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(54) **Electrical connection**

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Description

This invention relates to a connection between electric cables, for example multi-conductor cables, a component for use in the connection, and a method of making the connection. The invention is particularly, though not exclusively, useful for connecting heating cables, such as self-regulating heating cables.

When electric cables are to be connected together, outer layers such as protective jackets, earthing and/or screening layers, and dielectric layers are removed so as to expose the cable conductors. Respective conductors are then electrically interconnected in a suitable manner, and insulation re-applied to complete the cable splice. For example, the exposed conductors may be encased within individual insulating sleeves, and the conductors crimped together. If insulated crimps are used, the primary insulation is then complete, and the outer layers may be reinstated appropriately. However, if uninsulated crimps are used for making the electrical connections, further care has to be taken to ensure that no short circuits can occur in the connection region. The crimps may be individually insulated from one another, but this involves additional steps and the provision of additional components, and can lead to a bulky splice. One solution to this problem is provided by the S-69 heat shrinkable splice joint supplied by Raychem. In this joint the connections between respective conductors of the cables are arranged to be longitudinally offset from one another, such that, for example when joining together two dual-conductor cables, the uninsulated crimp of one pair of connected conductors is longitudinally adjacent an insulating sleeve of another pair of connected conductors and separated from the uninsulated crimp therebetween. In this way, a compact, low-profile splice can be obtained. To form such a splice between two cables each of which has two conductors, for example, in addition to the two uninsulated crimps, two shorter length insulating sleeves and two longer length insulating sleeves are needed, the difference in length of the sleeves being at least equal to the length of the crimp, and usually being about twice the length of the crimp. The offset of the two crimps is achieved by cutting back the two conductors of each cable to unequal lengths, as determined by the lengths of the supplied insulating sleeves, and then crimping the longer conductor of one cable to the shorter conductor of the other cable. Provided the insulating sleeves are correctly positioned on the corresponding lengths of stripped conductors, a properly insulated splice is obtained. However, in extreme circumstances, if the installer ignores the installation instructions for example, the situation can arise in which a shorter insulating sleeve is mounted on a longer stripped conductor. This arrangement can then give rise to a short circuit between the crimp of one spliced pair of conductors and the uninsulated length of a conductor of the adjacent pair.

Another solution is disclosed in GB-A-2148613, in

which the insulating sheath around a pair of conductors in a cable is cut off to an L- shape thereby to permit positioning of crimps longitudinally offset from each other and adjacent a remaining portion of the sheath (see Figure 2A). However, it is by no means straightforward reliably to achieve such a complex cut back of cable insulation.

Preferably the present invention provides a cable splicing arrangement, components therefor, and a splicing method, in which the likelihood of producing an incorrect splice is avoided, or at least minimised, by facilitating correct positioning of the splice components.

Preferably the present invention produces a cable splice that is of low profile, and one that resists high temperatures, for example those associated with electric heating cables.

The invention accordingly broadly provides an article, preferably an integral article, comprising two sleeves of electrically insulating material, the sleeves being of appreciably different lengths from one another, and being retained together by one, or more, insulating component, advantageously of low profile such as a sheet or web, such that the sleeves may only be pushed in a single orientation on to two parallel conductors of a cable.

Thus, in accordance with one aspect of the present invention, there is provided an article for insulating two elongate electrical conductors, the article comprising two tubular sleeves of electrically insulating material, which are of appreciably different lengths, and a securing portion that holds the sleeves together, characterised in that the securing portion comprises or defines a flexible sheet which extends in a plane that extends substantially parallel to or through a plane containing the axes of the tubular sleeves.

The sleeves are considered to be of "appreciably" different lengths if the difference is at least equal to the length of a connecting member, for example a crimp, to be associated therewith for connecting the electrical conductor of one cable to that of another. In practice, the difference in length should exceed such a minimum value in order to ensure good insulation between adjacent conductors and so to prevent a short circuit therebetween. The ratio of the sleeve lengths would be at least about 1.5:1, preferably about 2.0:1, and most preferably about 2.5:1, although it may exceed the latter value. The shortest length connection, or splice, region is preferred, in order to minimise the lengths of cable that have to be cut back, but a minimum length is necessary, when using uninsulated connection members, in order not only to avoid direct short circuit contact but also in order to avoid any longitudinally tracking, the formation of electrically conductive paths, flow of creepage current, or arcing between adjacent conductors.

Preferably the securing portion does not extend beyond one end of each of the sleeves. Advantageously one edge of the securing portion is co-planar with one end of each of the sleeves. Such a configuration con-

veniently allows the article to be mounted with the sleeves slid over respective conductors, for insulation purposes, and pushed towards the body of the cable thereby fully to insulate and to separate the sleeves beyond their emergence from the body (insulation, outer jacket etc.) of the cable. The securing portion serves to keep the two insulating sleeves together, thereby facilitating correct positioning of the two sleeves to ensure that in the final joint the entire lengths of the conductors beyond the electrical connecting members, such as crimps, are insulated. Having the securing portion extending between the insulating sleeves in a plane as defined, not only provides some rigidity for the article as a whole by retaining the sleeves fixed to one another, but also allows a splice to be achieved that is of low profile. In the latter respect, a securing portion extending in a plane transverse to that defined, for example as disclosed for the insulator designed for L- connections shown in GB-1308358, and as disclosed in GB-708320, would increase the transverse dimension of the splice region.

On the other hand, some flexibility is advantageous in the securing portion, to the extent that the lateral separation of the two sleeves, extending substantially parallel to each other, can be varied, within limits, in order to accommodate differences in separation of the conductors, which may be relatively rigid, in a multi-conductor cable, for example. Articles, such as the heat-shrinkable tube of Figure 5 of GB-1454838, which do not have such a securing portion, but which merely have two sleeves projecting from the base of a larger sleeve, are used for a different purpose - in GB-1454838 for example, such an article, commonly referred to as a breakout, is used to insulate otherwise uninsulated wires and to seal the region where they emerge from a cable.

A low profile splice is particularly advantageous when the cable is a heating cable, and especially a flat (as opposed to round) cable. After such a cable is applied to, for example wound around, a substrate to be heated, thermal insulation is applied around the outside, and its extension in a direction away from. i.e. laterally of, the substrate is to be minimised.

It will be appreciated that the article may be made of any suitable electrically insulating material, especially polymeric material, and including, for use at a higher temperature, with a heating cable for example, high temperature-resistant electrically insulating material such as VITON (trademark).

The article of the invention is placed over the exposed conductors of a cable and pushed tight against the cable insulation from which they emerge. To this end, the internal diameter of each sleeve merely needs to be the minimum size large enough so as easily to receive its associated conductor. The conductors are then cut back to leave substantially equal lengths exposed beyond the end of each sleeve. The provision of an integral article, the securing portion for example being formed as a web integral with and extending between

the two sleeves at one end thereof, ensures that the correct length of insulating sleeving is applied to each conductor. Having cut back both cables in this manner, and having applied one such article to each cable, simultaneously covering both conductors of each cable, there is very little or no likelihood that any length of conductor would subsequently be left exposed to form a short circuit.

The flexibility of the securing portion allows the article to be used with cables having relatively rigid conductors of different separations. It will thus be appreciated that the securing portion need not necessarily at all times lie in one plane, let alone a plane containing or parallel with the axes of the sleeve - its flexibility merely allows such an orientation to be achieved. Furthermore, the securing portion need not cover the full surface of a plane or sheet, but could, for example, comprise two elongate pieces spaced apart and extending between the insulating sleeves generally transverse to the axes thereof such that the elongate pieces and the sleeve axes are capable of forming such a plane.

It will be understood that the article may comprise three, or more, tubular sleeves, which may be secured by one or more securing portion, for use in splicing cables having three, or more, conductors. In this instance, it is envisaged that each sleeve of the article may be of an appreciably different length from each of the other.

The article of the invention finds particular, though not exclusive, application for use with uninsulated connecting members, such as crimps, and especially, though not exclusively, for use with heating cables, for example self-regulating cables. Such heating cables are available from the Chemelex Division of Raychem Corporation, under the tradename AUTOTRACE for example. Although insulated crimps, for example, are readily commercially available, no suitable crimp is available that is not only mechanically strong enough to withstand the force of a crimping tool but also resistant to operational temperatures of around 200°C.

In accordance with another aspect of the present invention, there is provided a kit of parts for connecting two conductors of one cable to respective ones of two conductors of another cable, comprising (i) a pair of electrically insulating articles, each of which is an article in accordance with the first aspect of the invention, and (ii) two electrical connecting members for connecting the respective conductors together.

Advantageously, the lengths of the shorter of the two tubular sleeves are substantially the same, the lengths of the longer of the two tubular sleeves are substantially the same, and the lengths of the two connecting members are substantially the same. Preferably the length of a shorter sleeve plus the length of a connecting member is less than the length of a longer sleeve.

In accordance with a further aspect of the invention, there is provided a connection between two electric cables made using a kit of parts according to the said another aspect of the invention, each of the electrical ca-

bles having two conductors, wherein (i) the conductors of each cable have been stripped of insulation and cut back to appreciably different lengths; (ii) the longer conductor of each cable has been connected to the shorter conductor of the other cable; and (iii) the stripped portions of the two conductors of each cable have been substantially completely reinsulated by the electrical insulating articles of the kit of parts.

After the primary insulation of the spliced conductors has been restored in accordance with the present invention, outer layers of insulation and/or sealing materials can then be applied to complete the splice. This may conveniently be achieved by the use of one or more layers of heat-shrinkable sleeves, employing an adhesive coating where desired. At this stage, any earthing and/or screening layers of the cables may also be interconnected across the splice region.

In accordance with a still further aspect of the present invention, there is provided a method of electrically connecting two electric cables, each of which has two conductors, using a kit of parts according to the earlier aspect of the invention, wherein

(i) the four conductors are stripped of electrical insulation;

(ii) over the two conductors of each cable is slid a respective one of the pair of insulating articles of the kit of parts, so as to enclose the stripped conductors, the conductors extending beyond one end of the respective article when the other end of that article is abutted against the remainder of the associated cable;

(iii) the exposed lengths of the four conductors are cut to leave substantially the same length extending beyond each tubular sleeve;

(iv) the longer conductor of each cable is connected to the shorter conductor of the other cable, thereby to have the two connections longitudinally offset from each other.

The insulating article of the invention advantageously is not heat-shrinkable, since the significant and variable longitudinal shrinkage that occurs with heat-shrinkable sleeves of high-temperature-resistant material, which can range from 0 to about 20% of its unrecovered length, would mean that complete insulation of the conductors could not be assured. However, in applications where sleeveings having consistent, very little, or no longitudinal shrinkage can be employed, then it is envisaged that the article could be made heat-shrinkable.

It will be appreciated that some applications of the present invention, in respect of multi-conductor cables for example, would mean that preferably the sleeves are of substantially the same internal, and external, diameter.

An insulating article for use in connecting cables, a kit comprising the article, an electrical connection, and a method of making the connection, each in accordance with the present invention, will now be described, by way of example, with reference to the accompanying drawings, in which:-

Figure 1 shows the article in perspective, and

Figure 2 shows a completed cable connection using a pair of the articles of Figure 1.

Referring to Figure 1, the article 2 consists of two tubular sleeve portions 4, 6 that are interconnected at one end by a small sheet or web 8. The article 2 is moulded as an integral component using electrically insulating material, such as VITON (trademark), which also has a high temperature resistance. The sleeve portion 4 is appreciably longer than the sleeve portion 6, so as to offset longitudinally the connections between electrical conductors, as described below. In this embodiment, sleeve 4 is about 55mm in length and sleeve 6 about 20mm in length. The interconnected web 8 is substantially planar, and is flexible so as to allow the separation between the two substantially parallel sleeve portions 4, 5 to be varied to accommodate, within limits, the separation of the electrical conductors of the cables to be connected, which conductors may be relatively rigid.

The web 8 extends between the sleeve portions 4, 6 at one end thereof such that the sleeves 4, 6 extend substantially parallel to each other with the web 8, when pulled taut into a plane, being substantially co-planar with the axes of the sleeves. The low profile of the web 8 is such that it does not extend beyond the outer circumferences of the sleeves 4, 6 in a direction perpendicular to the said plane.

Figure 2 shows two substantially identical electrical CHEMELEX AUTOTRACE (Trademarks) self-regulating heater cables 10, 12 of substantially rectangular cross-section. Each cable 10, 12 comprises an outer insulating and protection jacket 14 that encloses an earthing copper braid 16, and inner insulation 18 that encloses a pair of stranded copper conductors 20, 22 in side-by-side relationship separated by a polymer 24 that gives the heater cable its self-regulating ability. Below a defined transition temperature, the polymer 24 is electrically conductive and serves as the heating element of the cable, being supplied with electric power by the conductors 20, 22; above the transition temperature, the polymer 24 becomes highly resistive and so turns off the heating effect, and is thus self-regulating in order to prevent overheating. The heater cable may be of a different configuration, for example such that the conductors may be spaced apart by an electrically insulating component, and the conductive polymer, or other, heating element may be in the form of one or more fibres wrapped around the insulating component and around both conductors.

Each cable 10, 12 is prepared for connection to the

other by cutting back the outer jacket 14 to expose the braid 16, which is then pulled back along the inner insulation 18. The insulation 18 and conductive polymer 24 are cut back so as to leave exposed the pair of uninsulated conductors 20, 22. One of the insulating articles 2 is pushed over the pair of conductors of each cable 10, 12, with the conductors 20, 22 extending through the sleeve portions 4, 6, until the interconnecting web 8 and the adjacent sleeve portion ends about the polymer 24 and insulation 18 of the respective cable.

Since the conductors of the cables are to be connected by means of uninsulated crimps 26, these are to be longitudinally offset from one another in the splice region of the two cables, and the difference in the lengths of the sleeve portions 4, 6 conveniently and safely allows this to be done. In this embodiment, the length of each crimp 26 is about 17mm, which is approximately half the difference in length of the insulating sleeves 4, 6. Each of the four conductors 20, 22 is cut back so as to leave exposed beyond its respective enclosing sleeve portion 4, 6 a length equal to substantially half the length of the crimp 26. Since the insulating components 2 are identical, and since the crimps 26 are identical, each cable 10 is identically terminated, with an equal length of a longer conductor 20 exposed beyond the end of the longer sleeve portion 4, and an equal length of a shorter conductor 22 exposed beyond the end of the shorter sleeve portion 6. In order to join the cables 10, 12 together therefore, they necessarily have to be juxtaposed with the longer conductor 20 of one cable aligned with the shorter conductor 22 of the other cable. Furthermore, the major portion of the length of each conductor 20, 22 is safely insulated within a respective sleeve portion 4, 6 of an insulating component 2. With the cables 10, 12 thus juxtaposed, the crimps 26 are positioned over the ends of the aligned conductors 20, 22 of respective cables and secured in place. It is to be noted that the length of the longer sleeve portion 4 of the insulating component 2 appreciably exceeds the length of the shorter sleeve portion 6 by more than the length of the crimp, thereby to ensure that the crimps, which are uninsulated, are safely longitudinally offset from each other in the splice region.

The crimps 26 are of relatively thin wall thickness, such that they do not extend radially beyond the sleeve portions 4, 6 of the insulating components 2. In this way, a low profile is obtained in the splice region.

Having thus electrically connected the two cables 10, 12 together, and having restored primary insulation each side of each crimp 26, the splice region is finally reinsulated and the earthing connection made between the two cables as follows. Prior to making the crimp connections, three heat-shrinkable tubular sleeves, made of VITON (trademark), were loosely positioned, or parked, over one of the cables. For clarity, the sleeves are shown schematically in Figure 2 in position over the splice region before being recovered into conformity therewith. A first, inner, one 30 of the sleeves that has

an adhesive liner is now moved over the splice region, and is of a length such that it extends completely over the two insulating components 2 and crimps 26, and locates between the cut back insulations 18 of the two cables 10, 12. Heat is applied to recover the sleeve 30, thereby to insulate the crimps 26 and to seal around the crimps 26 and components 2. The braids 16 of the cables are then pulled back over the splice region (from the position shown in Figure 2) and caused to overlap on the outside of the sleeve 30. A strip (not shown) of high temperature solder is coiled around the overlap of the braids 16, and a second, short, heat-shrinkable sleeve 34 is moved along the spliced cables so as to enclose the solder. Heat is then applied to the sleeve 34 to cause it to recover and to melt the solder so as electrically to connect the two cable braids 16. Finally, outer insulation of the braids 16 and environmental protection of the splice region is achieved by sliding the third, outermost, heat-shrinkable sleeve 36, which has an adhesive liner, from its parked position so as completely to enclose the splice region. The sleeve 36 is heated to cause it to shrink and to seal on to the outer jackets 14 of the two cables 10, 12.

In this way, a low profile cable splice is obtained, in which because of the securing together of the unequal length insulating sleeve portions 4, 6, the conductors of the cables can be connected together only in one orientation. That orientation does not allow electrical short circuits to take place between one pair of crimped conductors and the other pair of crimped conductors, neither between the conductors themselves nor between the uninsulated crimps, or other connecting members.

It will be appreciated that if the cables to be connected together have three, or more, conductors, then an additional one, or more, sleeve portion would be provided by the insulating component of the invention. One, or more, additional further securing portion may be provided between each pair of sleeve portions, or only between two, or more, pairs, to ensure that the cables can be connected together only in an orientation such that no part of the conductors are left exposed for forming a short circuit, and such that the crimps, or other connecting members, cannot form a short circuit.

Whilst the invention has been described with respect to connecting together two multi-conductor, for example two dual-conductor, cables, it is also applicable to joining together single-conductor cables, or a single-conductor cable and a multi-conductor cable, which may be physically located closely together such that short-circuiting between conductors may occur.

Claims

1. An article (2) for insulating two elongate electrical conductors (20, 22), the article (2) comprising two tubular sleeves (4, 6) of electrically insulating material, which are of appreciably different length, and a

securing portion (8) that holds the sleeves (4,6) together, characterised in that the securing portion (8) comprises or defines a flexible sheet which extends in a plane that extends substantially parallel to or through a plane containing the axes of the tubular sleeves (4,6).

2. A kit of parts for connecting two conductors (20,22) of one cable (10) to respective ones of two conductors (22,20) of another cable (12), comprising (i) a pair of electrically insulating articles (2), each of which is an article in accordance with claim 1, and (ii) two electrical connecting members (26) for connecting the respective conductors.

3. A kit according to claim 2, wherein the lengths of the shorter (22) of the two tubular sleeves (4,6) are substantially the same, the lengths of the longer (20) of the two tubular sleeves (4,6) are substantially the same, and the lengths of the two connecting members (26) are substantially the same.

4. A kit according to claim 2 or 3, wherein the connecting members (26) are crimp connectors.

5. A connection between two electric cables (10,12) made using a kit of parts according to any of claims 2 to 4, each of the electrical cables having two conductors (20,22), wherein (i) the conductors (20,22) of each cable have been stripped of insulation (18) and cut back to appreciably different lengths; (ii) the longer conductor (20) of each cable (10,12) has been connected to the shorter conductor (22) of the other cable (12,10) using respective ones of the electrical connecting members of the kit of parts; and (iii) the stripped portions of the two conductors (20,22) of each cable (10,12) have been substantially completely reinsulated by the electrical insulating articles of the kit of parts.

6. A method of electrically connecting two electric cables (10,12), each of which has two conductors (20,22), using a kit of parts according to any of claims 2 to 4, wherein

(i) the four conductors (20,22) are stripped of electrical insulation (18);

(ii) over the two conductors (20,22) of each cable (10,12) is slid a respective one of the pair of insulating articles (2) of the kit of parts, so as to enclose the stripped conductors (20,22), the conductors (20,22) extending beyond one end of the respective article when the other end of that article is abutted against the remainder (18,24) of the associated cable (10,12);

(iii) the exposed lengths of the four conductors

(20,22) are cut to leave substantially the same length extending beyond each tubular sleeve (4,6) of each insulating article;

(iv) the longer conductor (20) of each cable (10,12) is connected to the shorter conductor (22) of the other cable (12,10) using respective electrical connecting members of the kit of parts, thereby to locate the two connections longitudinally offset from each other.

7. A method according to claim 6, wherein the conductors (20,22) are connected by crimping.

8. An article, kit, connection, or method in accordance with preceding claims, wherein the or each cable (10,12) is an electric heating cable, preferably a self-regulating heating cable.

Patentansprüche

1. Gegenstand (2) zum Isolieren von zwei langgestreckten elektrischen Leitern (20, 22), wobei der Gegenstand (2) folgendes aufweist: zwei rohrförmige Hülsen (4, 6) aus elektrisch isolierendem Material, die von deutlich unterschiedlicher Länge sind, und einen Befestigungsbereich (8), der die Hülsen (4, 6) zusammenhält, dadurch gekennzeichnet, daß der Befestigungsbereich (8) einen biegsamen Flächenkörper aufweist oder bildet, der sich in einer Ebene erstreckt, die im wesentlichen parallel zu einer oder durch eine Ebene verläuft, die die Achsen der rohrförmigen Hülsen (4, 6) enthält.

2. Teilesatz zum Verbinden von zwei Leitern (20, 22) eines Kabels (10) mit jeweiligen von zwei Leitern (22, 20) eines anderen Kabels (12), wobei der Teilesatz folgendes aufweist: (i) ein Paar von elektrisch isolierenden Gegenständen (2), von denen jeder ein Gegenstand nach Anspruch 1 ist, und (ii) zwei elektrische Verbindungselemente (26), um die jeweiligen Leiter zu verbinden.

3. Teilesatz nach Anspruch 2, wobei die Längen der kürzeren (22) der zwei rohrförmigen Hülsen (4, 6) im wesentlichen gleich sind, die Längen der längeren (20) der zwei rohrförmigen Hülsen (4, 6) im wesentlichen gleich sind und die Längen der zwei Verbindungselemente (26) im wesentlichen gleich sind.

4. Teilesatz nach Anspruch 2 oder 3, wobei die Verbindungselemente (26) Crimpverbinder sind.

5. Verbindung zwischen zwei elektrischen Kabeln (10, 12), die unter Verwendung eines Teilesatzes nach einem der Ansprüche 2 bis 4 hergestellt ist, wobei

jedes der elektrischen Kabel zwei Leiter (20, 22) hat, wobei (i) die Leiter (20, 22) jedes Kabels von Isolierung (18) befreit und auf deutlich unterschiedliche Längen zurückgeschnitten sind; (ii) der längere Leiter (20) jedes Kabels (10, 12) mit dem kürzeren Leiter (22) des anderen Kabels (12, 10) unter Verwendung von jeweiligen der elektrischen Verbindungselemente des Teilesatzes verbunden ist; und (iii) die abisolierten Bereiche der zwei Leiter (20, 22) jedes Kabels (10, 12) durch die elektrisch isolierenden Gegenstände des Teilesatzes im wesentlichen vollständig neu isoliert sind.

6. Verfahren zum elektrischen Verbinden von zwei elektrischen Kabeln (10, 12), von denen jedes zwei Leiter (20, 22) hat, unter Verwendung eines Teilesatzes nach einem der Ansprüche 2 bis 4, wobei

(i) die vier Leiter (20, 22) von elektrischer Isolierung (18) befreit werden;

(ii) über die zwei Leiter (20, 22) jedes Kabels (10, 12) ein jeweiliger von dem Paar von isolierenden Gegenständen (2) des Teilesatzes geschoben wird, um die abisolierten Leiter (20, 22) zu umschließen, wobei sich die Leiter (20, 22) über ein Ende des jeweiligen Gegenstands hinaus erstrecken, wenn das andere Ende dieses Gegenstands an dem Rest (18, 24) des zugehörigen Kabels (10, 12) in Anlage gebracht wird;

(iii) die freiliegenden Längen der vier Leiter (20, 22) abgeschnitten werden, um im wesentlichen die gleiche Länge zu belassen, die sich über jede rohrförmige Hülse (4, 6) jedes isolierenden Gegenstands hinaus erstreckt;

(iv) der längere Leiter (20) jedes Kabels (10, 12) mit dem kürzeren Leiter (22) des anderen Kabels (12, 10) unter Verwendung jeweiliger elektrischer Verbindungselemente des Teilesatzes verbunden wird, so daß die zwei Verbindungen in Längsrichtung voneinander versetzt positioniert werden.

7. Verfahren nach Anspruch 6, wobei die Leiter (20, 22) durch Crimpen verbunden werden.

8. Gegenstand, Teilesatz, Verbindung oder Verfahren nach vorhergehenden Ansprüchen, wobei das oder jedes Kabel (10, 12) ein elektrisches Heizkabel, bevorzugt ein selbstregulierendes Heizkabel ist.

Revendications

1. Article (2) pour isoler deux conducteurs électriques

allongés (20, 22), l'article (2) comportant deux manchons tubulaires (4, 6) en matière électriquement isolante, lesquels sont de longueurs notablement différentes, et une partie de fixation (8) qui maintient les manchons (4, 6) assemblés, caractérisé en ce que la partie de fixation (8) comporte ou définit une feuille flexible qui s'étend dans un plan s'étendant sensiblement parallèlement à, ou à travers, un plan contenant les axes des manchons tubulaires (4, 6).

2. Lot de pièces pour connecter deux conducteurs (20, 22) d'un câble (10) à certains, respectifs, de deux conducteurs (22, 20) d'un autre câble (12), comportant (i) une paire d'articles électriquement isolants (2), chacun étant un article selon la revendication 1, et (ii) deux éléments (26) de connexion électrique pour connecter les conducteurs respectifs.

3. Lot selon la revendication 2, dans lequel les longueurs des plus courts (22) des deux manchons tubulaires (4, 6) sont sensiblement les mêmes, les longueurs des plus longs (20) des deux manchons tubulaires (4, 6) sont sensiblement les mêmes, et les longueurs des deux éléments de connexion (26) sont sensiblement les mêmes.

4. Lot selon la revendication 2 ou 3, dans lequel les éléments de connexion (26) sont des connecteurs sertis.

5. Connexion entre deux câbles électriques (10, 12) réalisée en utilisant un lot de pièces selon l'une quelconque des revendications 2 à 4, chacun des câbles électriques ayant deux conducteurs (20, 22), dans laquelle (i) les conducteurs (20, 22) de chaque câble ont été dénudés de l'isolant (18) et coupés en arrière sur des longueurs notablement différentes; (ii) le conducteur plus long (20) de chaque câble (10, 12) a été connecté au conducteur plus court (22) de l'autre câble (12, 10) en utilisant certains, respectifs, des éléments de connexion électrique du lot de pièces; (iii) les parties dénudées des deux conducteurs (20, 22) de chaque câble (10, 12) ont été réisolées de façon sensiblement complète par les articles d'isolation électrique du lot de pièces.

6. Procédé pour connecter électriquement deux câbles électriques (10, 12) ayant chacun deux conducteurs (20, 22) en utilisant un lot de pièces selon l'une quelconque des revendications 2 à 4, dans lequel

(i) les quatre conducteurs (20, 22) sont dénudés d'un isolant électrique (18);

(ii) l'un, respectif, de la paire d'articles isolants (2) du lot de pièces est glissé sur les deux conducteurs (20, 22) de chaque câble (10, 12), de

façon à renfermer les conducteurs dénudés (20, 22), les conducteurs (20, 22) s'étendant au-delà d'une extrémité de l'article respectif lorsque l'autre extrémité de cet article est appliquée en butée contre la partie restante (18, 24) du câble associé (10, 12) ; 5

(iii) les longueurs à découvert des quatre conducteurs (20, 22) sont coupées pour laisser sensiblement la même longueur s'étendant au-delà de chaque manchon tubulaire (4, 6) de chaque article isolant ; 10

(iv) le conducteur plus long (20) de chaque câble (10, 12) est connecté au conducteur plus court (22) de l'autre câble (12, 10) en utilisant des éléments de connexion électrique respectifs du lot de pièces, plaçant ainsi les deux connexions afin qu'elles soient décalées longitudinalement l'une par rapport à l'autre. 15

7. Procédé selon la revendication 6, dans lequel les conducteurs (20, 22) sont connectés par sertissage. 20
8. Article, lot, connexion ou procédé selon les revendications précédentes, dans lequel le ou chaque câble (10, 12) est un câble électrique chauffant, avantageusement un câble chauffant à autorégulation. 25

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Figure 1

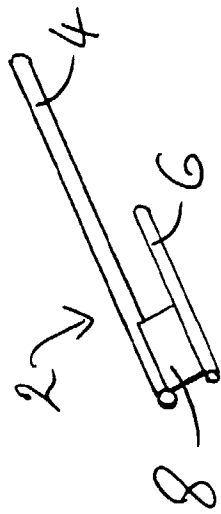


Figure 2

