

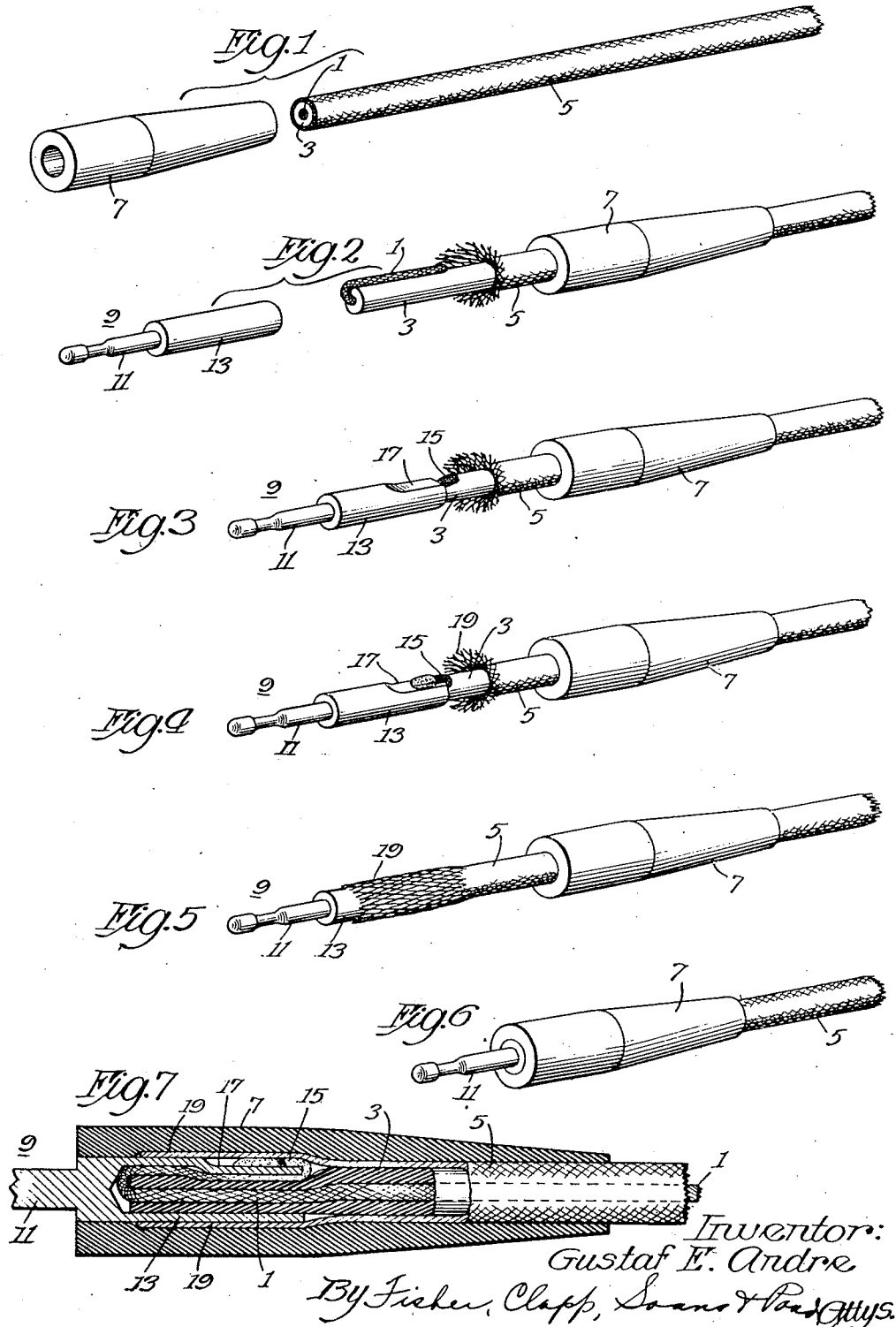
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ELECTRICAL CONNECTOR

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## ELECTRICAL CONNECTOR

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This invention relates to electrical connectors and particularly to mono-cord, plug type connectors for use with plug-in jack stationary contacts or the like.

Connectors of this type usually comprise a cylindrical, metallic, terminal contact of suitable dimensions, an insulated lead wire, the conductor of which is attached to the rear portion of the contact, which portion may comprise a hollow sleeve, and a suitable grip, preferably of insulating material, disposed about the rear portion of the contact and possibly about the adjacent portion of the lead wire for facilitating the grasping of the connector during its use.

In many applications of such connectors, they are constantly being subjected to bending and tension stresses, and breakage of the lead wire conductors has been a common and most troublesome occurrence. Such breakage often consists in separation of the electrical connection between the conductor wire and the contact plug.

To overcome this difficulty, a sleeve or grip element has been molded in place on the conductor and contact in an effort to securely connect the conductor and contact by means independent of the normal electrical connection between the conductor wire and contact. This arrangement does not entirely solve the problem, however, for the reason that it is very difficult to satisfactorily mold such a sleeve onto the lead wire without subjecting the lead wire conductor to considerable stress. Further, such a molding operation is relatively expensive, and in view of the extremely large number of these devices which are used, the cost of manufacture is a very important consideration.

The principal object of the present invention, therefore is to provide a low cost connector of the above described type which shall include means for minimizing the stresses induced in the lead wire conductor during the manufacture and use of the connector and which at the same time shall be less expensive to manufacture than the prior art devices.

A further object of the invention is to provide a connector which may be readily assembled by relatively unskilled labor without the use of complicated tools or other expensive equipment.

A preferred embodiment of my invention is illustrated in the attached sheet of drawings, wherein—

Figs. 1 through 5 are perspective views showing intermediate steps in the manufacture of my improved connector;

Fig. 6 is a perspective view showing the fea-

tures of a completed connector assemblage, and Fig. 7 is an enlarged, fragmentary, sectional view through the connector illustrated in Fig. 6.

Referring to the drawing, the lead wire with which my improved connector is used preferably comprises a flexible conductor cable 1 which is surrounded by a cylindrical sheath 3 of molded rubber or like insulating material. A woven covering preferably a braid 5 is disposed on the outer side of the insulating sheath 3 for the conductor cable, the covering being applied to that sheath during the manufacturing of the wire. A resilient sleeve 7, which may be formed of vulcanized rubber or like material, is slipped over the end of the lead wire during the assembling of the connector, through the use of a suitable hollow tool, to a position such as that indicated in Fig. 2. The braided covering 5 is next removed from the outer end of the lead wire, by burning or other similar means, to a point such as that illustrated in Fig. 2. The rubber sheath 3 about the cable conductor 1 of the lead wire is next removed so as to provide a bared end which is folded back over the adjacent end of the sheath 3 as shown in Fig. 2.

The terminal contact 9 for the lead wire comprises, as is illustrated particularly in Figs. 2 and 7, a solid, generally cylindrical, contact portion 11 which is formed integrally with a hollow, cylindrical sleeve portion 13 arranged co-axially therewith. The internal diameter of the hollow sleeve portion 13 is sufficiently large to receive the end of the lead wire 1 with the insulating sheath 3 thereon. The next step in the assembling of the connector consists in the slipping of the end of the lead wire 1, which has been prepared as described in the previous paragraph, and is now in the condition illustrated in Fig. 2, into the hollow sleeve portion 13 of the terminal contact 9.

The outer end of the lead wire is moved into the hollow terminal sleeve 13 until it engages the bottom end thereof (see Fig. 7). When in this position, a small portion 15 of the cable conductor 1 extends outwardly from the open end of the sleeve 13, as is shown in Fig. 3, a length of cable conductor sufficient to effect this having been previously bared at the end of the lead wire. The adjacent outer portion of the terminal sleeve 13 is then crimped, so as to create a depression or detent 17, as is illustrated in Figs. 3, 4 and 7. This crimping operation serves to securely attach the lead wire to the terminal 9 and also provides a convenient means for receiving the outer end 17 of the bared cable. The

outwardly projecting end 15 of the lead cable is next bent into the depression 17 and is there soldered securely in place, so as to provide a good electrical connection between the cable conductor 1 and the terminal 9.

At this point in the assembling operation, the conductor is in the condition shown in Fig. 4. To prevent the stresses induced during the use of the connector from being wholly absorbed by the conductor cable 1 and directly transmitted to the electrical connection between the terminal 9 and the conductor cable 1, the end portion of the braided or woven covering 5 is unwound or otherwise removed from the sheath 3 for a short distance and the resultant loose ends 19 are smoothed over the outer surface of the sleeve portion 13 of the terminal contact, as is illustrated in Fig. 5. Next, the resilient sleeve 7, which provides a convenient grip for the connector, is slid from the position shown in Fig. 5 to the position shown in Fig. 6. The internal diameter of this resilient sleeve 7 is materially less than the external diameter of the sleeve portion 13 of the terminal contact or the lead wire 5. Hence, when the resilient sleeve 7 is moved over the terminal sleeve 13, it securely holds the loose ends of the braided or woven covering 5, which are then positioned intermediate the outer end of the resilient sleeve 7 and the adjacent portions of the contact sleeve 13, against movement. Thus, any tensional or bending stresses which are induced in the connector during its use are impressed, for the most part, upon the braided covering 5 of the lead wire and not upon the conductor cable 1. This removal of stress from the conductor cable by means of the above described structural arrangement, constitutes the most important feature of the invention, for the reason that it makes possible a connector having equal or longer operational life than the one-piece molded construction and which, at the same time, is much less expensive to manufacture. To best accomplish the removal of stresses from the conductor cable 1, it is desirable that the braided or woven covering 5 shall be so formed that it is incapable of stretching to any great extent relative to the cable and its sheath.

If desired, the loose end portion 19 of the braided covering 5, which is disposed between the resilient sleeve 7 and the contact sleeve 13 may be cemented in place. This construction is probably the preferred one, for the reason that it provides a somewhat more positive mechanical connection between the braid and the contact terminal.

From the foregoing, it will be seen that I have provided a novel form of connector which is particularly suitable for use with plug-in stationary contacts or the like. My improved connector, while simple in design, is much easier to manufacture than the structures heretofore utilized. Substantially, all of the stresses induced during the use of the connector are impressed, by my novel arrangement of the structural features of the connector, upon the braided or woven covering of the lead wire, thereby obviating to a very large extent the troublesome breakage of lead conductors heretofore experienced in apparatus of this type. Moreover, through the use of a sleeve not molded integrally with the connector, it is possible to disassemble my device for inspection or repair. The unitary molded structures are, of course, not disassemblable.

The features of my invention which I believe to be new are particularly set forth in the ap-

ended claims. Various modifications of the invention may be apparent to those skilled in the art, and it is my desire that those claims shall be construed as broadly as is possible, consistent with the state of the art.

I claim:

1. In an electrical connector, a lead wire comprising a flexible conductor having a woven covering formed thereon, a plug type terminal having a contact portion and a hollow, tubular portion formed integral therewith, said hollow, tubular portion being adapted to receive one end of said conductor when said connector is assembled on said wire, means for electrically connecting said conductor to said terminal, and a strain relief for the electrical connection between said conductor and said terminal including a resilient sleeve having a portion which is disposed about and tightly engages said tubular portion of said terminal and a portion which is disposed about and tightly engages a substantial length of said lead wire adjacent said terminal solely because of the inherent resilience of said sleeve, the end portion of said woven covering extending between said tubular portion of said terminal and said resilient sleeve, being cemented to said tubular portion, and being held in such position partly by said cement and partly by the forces exerted by said resilient sleeve.

2. In an electrical connector, a lead wire comprising a flexible conductor having an insulated sheath and a woven covering formed thereon, a plug type terminal having a contact portion and a hollow, tubular portion formed integral therewith, and the interior of said tubular portion being of sufficient cross sectional area to receive one end of said conductor with said insulating sheath thereon, a bared portion of said conductor being looped back upon the end portion of the wire and sheath which extends into said hollow tubular portion of said terminal, said bared portion being mechanically and electrically connected at its end to said terminal, and means for relieving the electrical connections of said connector from mechanical stress during use including a sleeve of resilient insulating material disposed about and tightly engaging said tubular portion of said terminal and a substantial length of the adjacent lead wire solely because of the inherent resilience of said sleeve, the end portion of said braided covering extending between said tubular portion of said terminal and said resilient sleeve, being cemented to said tubular portion, and being held in such position partly by said cement and partly by the forces exerted by said resilient sleeve.

3. In an electrical connector, a lead wire comprising a conductor having a woven covering formed thereon, a terminal for said lead wire having a hollow, generally tubular conductor-receiving portion and a contact portion, means for electrically connecting said conductor to said terminal, and means for relieving the electrical connections of said connector from mechanical stress during use including a relatively heavy walled resilient sleeve adapted to cover and to tightly engage both the conductor-receiving portion of said contact and a substantial length of the adjacent portion of said lead wire solely by virtue of the inherent resilience of said sleeve, the covering of said wire adjacent the conductor-receiving portion extending between the outer surface of said conductor-receiving portion and said sleeve and only partially covering that portion, whereby a substantial part of the outer sur-

face of said contact-receiving portion is directly engaged by said resilient sleeve.

4. In an electrical connector, a lead wire comprising a flexible conductor having a resilient insulating sheath and an outer woven covering formed thereon, a terminal for said lead wire having a hollow, generally tubular conductor-receiving portion and a contact portion, the interior of said tubular portion being of sufficient cross sectional area to receive one end of said conductor with said insulating sheath thereon, a bared portion of said conductor being looped back upon the end portion of the lead wire and sheath which extends into said tubular portion, said

bared portion being mechanically and electrically connected at its end to said tubular portion at a point remote from and rearwardly of the end of the lead wire, and a relatively heavy walled resilient sleeve adapted to cover and to tightly engage both the conductor-receiving portion of said terminal and a substantial length of the adjacent portion of said lead wire solely by virtue of the inherent resilience of said sleeve, the end portion of said woven covering extending between said tubular portion of said terminal and said resilient sleeve.

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