

Nov. 13, 1962

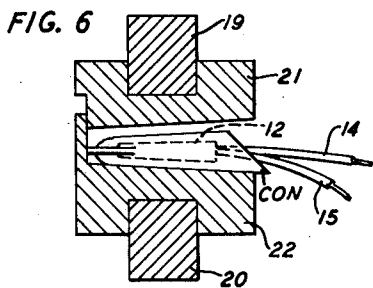
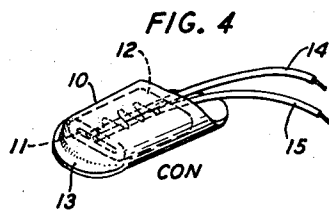
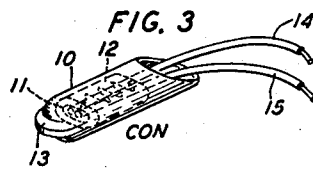
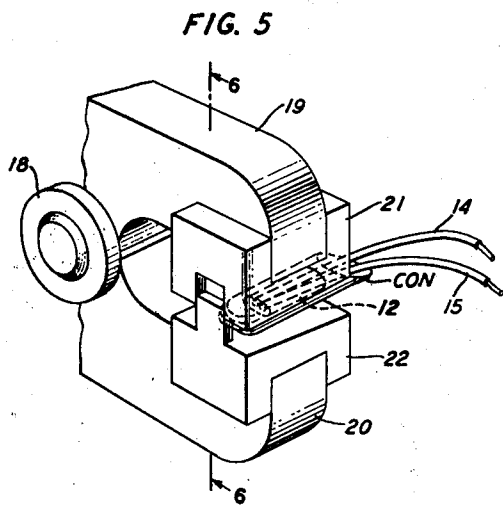
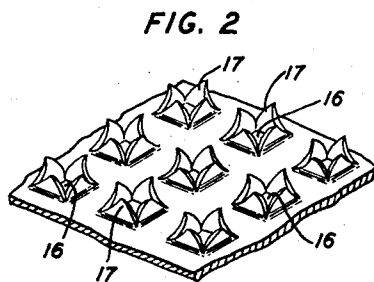
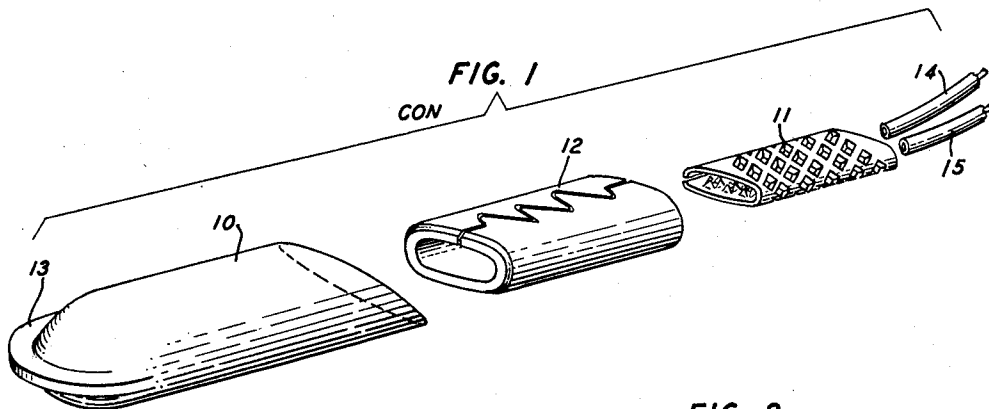
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3,064,072

CONNECTOR FOR INSULATED CONDUCTORS

Filed June 10, 1960

2 Sheets-Sheet 1



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CONNECTOR FOR INSULATED CONDUCTORS

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2 Sheets-Sheet 2

FIG. 7

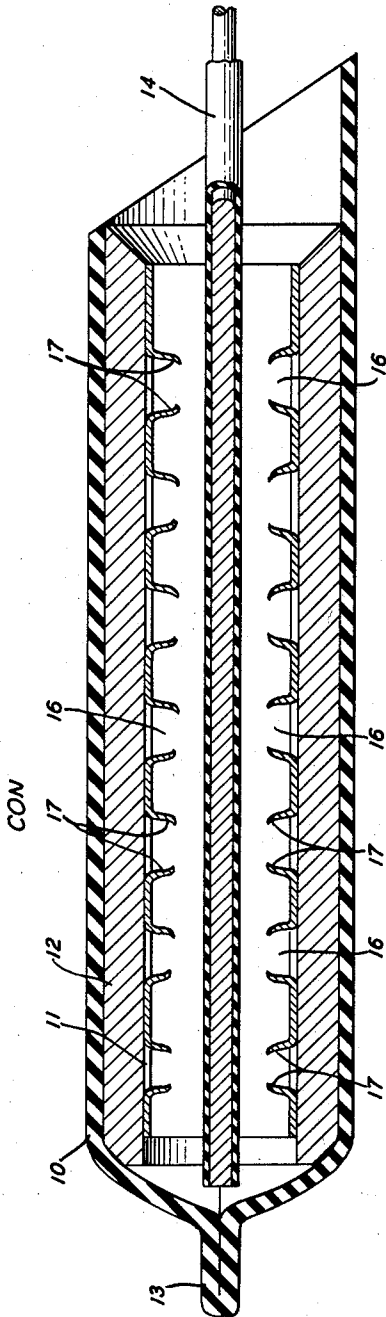
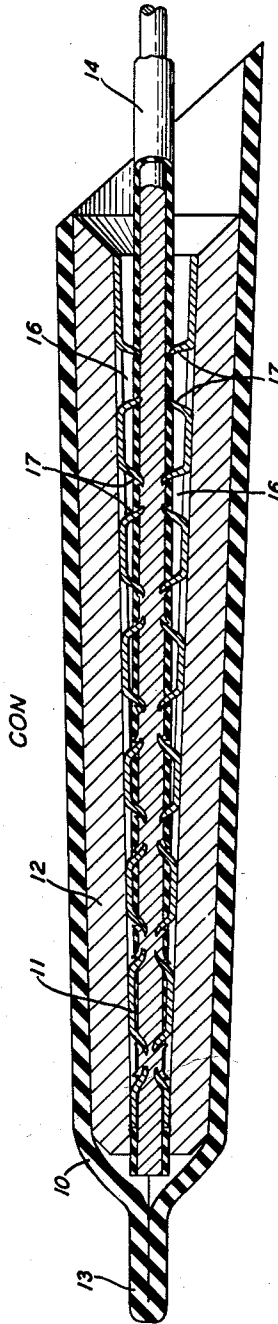


FIG. 8



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CONNECTOR FOR INSULATED CONDUCTORS
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This invention relates to the joining of electrical conductors and more particularly to the making of solderless insulated joints in insulated conductors without removing the insulating jacket therefrom.

An object of the present invention is the provision of a joint or splice for insulated electrical conductors wherein the ends of the conductors are joined together and insulated in a single simple operation by the use of a novel type of composite sleeve which obviates the need for skinning or removing the insulation from the ends of the conductors to be joined.

Another object of the invention is the provision of a joint for insulated electrical conductors wherein a plurality of said conductors are joined or spliced together in a composite sleeve which comprises a unitary structure having high insulating qualities combined with low electrical resistance.

A further object of the invention is the provision of a solderless connection for insulated electrical conductors wherein the composite sleeve is deformed to cause one of the components thereof to rupture the insulation on the conductor at a number of points and establish a multiplicity of contacts with the electrical metallic members of the conductor.

A feature of the present invention is the provision of a connector or splice for insulated conductors wherein the medium which establishes the electrical connection with the conductors does so with varying degrees of penetration in order to minimize the possibility of conductor breakage and to restrict any weakening of the conductor to that portion of the conductor within the confines of the sleeve.

A further feature of the invention is the provision of a novel type of insulation rupturing and contact making medium utilized as a component part of the composite sleeve connector of this invention, wherein a plurality of spaced apart perforations define inturned, upstanding, tang-like protuberances on a separate liner to rupture the insulation on the conductor and bite into the metal portion thereof with a sliding, digging action.

A still further feature of the invention is the provision of a type of pressing tool wherein the jaws thereof have a tapered configuration in order to exert more pressure at the free or closed end of the splice than at the near or open end.

A still further feature of this invention is the provision of a composite solderless wire connector wherein the metallic portions thereof comprise elements of varying thickness and ductility, the element being embraced being thin and hard and the embracing element being relatively thick and soft.

The contemplated sleeve structure of this invention comprises a plastic envelope or outer covering closed at one end and having enclosed therein a first liner of comparatively thin, hard metal and a second or outer liner of comparatively thick, soft metal. The liners and plastic envelope are substantially oval in cross section but not necessarily so. The inner liner is thin, compared to the second liner or sleeve, is very hard and is provided with tangs or protuberances resulting from the novel type of perforations.

In using the connector of this invention, the wires to be joined are positioned within the confines of the inner

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sleeve of the structure heretofore described and are subsequently subjected to external pressure by a suitable tool to force the protuberances or tangs on the inner liner through the insulation on the conductors and into intimate contact with the metallic portion of the conductors.

The novel configuration of the protuberances is such that the ends thereof, upon engagement with the metallic wire, will dig in slightly, curl and slide along the conductor.

Inasmuch as the inner sleeve is constructed of hard spring-like material and the encompassing or embracing outer sleeve is comparatively soft and thick, the spring back of the inner liner and the encompassing sleeve, which is kept within certain prescribed limits, is minimized and will cause the protuberances to dig into the metallic conductor, slide thereon and thereby make and maintain good electrical contact.

The inner sleeve is constructed of hard spring-like material and the encompassing or embracing outer shell is comparatively soft and thick. In general, when a metallic sleeve is compressed, there is spring back of the sleeve walls when the compressing force is removed. By the use of the inner liner of spring material, this spring back is compensated for by spring back in the tangs of the liner, due to energy stored in the tangs during the operation of pressing. Thus, the digging in and sliding of the tangs over the conductor metal which occurs during the pressing, is maintained and the good electrical contact therefore remains after the compressive force is removed.

The invention will be more clearly understood from the following detailed description when read in connection with the accompanying drawings, in which:

FIG. 1 is an exploded perspective view of the connector of this invention disclosing the component parts thereof together with a pair of insulated wires intended to be inserted therein;

FIG. 2 is an enlarged fragmentary view, in perspective, of a portion of the inner sleeve disclosing the configuration of the protuberances on the interior thereof formed by the perforations therein;

FIG. 3 is a perspective view of the connector of this invention with the conductors positioned therein prior to the deformation of the connector;

FIG. 4 is a view similar to FIG. 3 and illustrates how the connector is deformed to secure the conductors therein;

FIG. 5 is a fragmentary perspective view of a tool suitable for forcing the connector into intimate contact with the conductors contained therein;

FIG. 6 is a fragmentary cross-sectional view, taken on line 6-6 of FIG. 5, and illustrates the configuration of the jaws and their relation to the connector positioned therein, after deformation;

FIG. 7 is an enlarged longitudinal view partly in section illustrating the relative position of the conductor and the components of the connector before deformation; and

FIG. 8 is a view similar to FIG. 7 illustrating the appearance of the connector and the conductors contained therein after it has been deformed and illustrates how the insulation is ruptured and the protuberances bite into the metal conductor.

Referring now to the various figures and in particular to FIG. 1, the connector CON of this invention comprises three components, namely, an outer plastic sleeve 10, a first inner metallic sleeve 11 and a second or outer metallic sleeve 12.

The plastic sleeve 10 is pinched together or otherwise closed at 13 to provide a suitable seal, extends slightly beyond the ends of the metal liners 11 and 12 and has at its other end, an angular configuration to facilitate the introduction of the liners 11 and 12 during manufacture

and to further facilitate the introduction of the insulated conductors 14 and 15 when the connector is in use.

As shown in the various figures and more in detail in FIG. 1, the inner liner or first sleeve 11 is comparatively thin with respect to the second liner or sleeve 12, is constructed of hard spring-like material such as spring-tempered phosphor bronze, and is provided on its inner surface with a plurality of inturned perforations 16 which provide the protuberances or tangs 17. These protuberances may be spaced on the inner sleeve in any suitable manner.

As shown, particularly in FIG. 2, the configuration of the perforations 16 and the resultant protuberances or tangs 17 is such that a plurality of curved upstanding knife-like edges are provided for each perforation. The outer metallic sleeve 12 is formed of a soft, permanently deformable material, such as annealed brass.

In FIG. 3, we have shown the conductors 14 and 15 in position in the connector CON prior to the deformation of the connector.

In FIG. 4, we have shown the connector CON after it has been deformed by means of a suitable tool, for example, the tool shown in FIG. 5. This tool as shown at 18 in FIG. 5 is the well-known type of compressing tool with suitable jaws 19 and 20 in which there are mounted the dies 21 and 22.

As shown in FIG. 6, the dies 21 and 22 have a tapered configuration to impart to the connector CON placed therebetween a varying pressure, i.e., more pressure at the closed end than at the open end.

In FIG. 7, we have shown the relative position of the components of the connector CON before deformation with the sleeves 10, 11 and 12 having a substantially uniform diameter and the tangs or protuberances 17 in spaced relation with respect to the conductor 14.

In FIG. 8, we have shown what has happened after the connector CON has been subjected to deformation by the tool 18 shown in FIG. 5. In FIG. 8, we now see the tapered configuration of the connector CON which has been brought about by means of the tapered jaws in the tool 18 and the resulting rupturing of the insulation on the conductor 14 and the subsequent biting into the metallic conductor as shown with a varying degree of pressure due to the tapering structure of the embracing dies.

The outer metal sleeve 12 is permanently deformed by plastic flow and, in its deformed condition, restricts spring back of the elastically deformed sleeve 11 of spring material. The energy stored in the tangs 17 by elastic deformation serves to maintain good electrical contact.

While we have shown and described one embodiment of our invention, it is to be understood that various changes and modifications may be made therein without departing from the spirit of our invention and it is not our intention to be limited to any specific number of wires in the sleeve or by the materials which comprise the sleeve structure or the number or particular configuration of the tangs resulting from the perforations.

What is claimed is:

1. A joint for insulated electrical conductors and the like including a pair of coaxially telescopically disposed metallic sleeves, defining an inner liner of relatively hard spring-like material and an outer sleeve of relatively soft material, said inner liner having on its inner surface spaced apart perforations defining inwardly extending insulation piercing and wire engaging protuberances, a plurality of insulated electrical conductors positioned in the central bore of said inner liner and having their end portions confined and embraced by the protuberances on said inner liner and establishing electrical contact with the metallic portion of said electrical conductors when said outer

metallic sleeve is deformed by pressure applied to the outside thereof to exert a crushing action on said inner liner thereby forcing the protuberances through the insulation on the conductors and causing said protuberances to engage the metallic portion of the conductor with a sliding, biting action.

2. A joint for insulated electrical conductors and the like comprising a composite sleeve having an outer jacket of insulating material and a pair of coaxially disposed metallic sleeves, defining an inner liner of relatively hard spring-like metal and an outer liner of relatively soft metal positioned within said jacket, said inner liner having on its inner surface spaced apart perforations defining inwardly extending insulation piercing and wire engaging protuberances having diverging knife-like edges, a plurality of insulated electrical conductors positioned in the central bore of said inner sleeve and having their end portions confined and embraced by the protuberances on said inner liner and establishing electrical contact with the metallic portion of said electrical conductors when said outer metallic liner is deformed by pressure applied to the outer insulating jacket of said sleeve to exert a crushing action on said first liner thereby forcing the protuberances through the insulation on the conductors and causing said protuberances to engage the metallic portion of the conductor with a sliding, biting action.

3. A joint for insulated electrical conductors and the like comprising a composite sleeve having an outer jacket of insulating material and a pair of coaxially disposed metallic sleeves, defining an inner sleeve of relatively thin hard spring-like metal and an outer sleeve of relatively thick soft metal positioned within said jacket, said inner liner having on its inner surface spaced apart perforations defining inwardly extending insulation piercing and wire engaging protuberances, a plurality of insulated electrical conductors positioned in the central bore of said inner sleeve and having their end portions confined and embraced by the protuberances on said inner liner and establishing electrical contact with the metallic portion of said electrical conductors when said outer metallic liner is deformed by pressure applied to the outer insulating jacket of said sleeve to exert a crushing action on said first liner thereby forcing the protuberances through the insulation on the conductors and causing said protuberances to engage the metallic portion of the conductor with a sliding, biting action.

4. A connector for joining the ends of insulating electrical conductors comprising in combination an outer sleeve of insulating material having on its interior a pair of metallic sleeves coaxially disposed in telescopic relation to provide an inner liner of relatively hard spring-like material and an outer liner of relatively soft material, said inner sleeve liner having spaced apart perforations defining inwardly extending insulation piercing and wire engaging protuberances, whereby pressure applied to said outer insulating sleeve will exert a crushing action to said outer liner which in turn will crush said inner liner and force said protuberances thereon through the insulation on the conductor and establish electrical contact with the metallic core thereof.

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