

Oct. 2, 1945.

V. E. CARLSON
ELECTRICAL CONNECTOR

2,385,792

Filed Aug. 17, 1942

2 Sheets-Sheet 1

Fig. 1.

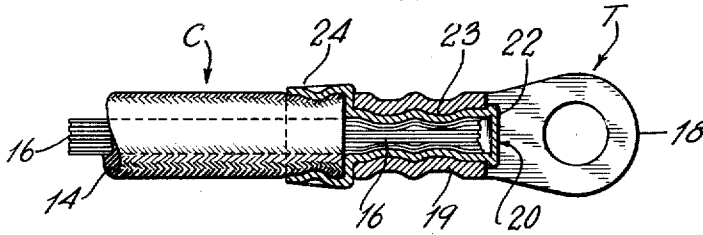


Fig. 2.

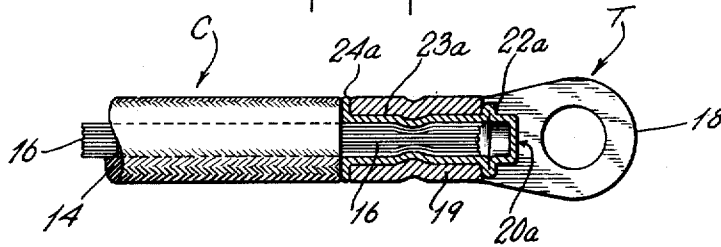
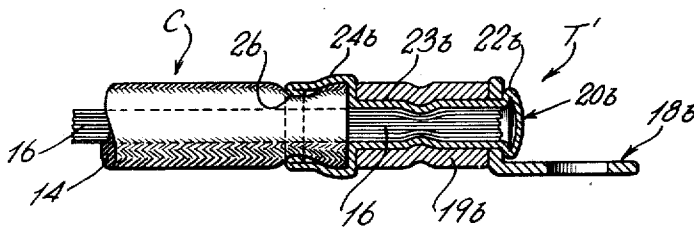


Fig. 3.



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2 Sheets-Sheet 2

Fig. 4.

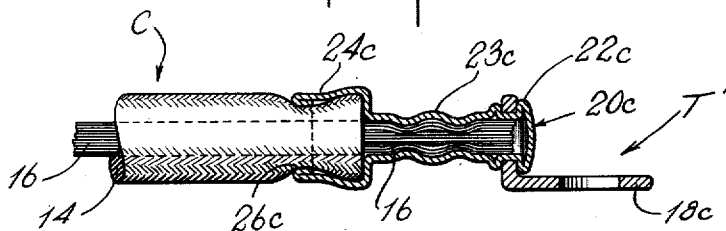


Fig. 5.

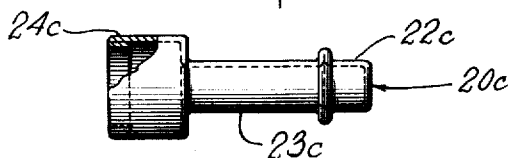


Fig. 6.

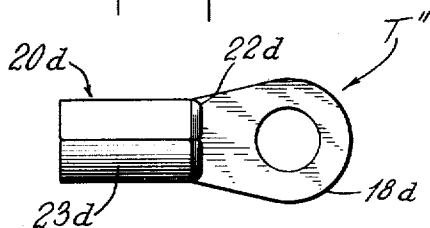


Fig. 7.

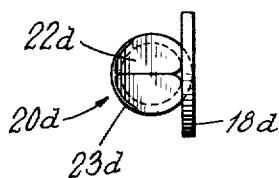


Fig. 8.

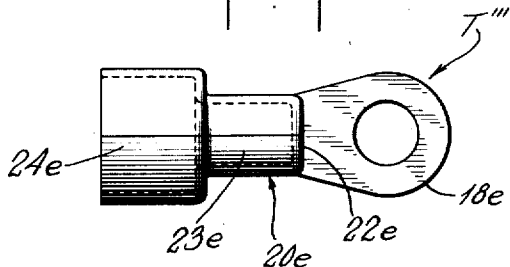
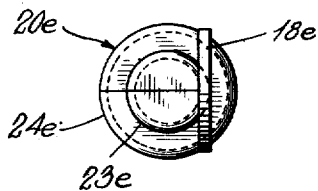


Fig. 9.



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UNITED STATES PATENT OFFICE

2,385,792

ELECTRICAL CONNECTOR

Vernon E. Carlson, Short Hills, N. J., assignor to
Aircraft-Marine Products, Inc., Elizabeth, N. J.,
a corporation of New Jersey

Application August 17 1942, Serial No. 455,034

3 Claims. (Cl. 173—269)

This invention relates to terminals for electrical conductors and, more specifically, to terminals of the solderless type wherein a ferrule is attached by crimping, for example, to the end of an insulated conductor.

It is an object of this invention to provide an electrical connector adapted to connect a terminal or other electrical device to an electrical conductor by a simple crimping or upsetting operation.

A further object is the provision of a novel and improved electrical connector wherein the end of an electrical conductor is sealed fluid tight within the connector, thus avoiding both possible corrosion which might reduce the efficiency of electrical contact and any possibility of leakage from the end of the conductor and through its interstices if the conductor should pass through a bulkhead or the wall of a pressure chamber.

A further object of the invention is to provide a multi-part connector in which one part for application to the conductor may be standard for a substantial range of connectors and may be readily connected and secured to another part.

Further objects and advantages will be in part pointed out as the description proceeds and will in part become apparent therefrom.

In the drawings, I have shown and described a preferred embodiment of my invention and various modifications thereof; but it is to be understood that these are not intended to be exhaustive nor limiting of the invention, but on the contrary are given for purposes of illustration in order that others skilled in the art may fully understand the invention and the principles thereof and the manner of applying it in practical use so that they may modify and adapt it in various forms, each as may be best suited to the conditions of the particular use.

In the drawings, in which exemplary embodiments for attaining the above objectives are set forth and in which like reference characters refer to like parts throughout:

Figure 1 is a plan view, with parts broken away and parts in section, of a novel and improved solderless connection embodying the invention;

Figure 2 is a plan view, with parts broken away and parts in section, of a modified form of solderless connection embodying the invention;

Figure 3 is a view, partly in longitudinal section and partly in side elevation, of a still fur-

ther form of solderless connection embodying the invention;

Figure 4 is a view, partly in longitudinal section and partly in side elevation, of yet another form of solderless connection embodying the invention;

Figure 5 is a view, partly in longitudinal section and partly in side elevation, showing the thimble of Figure 4 before it is applied to an electrical conductor;

Figures 6 and 7 are, respectively, a longitudinal plan view and an elevational end view of another type of connector embodying the invention; and,

Figures 8 and 9 are, respectively, a longitudinal plan view and an elevational end view of still another type of connector embodying the invention.

Referring to Figure 1, a solderless connection is illustrated between an electrical conductor, indicated generally by C, and a terminal connector, indicated generally by T. Conductor C comprises insulation 14 and a wire 16 made of a number of tinned copper strands. The electrical conductor is of a usual insulated stranded wire type commonly found in aeroplane controls, automobiles, radios, and the like. The connector T consists of a terminal contact portion 18 and a rolled or drawn ferrule portion 19. The invention is suited to use with other types of ferrules, however, and might advantageously be combined with a great variety of different types of connections. The conductor C and ferrule portion 19 illustrated and described are shown merely by way of example.

Between conductor C and connector T there is shown a thin metal thimble, indicated generally by 20. The closed end 22 of thimble 20 has been upset against an edge of the ferrule portion 19. Central portion 23 of thimble 20 fits over the stripped end of wire 16, and open end 24 of thimble 20 has been expanded and fitted over the end of insulation 14 of the conductor. Ferrule portion 19, together with the central portion 23 of the thimble, is crimped onto the wire 16 to form a tight electrical and mechanical connection between the conductor, the thimble, and the ferrule. The open end portion 24 of thimble 20 may also be crimped or otherwise compressed onto the insulation to form a firm support and a fluid tight seal therefor. Additional sealing means, e. g., an adhesive cement or plastic, may be used if desired between the thimble 20 and the conductor C, but ordinarily this will not be

necessary if the end 24 is suitably compressed onto the insulation 14.

Referring to Figure 2, conductor C and connector T are of the same type as illustrated in Figure 1. A thin metal thimble 20a is illustrated in position over the stripped end of wire 18 and inside of ferrule 19. Thimble 20a has been upset near its outer end, as at 22a, and flanged at its open end, as at 24a, to engage ferrule 19. The ferrule 19 may be crimped onto the wire 18 and the thimble 20a to form a tight electrical and mechanical connection.

In this embodiment of the invention, a band of insulating material (not shown) may be used as a sheath to insulate the ferrule 19 and to support it from the insulated portion of the conductor C beyond 24a, and this may also assist, by compression or cementing, in sealing the thimble 20a to the conductor C.

Referring to Figure 3, conductor C is similar to that illustrated in Figures 1 and 2. The connector, generally indicated by T', consists of a terminal portion 18b and a ferrule portion 19b. Portions 18b and 19b are held together, as shown, by the upset head 22b of a thin metal thimble 20b. In some instances it may be desirable to hold portions 18b and 19b together, as by brazing them or soldering them, either before or after they are applied to the electrical conductor. The open end 24b of thimble 20b has been enlarged and fitted over the end of insulation 14 of the conductor and the peripheral edge of the end 24b has been folded back into the thimble and crimped, or otherwise compressed, into insulation 14, as indicated at 26. This edge may be formed and applied in accordance with the copending application of Vernon E. Carlson and Thomas C. Freedom, Serial No. 459,624, filed September 25, 1942. As in the examples of Figures 1 and 2, the ferrule 19b, together with the central portion 23b of the thimble 20b, may also be crimped onto wire 18.

The ferrule 19b may be omitted if the central portion 23b of the thimble is made sufficiently heavy to serve alone and is stepped near its end to provide a seat against which the terminal contact member 18b may be riveted. Such an embodiment is illustrated in Figure 4, wherein terminal connector T' is shown attached to conductor C by thimble 20c. Figure 5 represents thimble 20c before it is applied and upset onto the electrical conductor. Preferably it is made from sufficiently heavy stock to provide full strength in the electrical connection.

Figures 6 and 7 illustrate an electrical connector wherein thimble 20d is rolled and formed with tabs and ears integral with terminal connector T'. The ears and tabs are rolled and formed, as illustrated, and the seams may be sealed by soldering or by brazing, for example.

Figures 8 and 9 illustrate an electrical connector wherein thimble 20e is formed with an enlarged open end 24e. In this embodiment the central portion 23e and enlarged end 24e are drawn directly into the configurations illustrated and the seam where the edges meet is sealed as by soldering or by brazing. A connector may be attached to an electrical conductor in much the same manner as the members of Figures 1 or 3.

The crimps illustrated in the various forms between the thimble and the wire and between the thimble and the insulation are illustrative only and are not intended to delineate the precise extent to which any particular crimp may be im-

pressed. The degree of crimping will depend upon the materials used in any given instance, upon the relation of the size of the wire to the size of the ferrule, and upon the stresses which a given connection may be required to withstand. The forms of the ferrule and of the terminal connector also are illustrative. Obviously other forms of terminals may be used; and the principle of the closed thimble made by stamping and rolling from flat stock may be used with other forms, e. g., without the portion 24d, as in Figure 2.

From the foregoing, it will be seen that connections made in accordance with the present invention are well adapted to attain the ends and objects hereinbefore set forth and to be economically manufactured. The connections are watertight and hence eliminate corrosion and/or electrolysis between the wire and the terminal, whether they are of bright copper, aluminum, or tinned or silvered copper or aluminum, or other conducting material. In addition, the intermediate thimbles serve to center and confine the wire of the conductor so as to assure solid engagement with the exterior portion during a subsequent crimping operation. Because of the thimble, the wire cannot escape to one side of a crimp or work its way between the edges of a rolled ferrule. Furthermore, the invention reduces the number of sizes of ferrules which must be kept in stock, since a relatively small wire may be coupled with a relatively large ferrule by using a thimble of proper dimensions and, as shown particularly in Figure 3, a few standard sizes of ferrules and/or thimbles may be used with a wide variety of terminal connectors each made as a simple stamping, etc., in a single standard size.

Not only does the thimble of the invention afford the above advantages among others, but also it may, by reason of its shape and the upset of its end, serve as a rivet or holding member between the various portions of a ferrule and a conductor; and if previously secured in tight electrical contact with the conductor may thus make unnecessary any crimping of the ferrule.

In the use of these connectors the thimble 20 may be assembled with the connector T at the factory, the end portion as at 22 being pressed against one end of ferrule portion 19, so as to give a mechanically secure and electrically efficient and moisture tight connection and the opposite end as at 24 being formed into an abutment against the other end of ferrule portion 19. The connector thus assembled may be slipped onto the end of the bared conductor, as shown in the drawings, and then secured and sealed thereon, e. g., by crimping the end 24 and the ferrule 19 with a tool such as disclosed in copending applications of Vernon E. Carlson, Serial No. 455,033, filed August 17, 1942, now Patent No. 2,359,083, dated September 26, 1944, and of U. A. Whitaker, Serial No. 455,039, filed August 17, 1942. Or, instead of assembling the thimble and connector at the factory, this may be done on the job; and, likewise, the thimble may be assembled with and secured to the wire 18 at the factory or on the job. Thus, the thimble may be slipped over the bared end of the conductor and crimped or otherwise secured to the wire; and subsequently the wire and thimble together may be pushed into the terminal connector T—either into the ferrule 19 of Figures 1 and 2, or into the hole in the simple terminal contact member 18b of Figure 3. The wire and thimble assembly may

then be secured to the terminal connector by upsetting the end of the thimble as shown.

I claim:

1. An electrical connector comprising a terminal contact portion and a thimble-receiving ferrule portion, and a thin metal thimble having a closed end, and an open end adapted to receive the end of an electrical conductor; said thimble being embraced within said ferrule portion, and the closed end of said thimble being upset over an edge of the ferrule portion toward the terminal contact portion and another portion of the thimble being extended over an opposite edge of the ferrule portion, whereby the thimble is secured in position in the ferrule portion.

2. An electrical connector comprising a terminal contact portion and a rolled ferrule portion, and a metal sleeve for receiving an end of an electrical conductor; said sleeve being relatively thin with respect to said ferrule portion and

being telescoped and embraced within said ferrule portion, one end of said sleeve being enlarged for embracing insulation on the electrical conductor and forming an abutment for one edge of said ferrule portion, and the other end of said sleeve being deformed laterally to engage an opposite edge portion of said ferrule portion, whereby said ferrule portion is held against said abutment.

3. In combination with a terminal connector having a ferrule to receive an end of an electrical conductor, an imperforate thimble making a tight fit within the ferrule; said thimble being relatively thin with respect to said ferrule and having a closed end thereof upset against one end of the ferrule and an open end thereof flared over the opposite end of the ferrule.

VERNON E. CARLSON.

CERTIFICATE OF CORRECTION.

Patent No. 2,385,792.

October 2, 1945.

VERNON E. CARLSON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 16, for "electrical" read --elevational--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 19th day of March, A. D. 1946.

(Seal)

Leslie Frazer
First Assistant Commissioner of Patents.

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