions so as to define a substantially cylindrical socket open at both ends.

The actual junction between the socket defining portion 25 and the ledge 21 comprises a fillet portion 26 which provides a sort of "transition curve," and it will be seen that as viewed from the end the adaptor comprises a channel portion having a pair of S-shaped portions extending upwardly from its flanges and curving in opposite directions. It will be observed that the entire adaptor is thus formed of a single piece of relatively light sheet material and is symmetrical about a longitudinal central plane which passes between the adjacent edges 27 of the arcuate portions defining the upper cylindrical socket.

In order to provide a detent which will preclude accidental withdrawal of the male bullet terminal from the cylindrical socket, the bullet terminal is normally provided with a medial circumferential groove 28 and the arcuate extensions defining the cylindrical socket are inwardly ridged, as at 29. Because the arcuate portions defining the upper cylindrical socket are able to yieldingly spread slightly during insertion of the bullet terminal into the socket, the rounded front end portion 30 of the "bullet" cams itself past the ridge 29, and this ridge engages in the circumferential groove 28 with a detent action.

The distance between the groove 28 and the shoulder defined by the enlarged rear portion 14 of the bullet terminal is somewhat shorter than the corresponding distance between the dimple 22 and the forwardly facing shoulder on the lug 10 of the spade terminal, and to compensate for this difference the upper portion of the adaptor is cut back as at 32 or, stated another way, the upward extensions 25 do not extend the full length of the ledges 21. To clear the shoulder on the bullet, this cut-back extends through the fillet portion 26 which connects the ledge with the upward extensions 25.

To facilitate insertion of a bullet terminal into the cylindrical socket the end portions of the arcuate extensions are outwardly flared as at 33. Attention is directed to the fact that the adaptor of this invention is symmetrical about its transverse center plane so that either type of terminal which it is adapted to accommodate may be inserted from either end of the adaptor.

By means of the modified embodiment of the invention shown in Figures 4 and 5, two male terminals of the bullet type or two male terminals of the spade type may be securely connected with one another, or a bullet terminal may be connected with a spade terminal. Essentially this embodiment of the invention comprises a pair of the Figure 1 adaptors formed integrally with one another in end-to-end relation. While the "two" connectors of this embodiment are formed with their base portions integral with one another, their upper cylindrical socket-forming portions 25' are separated by a narrow transverse slit 34 to enable the pairs of upward extensions 25' defining the cylindrical sockets to flex independently of one another upon insertion of bullet terminals from their opposite ends, thereby insuring that each of such terminals will be individually held with complete security. Because the slots 24' in the web of the base portion of the Figure 4 embodiment do not extend the entire length thereof, the two "pimples" 23' in the web of the base will flex independently of one another, thus assuring their secure engagement with the individual spade terminals inserted thereinto in spite of the fact that the entire base of this dual adaptor is formed as a single unit.

From the foregoing description, taken together with the accompanying drawings, it will be readily apparent that this invention provides an adaptor whereby a good mechanical and electrical connection can be established between a male terminal of the bullet type and a male terminal of the spade or flat strip type without the necessity for any operation upon the terminals themselves other than their mere axial insertion into sockets in the adaptor.

What I claim as my invention is:

1. Means for establishing a good mechanical and electrical connection between a male terminal of the flat blade type and a male terminal of the bullet shaped type, said means comprising: a substantially channel shaped base portion having a web and flanges integrally joined to and projecting substantially perpendicularly upwardly from opposite side edges of the web, portions of said web extending continuously across the channel between the

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flanges thereof; ledge means integral with said flanges overlying and spaced from the channel web a substantial distance so as to be cooperable with the web of the channel in snugly gripping a blade type terminal having one of its faces flatwise overlying the web and its side edges closely embraced by the flanges of the channel; and means for receiving a bullet type male terminal comprising a substantially cylindrical wall circumferentially interrupted along its top and joined to said ledge means and defining a tubular socket, the axis of which is parallel to the channel flanges and spaced above the channel web a distance sufficiently greater than said ledge means so that the lowest portion of a cylinder partially defined by said cylindrical walls is spaced above the plane of said ledges to enable a bullet type male terminal to be accommodated in said tubular socket without interference from a blade terminal in the channel shaped base, the longitudinally extending interruption in said cylindrical wall enabling said tubular socket to expand radially independently of the channel shaped base.

2. The connection means of claim 1 further characterized by: means on the channel web defining a member which is flexible in directions normal to the plane of the web; and an inward protuberance on said member cooperable with a recess in a blade type terminal to readily releasably grip the terminal.

3. Means for establishing a good mechanical and electrical connection between a male terminal of the flat blade type and a male terminal of the bullet shaped type, said means comprising: a substantially channel shaped base portion having a web and flanges integrally joined to and projecting substantially perpendicularly upwardly from opposite side edges of the web, portions of said web extending continuously across the channel between the flanges thereof; an integral extension of each flange of the channel extending along substantially the entire length thereof and extending upwardly therefrom, each of said extensions having a substantially S-shaped cross section and said extensions being curved in opposite directions with their lower portions extending laterally inwardly from the channel flanges to overlie the web of the channel, spaced thereabove a substantial distance so as to accommodate a blade type terminal and so as to cooperate with the web of the channel in snugly gripping a blade type terminal having one of its faces flatwise overlying the web and its side edges closely embraced by the flanges of the channel, the upper portions of said extensions cooperating to define a tubular socket, the axis of which is parallel to the channel flanges and spaced above the channel web a substantial distance such that the lowest portion of a cylinder partially defined by said tubular socket is spaced above the plane of the lower portions of said extensions to enable a bullet type male terminal to be accommodated in said tubular socket without interference from a blade terminal in the channel shaped base, said upper portions of the extensions being flexible to permit said tubular socket to be expanded radially, independently of the channel shaped base.

4. The connection means of claim 3 further characterized by detent defining means on said channel shaped base portion comprising: an independently flexible portion on the web of the channel defined by a pair of substantially parallel slits in the web; and an upward protrusion on said portion engageable in a recess in the terminal to readily releasably grip the terminal.

5. A universal adaptor for establishing a good mechanical and electrical connection between a pair of male terminals of the flat blade and/or bullet shaped type, said adaptor comprising: a substantially channel shaped base portion having a length sufficient to accommodate a pair of flat blade type conductor terminals, one inserted from each end thereof with one of its faces flatwise overlying the web of the channel, said channel having flanges integrally joined to and projecting upwardly from opposite side edges of its web, perpendicular thereto, portions of said web extending continuously across the channel between the flanges thereof; and a pair of integral upward extensions on each flange of the channel, each extending along substantially half the length thereof, each of said extensions being curved to a substantially S-shaped cross section, the extensions of the two flanges being curved in opposite directions with their lower portions extending laterally inwardly from the channel flanges and spaced above the web of the channel a substantial distance so as to accommodate the thickness of a blade type terminal between the web

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and said lower portions of the extensions, the upper portions of said extensions on the two channels cooperating to define a pair of coaxial substantially cylindrical sockets above the channel shaped base portion having their axis parallel to the channel flanges and spaced a sufficient distance above the web so that a cylinder partially defined by said cylindrical sockets has its lowest portion spaced above the plane of said lower portions of the extensions to enable bullet type male terminals to be accommodated in said cylindrical sockets without interference from blade terminals in the channel shaped base, said upper portions of the extensions being flexible to permit said tubular

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socket to be expanded radially, independently of the channel shaped base.

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