Dec. 14, 1943. C. E. WADE 2,336,517

ELECTRICAL CONNECTOR

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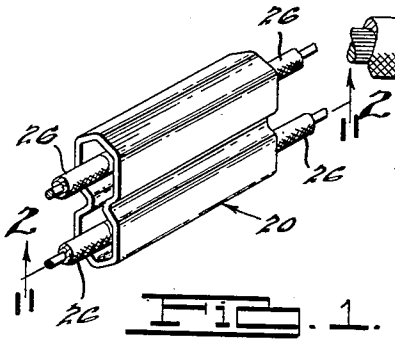


Fig. 1.

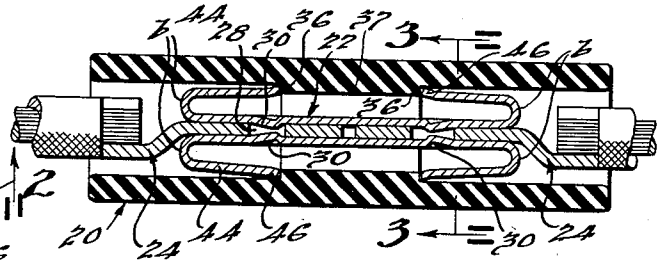


Fig. 2.

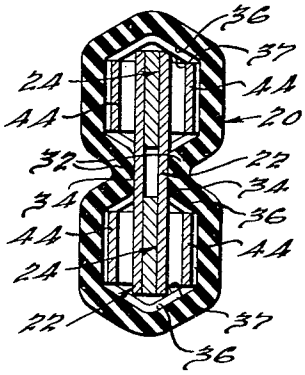


Fig. 3.

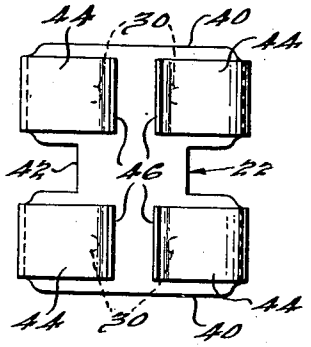


Fig. 4.

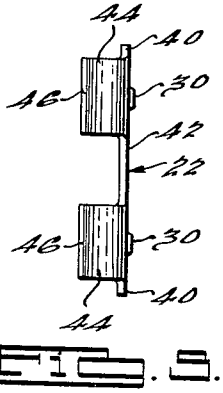


Fig. 5.

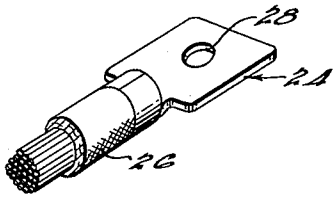


Fig. 6.

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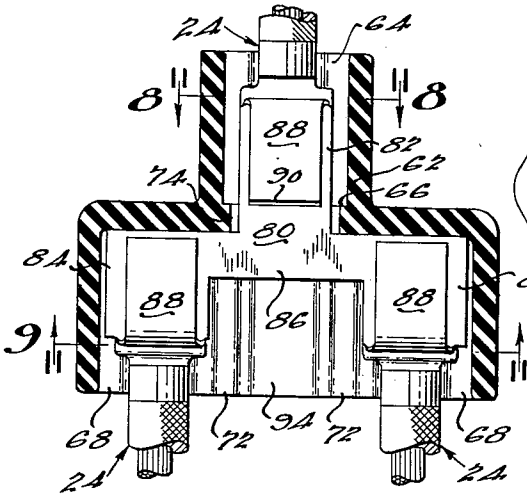


FIG. 7.

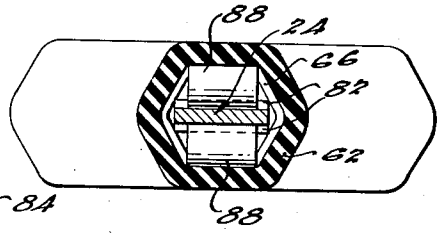


FIG. 8.

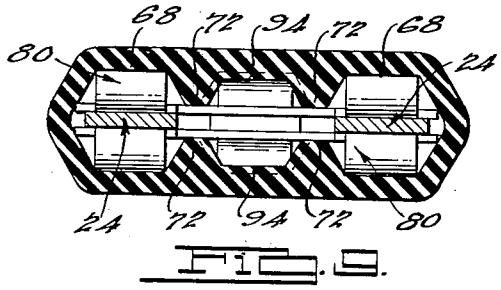


FIG. 9.

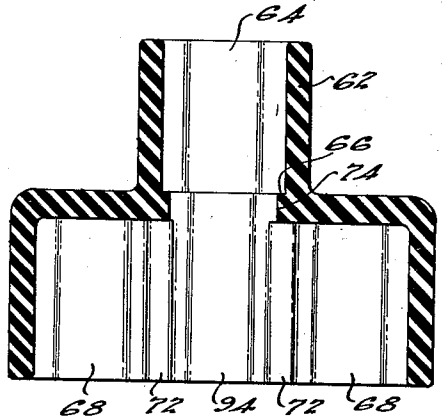


FIG. 10.

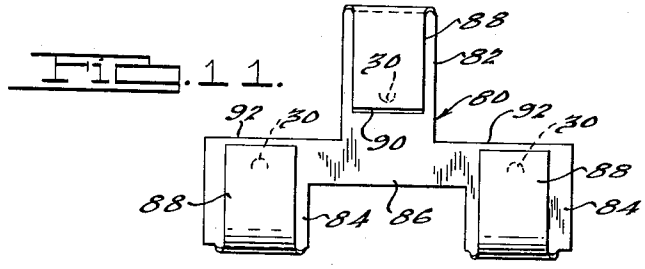


FIG. 11.

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ELECTRICAL CONNECTOR

Charles E. Wade, Sturgis, Mich.

Application December 13, 1940, Serial No. 369,919

5 Claims. (Cl. 173—328)

The present invention relates to electrical connectors, and in particular is directed to the provision of improved means for forming a ready-made connection between one or more pairs of terminals, or between an odd number of terminals. The present constructions are improvements upon and modifications of the structures disclosed in applicant's copending application Serial No. 333,017, filed May 2, 1940.

The principal objects of the present invention are to provide electrical connectors of the above indicated type, which may be economically manufactured and assembled, and which enable the associated terminals to be snapped into place without the use of tools; to provide such structures wherein the electrical connections between the individual terminals, while being of the snap-in type, are positive and efficient; to provide such constructions comprising a housing, embodying intercommunicating recesses adapted to receive contact elements arranged to accommodate one or more pairs, or an odd number, of terminals; to provide such constructions wherein each contact element is formed of two portions arranged in back-to-back relation; and to generally improve the construction and arrangement of connectors of the above indicated type.

With the above, as well as other and more detailed objects in view, which appear in the following description and in the appended claims, a preferred but illustrative embodiment of the invention is shown in the accompanying drawings, throughout the several views of which corresponding reference characters are used to designate corresponding parts, and in which:

Figure 1 is a perspective view of a connector adapted to provide a direct electrical connection between four associated terminals;

Fig. 2 is a view in longitudinal central section taken along the line 2—2 of Fig. 1;

Fig. 3 is a view taken along the line 3—3 of Fig. 2;

Fig. 4 is a view of one of the two duplicate contact elements employed in the structure of Figs. 1 through 3;

Fig. 5 is an end view of the contact element shown in Fig. 4;

Fig. 6 is a view of a spade terminal adapted for use with the present structures;

Fig. 7 is a view in longitudinal central section of a modification of the invention adapted to accommodate three terminals;

Fig. 8 is a view taken along the line 8—8 of Fig. 7;

Fig. 9 is a view taken along the line 9—9 of Fig. 7;

Fig. 10 is a view in longitudinal central section, showing the housing, with the contact elements removed; and

Fig. 11 is a view of one of two duplicate contact elements employed in the structure of Fig. 7.

Referring first to Figs. 1 through 5, the illustrated four-way connector comprises, generally, a housing or insulator **20** and a contact designated as a whole as **22**, which is received within the housing. The contact **22** is arranged to receive and provide a direct connection between four terminals such as **24**, each of which may be permanently secured by welding, soldering, or otherwise, to an associated wire **26**. As most clearly appears in Fig. 6, the terminals **24** are of the spade type and comprise a flat generally rectangular body portion having a detent opening **28** centrally positioned therein to cooperate with the hereinafter described detents **30**, provided on the contact **22**.

The housing **20**, which may be and preferably is formed by a molding operation, defines two longitudinally extending pockets or recesses arranged in side-by-side relation, each pocket being generally hexagonal in cross-section, and each pocket extending throughout the length of the housing. The longitudinally extending dividing wall **32** between the two pockets is cut away throughout the length of the housing to define a connecting passage between the two pockets, having the walls **34**. The pockets are of uniform section throughout their length, with the exception that midway between the ends of the housing an annularly extending rib **37** is provided in each pocket, which defines spaced shoulders **36** therein. The shoulders **36** extend entirely around the corresponding pocket except where it is interrupted by the just-mentioned connecting passage. The opposite ends of the shoulders **36** constitute abutments which cooperate with the reversely turned end portions of the contact **22**, so as to hold the contact in place within the housing.

The contact **22** is made up of a pair of duplicate contact elements, one of which is shown in detail in Figs. 4 and 5. Each contact element comprises a generally flat body portion of H-shape, having legs **40** connected together by a web **42**. The end portions **44** of the legs **40** are somewhat narrower in width than the intermediate leg portions and these end portions are reversely turned, having their extreme ends slightly outwardly bent to define abutments **46** to cooperate with the previously

mentioned shoulders **36**. The leg portions **40** are provided with the previously mentioned detents **30**, which are struck from the body thereof in a direction opposite to the positioning of the end portions **44**.

The two contact elements are received within the housing in back-to-back relation with the abutments **46** in locking engagement behind the associated shoulders **36**. When the associated terminals **24** are disconnected from the connector, the spring-like action of the leg portions **44** bring the intermediate leg portions **40** into abutting relation with each other, and the spring-like action also retains the abutments **46** in solid interlocking engagement with the shoulders **36**, so that the contact is positively retained in place within the insulator or housing.

In applying a terminal **24** to the connector, it will be appreciated that such terminal is introduced into the open end of the corresponding pocket, and that the leading edge thereof, upon engaging the corresponding end of the contact **22**, applies a wedging force between the rounded end areas, designated *b*, which wedging force springs the two contact elements apart sufficiently to enable the terminal to pass into the space between them. During the course of the further entering movement, the opening **28** in the terminal comes into registry with the corresponding detent **30**, which thereupon snaps into such opening. This springing apart of the contact elements enables the elements to wedge the terminal between them and, in view of the fact that the engaging surfaces of the terminal and of the contact element are flat or substantially so, it will be appreciated that a relatively large area of electrical contact is provided, which affords an exceedingly efficient electrical connection between each terminal and the contact. The entering movement also increases the positiveness of the interlocking connection between the abutments **46** on the contact and the shoulders **36** in the housing. The detent connection afforded by the detents **30** materially increases the holding effect on the terminal.

It will be noticed that the separating movement of the contact elements brings the outer marginal edges of the intermediate parts of the legs **40** into abutting relation to the outer sloping walls of rib **37** in the associated pocket, and also brings the intermediate or web portions **42** of each contact element into abutting engagement with the defining walls **34** of the passage which connects the two housing pockets. The just-mentioned abutting relations give lateral support to the contact elements, which enhances their holding effect on the associated terminals.

It will be noticed that each terminal is substantially co-extensive in width with the wider portions of the contact legs **40** and is thus wider than the narrow portions of each pocket which receive the reversely turned leg portions **44**. Consequently, in applying a terminal to the connector, the sloping walls of each pocket prevent the terminal from being inserted into the space between a reversely turned leg portion and wall of the pocket, and instead act to positively guide the terminal into the space between the two contact elements.

It will be appreciated that the electrical connection between two terminals **24** inserted into the opposite ends of one pocket is made directly through the corresponding legs **40** of the two contact elements. On the other hand, the electrical connection between a terminal associated with one pocket and a terminal associated with the opposite pocket is made through said leg portions and also through the connecting webs **42** of the contact elements.

In assembling a connector of the type shown in Figs. 1 through 5, it will be appreciated that the two contact elements may be initially placed in back-to-back relation and may then be inserted into the housing from either end thereof. As previously mentioned, the spring-like leg portions **44** are slightly sprung towards the intermediate portions of the legs **40** when the contact is received in the housing in the absence of any terminals. Consequently, the entering movement of the contact during assembly thereof with the housing causes the leading leg portions **44** to be slightly sprung inwardly as they slide along the opposite wall portions of the pockets at the entering end of the housing. During the course of this entering movement, the backs of the leg portions **44** encounter the shoulders **36** and are thereupon sprung inwardly further, so as to pass thereover. As the contact reaches its proper position within the housing, the abutments **46** pass beyond the rib **37**, and move into locking engagement behind the corresponding shoulder **36**. At this time, also, the abutments **46** at the following end of the contact reach a position in substantial engagement with the shoulder **36** at the opposite side of the rib **37**. The contact is, consequently, securely interlocked within the housing in readiness to receive the corresponding terminals.

It will be noticed that although the structure of Figs. 1 through 5 is illustrated as accommodating only four terminals, the structure may be amplified to accommodate additional pairs of terminals by the addition of further connecting webs and leg portions. It will also be noticed that the functioning of the device does not depend on the concurrent use of all of the pockets. That is to say, the connector affords an efficient contact between two or three terminals, even though the remaining pockets or pocket is not occupied.

Referring now to Figs. 7 through 11, the structure there shown is arranged to accommodate three terminals, one of which may be inserted into the housing from one end and the remaining two of which may be inserted into the housing from the other end.

The housing, preferably formed by a molding operation, as before, is of generally T-shape, the leg **62** whereof defines a generally hexagonal pocket **64** having at its inner end an annularly extending shoulder **66**. The cross arm of the housing is formed to define two transversely spaced pockets **68**, the inner ends whereof are closed. The pockets **68** communicate with each other through passages defined between the crests of the ribs **72**, and these pockets communicate with the pocket **64** through the opening **74** at the inner end thereof.

The contact designated as a whole as **80** is formed of two duplicate elements, one of which is shown in Fig. 11. Each element comprises a central leg **82** associated with the pocket **64** and two laterally spaced legs **84** associated with the respective pockets **68**. The legs **82** and **84** are interconnected by means of a web **86**. As in the previous case, the end portions **88** of the legs, which are narrowed in width, are reversely bent to provide the previously described spring-like action. The wider leg portions are also provided with detents **30** for the previously described purpose, and the extreme end portion **90** of the reversely turned portion **88** of the leg **82** is slightly outwardly flared to provide an abutment for interlocking engagement with the previously de-

scribed shoulder 66. In the present case, the engagement between the inner ends 92 of the legs 84 and the closed inner ends of the pockets 68 provides the necessary interlocking action, and consequently, no abutments are employed at the ends of the corresponding reversely turned leg portions 88.

In assembling the contact 80 with the housing, the two contact elements are, as before, arranged in back-to-back relation, and the single end of the contact is introduced into the double-end of the housing. During this entering movement, the reversely turned leg portions 88 of the legs 82 are received in the deepened center portion 94 of the connecting passage between the two pockets 68, and the wider parts of the legs 82 are received in the space between the narrower parts of the opposing ribs 72. As before, the entering movement causes the end portions of the legs 82 to be sprung towards each other. In the course of the entering movement, the leg 82 passes through the opening 74, and the legs 84 enter the pockets 68. Also, the web portions 86 of the contact pass between the opposed crests of the ribs 72. Ultimately, the abutments 90 pass beyond the shoulder 66 and snap therebehind. At this time, also, the inner ends 92 of the legs 84 are in substantial abutting engagement with the inner ends of the pockets 68. The latter engagement consequently limits the entering movement of the contact, and the cooperation between the abutment 90 and the shoulder 66 prevents withdrawal of the contact from the housing. As in the previous case, the introduction of terminals into the housing springs the contact elements apart and brings the wider portion of the legs 84 and parts of the connecting web 86 into abutting engagement with the outer sloping walls of the housing pockets 68 and with the ribs 72, thus affording lateral support for the contact and improving the holding action. The leg 82 also abuts the walls of the opening 74 when a contact is introduced into the single-end of the unit. In all other respects except those noted, the functioning of the arrangement of Figs. 7 through 11 duplicates that of Figs. 1 through 5.

Although only several specific embodiments of the invention have been described in detail, it will be appreciated that various further modifications in the form, number and arrangement of parts may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. In a connector for at least three blade-like terminals, the combination of a contact having a plurality of electrically continuous blade-like conductive receptacles joined together by conductive means, one receptacle being individual to each said terminal and each receptacle being constituted by a pair of spaced blade-like legs each having a reversely turned end portion, and a housing for receiving said contact having at least three intercommunicating bore portions, one bore portion being individual to each receptacle, said housing having means cooperating with at least certain of said reversely turned end portions to hold said contact in place within said housing with said receptacles in said respective bore portions.

2. In a connector for at least three blade-like terminals, the combination of a contact having at least three electrically continuous blade-like conductive receptacles joined together by conductive means, one receptacle being individual to each said terminal and each receptacle being constituted by a pair of spaced blade-like legs, at least one leg of each pair having a reversely turned end portion, and a housing for receiving said contact having at least three intercommunicating bore portions, one bore portion being individual to each receptacle, said housing having means cooperating with at least certain of said reversely turned end portions to hold said contact in place within said housing with said receptacles in said respective bore portions.

3. In a connector for at least three blade-like terminals, the combination of a contact comprising two similar elements arranged in back-to-back relation and cooperating to define between them at least three electrically continuous blade-like conductive receptacles, one receptacle being individual to each said terminal and each receptacle being constituted by a pair of spaced blade-like legs, said blade-like legs of each said element being connected by a conducting web, at least one leg of each pair having a reversely turned end portion, and a housing for receiving said contact having at least three intercommunicating bore portions, one bore portion being individual to each receptacle, said housing having means cooperating with at least certain of said reversely turned end portions to hold said contact in place within said housing with said receptacles in said respective bore portions.

4. In a connector for at least three blade-like terminals, the combination of a contact comprising two similar elements arranged in back-to-back relation and cooperating to define between them at least three electrically continuous blade-like conductive receptacles, one receptacle being individual to each said terminal and each receptacle being constituted by a pair of spaced blade-like legs, said blade-like legs of each said element being connected by a conducting web, at least one leg of each pair having a reversely turned end portion, and a housing for receiving said contact having at least three intercommunicating bore portions, one bore portion being individual to each receptacle, each said bore portion having an outwardly presenting shoulder, each said reversely turned end portion engaging the shoulder of the corresponding bore portion and such engagements cooperating to secure said contact in place within said housing with said receptacles in said respective bore portions.

5. In a connector for at least three blade-like terminals, the combination of a contact comprising two similar elements arranged in back-to-back relation and cooperating to define between them at least three electrically continuous blade-like conductive receptacles, one receptacle being individual to each said terminal and each receptacle being constituted by a pair of spaced blade-like legs, said blade-like legs of each said element being connected by a conducting web, at least one leg of each pair having a reversely turned end portion, and a housing for receiving said contact having at least three intercommunicating bore portions, one bore portion being individual to each receptacle, each said bore portion having an outwardly presenting abutment, said webs engaging the abutment in certain of said bore portions to limit movement of the contact relative to said housing in one direction, and said reversely turned end portions engaging the abutment in another of said bore portions to limit movement of said contact in the opposite direction.

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