(54) Strain relief device
Zugentlastungsvorrichtung
Serre-cable

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a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art.
The present invention relates to a cable strain relief of the kind defined in the preamble of Claim 1 (DE-C-19523795).

A strain relief is a connection element that is coupled to the circumference of a cable and enables forces that act in the length direction of the cable, i.e. axially acting forces, to be transferred to an external construction (e.g. a cable cabinet). Such a cable will normally include a bundle of individual, insulated conductors which may be covered with a common screen braiding. An insulating sleeve is provided on top of the braiding.

Such strain reliefs will preferably be electromagnetically impervious, i.e. provide electromagnetic insulation (EMI), and must also be capable of transferring forces effectively, so as to prevent individual fibers from being subjected to tensile forces in junction boxes or the like.

A known type of strain relief intended for this purpose is comprised of two tubular parts that have co-acting conical surfaces. One part (the inner part) has slits that extend axially from one end thereof, such as to form axially extending tongues. When the two parts are fitted together axially, the free ends of the tongues will be bent inwardly against the outside of the cable. The outer insulation is removed at the end of the cable and the braiding is folded back around the end of the remaining insulating sleeve. Consequently, when the two tubular parts are fitted together, parts of the braiding threads will be clamped between adjacent tongues. This often results in unsatisfactory anchoring of the strain relief to the cable.

Other known strain reliefs incorporate a U-shaped element whose legs are bent in towards the cable so as to overlap each other. This solution can result in damage to the individual conductors in the cable, and may also cause EMI-leakages to occur through the overlap.

Earlier known strain reliefs are expensive and require the use of complex devices for fitting the reliefs to cables, and also result in joints of greatly differing qualities.

Accordingly, the object of the invention is to provide a strain relief that can be fitted to cables of different standard diameters with the aid of a simple tool, such as to obtain transfer of axial forces between the crimped sleeve and the cable and a uniform result on each occasion.

Further objects of the invention will be evident from the following text, either directly or indirectly.

This object is achieved fully or partially with the strain relief according to Claim 1.

Further embodiments of the invention are defined in the accompanying dependent claims.

The invention is basically concerned with establishing a strain relief for a possibly screened cable that includes a plurality of conductors, by crimping a crimp sleeve on that part of the cable at which the braiding has been folded back over said cable, said crimp sleeve incorporating means which function to achieve an EMI-tight coupling of the sleeve to the wall of an apparatus housing at the cable leadthrough or transit. Crimp sleeves of this kind are available in various diameters, lengths and wall thicknesses adapted to different cable diameters, so as to ensure that the crimp sleeve will be effectively anchored to the cable with the aid of a crimping tool and therewith provide an EMI-impervious cable connection.

In order to enable a generally uniform crimping force to be applied with sleeves of different diameters and different wall thicknesses, the crimp sleeves include a circumferential groove that reduces the crimping force required to achieve the requisite strain relief anchorage of the crimp sleeve to the cable.

A crimping tool for crimping such strain relief sleeves may include a tool frame structure that has two generally parallel and mutually opposing frame members. Two opposing crimp inserts are placed between the frame members. The inserts include on their mutually facing sides recesses for crimping a sleeve of corresponding diameter on a corresponding cable. A screw meshes with a threaded hole through one frame member, so that the screw can be screwed in a direction towards the second frame member such as to bring the two inserts together. The inserts include means for guiding relative movement in said direction. The two inserts also include spring means which strive to move the inserts apart in said direction.

The two frame members have shallow recesses for receiving and localizing respective inserts. The tool can be used in conjunction with a set of insert pairs which each include crimping recesses that are adapted to crimp sleeves of correspondingly different sizes. In other respects, the insert pairs have generally equal outer dimensions in order to enable said insert pairs to be readily swapped in the frame structure. Owing to the relative guiding of the inserts and the spring means, the pair of inserts will be held automatically in the frame structure immediately the inserts are inserted thereinto, and can readily be replaced manually with another pair of inserts, by first pressing the fitted pair of inserts together against the action of the spring means and then tipping said inserts out one of the recesses and out of the frame structure. The recesses in the frame members are shallow recesses. The frame structure may conveniently have an elongated support arm and the screw may include a lever for facilitating rotation of the screw.

The invention will now be described in more detail with reference to an exemplifying embodiment thereof and also with reference to the accompanying drawings.

Figure 1 shows an inventive strain relief fitted to the end of a cable and connected to the wall of an ap-
In requisite crimping forces that must be exerted by the apparatus housing.

Figure 2 is a cross-sectional view taken on the line A-A in Figure 1 and images the strain relief prior to being crimped on the end of the cable. Figure 3 illustrates the configuration of the strain relief subsequent to being crimped on the end of the cable. Figure 4 shows a tool for crimping the strain relief sleeve. Figure 5 is a sectional view of a crimping tool insert.

[0016] Figures 1 and 2 illustrate a cable 1 comprising a core 2 that includes a plurality of insulated conductors 24, said core 2 being provided with screening braiding 3 which, in turn, is embraced by a cable casing 4. A length of casing 4 has been removed from the outermost end of the cable 1 and the braiding folded back over the remaining end part of the casing 4. A strain relief sleeve 10 is shown fitted over the backwardly folded screening part 3’ of said end section. The front part of the sleeve 10 includes an externally threaded section 12 and also an outwardly open circumferential groove 11 between its ends. An opening 13 through the casing wall, for instance in the groove 11, enables it to be ascertained whether or not the screen 3’ is located immediately beneath the sleeve 10. Figure 1 also shows the wall 20 of an apparatus housing. The wall 20 includes an opening 21 having a thread that will mesh with the outer thread 12 on the sleeve. The sleeve 10 is anchored to the wall 20 by means of the screw joint 12, 22. The sleeve 10 lies in intimate contact with the screen 3, 3’ around the whole of its circumference and tightly engages the wall 20 via the screw joint, so that the sleeve 10 will provide an EMI-tight connection to the apparatus housing (provided that the sleeve 10 and the wall 20 are made of a suitable material in this respect).

[0017] The sleeve 10 is crimped onto the cable 1 so as to obtain an EMI-tight connection therewith. By crimping is meant that the sleeve 10 is subjected to plastic deformation from an essentially circular, round state into a polygonal shape, as illustrated in Figure 3. Such crimping of the strain relief sleeve 10 provides a highly durable anchorage of the end of the cable 1 to the sleeve 10 with respect to tensile forces or strain acting in the length direction of the cable, while providing, at the same time, an EMI-tight connection between the sleeve 10 and the cable 1 and subjecting the insulated conductors 24 to stresses that are generally safe with respect to the integrity of the conductors 24.

[0018] The crimping technique requires a larger material thickness of the sleeve 10 in the case of large diameter cables 1 (with maintained crimping deformation pattern), which normally means that the crimping tool must exert crimping forces that increase markedly with increasing diameters of the cable 1 and the sleeve 10, by providing larger sleeves 10 with a circumferential groove 11 between its ends, and can limit the increase in requisite crimping forces that must be exerted by the crimping tool. This enables the use of a simple, and therewith cost favorable tool that includes exchangeable inserts that cover a whole series of differently sized sleeves 10 adapted to cables 1 of standard sizes.

[0019] Figure 4 and 5 illustrate one such simple tool 30 with associated inserts 40.

[0020] The crimping insert 40 is comprised of two mutually co-acting blocks 41, 42, which may be mutually identical. Each of the blocks 41, 42 has an orthogonal parallelepipedic shape and each of the mutually opposing sides of the blocks includes a recess 43, said recesses together defining an hexagonal opening when the blocks 41, 42 are in mutual abutment. The hexagonal shape corresponds to the final external shape 10’ (Figure 3) of the crimped sleeve 10. Each block 41, 42 has a guide pin 44 on one side of the recess 43 and a corresponding aperture or hole 45 on the other side thereof. A helical spring 48 is placed on the bottom of each aperture 45. Each block 41, 42 is therewith designed so that the pin 44 of one block 41 will fit into the hole 45 in the other block, and vice versa.

[0021] Although the blocks 41, 42 are mutually identical as a result of the illustrated construction of the insert 40, it will be obvious to the person skilled in this art that the blocks 41, 42 can be constructed differently with respect to the pins 44, the holes 45 and the springs 48, while retaining the function of said blocks. Figure 4 illustrates a tool handle 31 which has at one end a frame structure 50 formed by the end-part 32 of said handle, with the blocks 41, 42 thus held together defining an hexagonal opening when the blocks 41, 42 are in mutual abutment. Each block 41, 42 has an orthogonal parallelepipedic shape and each of the mutually opposing sides of the blocks includes a recess 43, said recesses together defining an hexagonal opening when the blocks 41, 42 are in mutual abutment. The hexagonal shape corresponds to the final external shape 10’ (Figure 3) of the crimped sleeve 10. Each block 41, 42 has a guide pin 44 on one side of the recess 43 and a corresponding aperture or hole 45 on the other side thereof. A helical spring 48 is placed on the bottom of each aperture 45. Each block 41, 42 is therewith designed so that the pin 44 of one block 41 will fit into the hole 45 in the other block, and vice versa.

[0022] When the blocks 41, 42 (Figure 5) are pressed together such as to bring their adjacent surfaces 46 essentially into contact with one another, the insert 40 can be inserted laterally into the frame structure 50 in alignment with the recess 36, whereafter the insert 40 is allowed to expand under the action of the spring 48 to the state shown in Figure 4, where the insert 40 is thus held by the expansion forces of the springs 48. The insert 40 can, nevertheless, be easily removed from the frame structure, by first compressing the insert and then tilting it out of the frame structure 50.

[0023] Shown in Figure 4 is a screw 37 which is threaded through a through-penetrating opening in the handle part 32 and acts against the bottom plate 39 in the recess 36 in the plate 35, such as to push the plate 35 towards the yoke 33. The screw 37 is provided with a long, lateral lever 38 by means of which heavy torque can be exerted manually on the screw 37, while rotational forces can be counteracted at the same time, by
A strain relief for a cable (1) comprising a plurality of conductors (24) which are surrounded by a common cable casing (4), wherein the strain relief is a tubular ring shaped crimp sleeve that is crimped on the cable (1) on the cable casing; the crimp sleeve as crimped has a hexagonal external shape; and the crimp sleeve (10) embodies means (12) for coupling the strain relief sleeve (10) to an apparatus housing wall (20) via a cable leadthrough or transit (21), characterized in that the crimp sleeve (10) has a circumferential groove (11) between its axial ends in order to provide an outwardly convex axial profile for the interior side of the sleeve as crimped and in that the groove is located on the exterior side of the crimp sleeve.

A strain relief according to Claim 1, characterized in that the crimp sleeve (10) embodies means (12) for coupling the strain relief sleeve (10) to an apparatus housing wall (20) via a cable leadthrough or transit (21), characterized in that the groove (11) is located on the exterior side of the crimp sleeve.

A strain relief according to Claim 1 or 2 characterized in that the crimp sleeve (10) engages the screen (3).

A strain relief according to Claim 3, characterized in that the wall of the crimp sleeve (10) includes an inspection opening (13) for inspection of the screen (3).

A strain relief according to claim 4 characterized in that an end portion (3') of the screen (3) as folded back over the cable casing (4), and in that the crimp sleeve (10) is crimped onto said screen end portion (3').

Claims

1. A strain relief for a cable (1) comprising a plurality of conductors (24) which are surrounded by a common cable casing (4), wherein the strain relief is a tubular ring shaped crimp sleeve that is crimped on the cable (1) on the cable casing; the crimp sleeve as crimped has a hexagonal external shape; and the crimp sleeve (10) embodies means (12) for coupling the strain relief sleeve (10) to an apparatus housing wall (20) via a cable leadthrough or transit (21), characterized in that the crimp sleeve (10) has a circumferential groove (11) between its axial ends in order to provide an outwardly convex axial profile for the interior side of the sleeve as crimped and in that the groove is located on the exterior side of the crimp sleeve.

2. A strain relief according to Claim 1, characterized in that the crimp sleeve (10) and the apparatus housing wall (20) are adapted to provide an EMI-tight connection of the cable (1) to the interior of the housing, the cable comprising a screen (3) surrounding said plurality of conductors (24).

3. A strain relief according to claim 1 or 2 characterized in that the crimp sleeve (10) engages the screen (3).

4. A strain relief according to Claim 3, characterized in that the wall of the crimp sleeve (10) includes an inspection opening (13) for inspection of the screen (3).

5. A strain relief according to claim 4 characterized in that an end portion (3') of the screen (3) as folded back over the cable casing (4), and in that the crimp sleeve (10) is crimped onto said screen end portion (3').

Patentansprüche

1. Zugentlastung für ein Kabel (1), aufweisend eine Vielzahl von Leitern (24), die von einer gemeinsamen Kabelhülle (4) umgeben sind, wobei die Zugentlastung eine rohrförmige, ringförmige Crimphülse ist, die auf dem Kabel (1) auf die Kabelhülle gequetscht wird, wobei die Crimphülse gequetscht eine hexagonale äußere Form aufweist, und die Crimphülse (10) Mittel (12) zum Koppeln der Zugentlastungshülse (10) an eine Vorrichtungsgewinde wand (20) über eine Kabeldurchführung oder -durchgang (21) enthält, dadurch gekennzeichnet, dass die Crimphülse (10) eine Umfangsnut (11) zwischen ihren axialen Enden aufweist, um ein nach außen konvexas axiales Profil für die Innenseite der Hülse, wenn gequetscht, zu liefern, und dass die Nut auf der Außenseite der Crimphülse angeordnet ist.

2. Zugentlastung nach Anspruch 1, dadurch gekennzeichnet, dass die Crimphülse (10) und die Vorrichtungsgewinde wand (20) angepasst sind, zum Liefern einer EMI-dichten Verbindung des Kabels (1) mit dem Innern des Gehäuses, wobei das Kabel eine Abschirmung (3) aufweist, die die Vielzahl der Leiter (24) umgibt.

3. Zugentlastung nach Anspruch 1 oder 2, dadurch
gekennzeichnet, dass die Crimphülse (10) mit der Abschirmung (3) in Eingriff ist.

4. Zugentlastung nach Anspruch 3, dadurch gekennzeichnet, dass die Wand der Crimphülse (10) eine Inspektionsöffnung (13) zur Inspektion der Abschirmung (3) aufweist.

5. Zugentlastung nach Anspruch 4, dadurch gekennzeichnet, dass ein Endabschnitt (3') der Abschirmung (3) über die Kabelhülle (4) zurückgefalld ist und dass die Crimphülse (10) auf den Endteil (3') der Abschirmung gequetscht ist.

Revidcations

1. Réducteur de tension pour un câble (1) comprenant une pluralité de conducteurs (24) qui sont entourés d'une gaine de câble commune (4), dans lequel le réducteur de tension est un manchon à sertir tubulaire, en forme d'anneau, qui est serti sur le câble (1), sur la gaine de câble, le manchon à sertissage, lorsqu'il est serti, ayant une forme extérieure hexagonale ; et le manchon à sertir (10) réalise un moyen (12) de couplage du manchon du réducteur de tension (10) sur une paroi du boîtier d'un appareil (20) via une traversée de câble ou un passage de câble (21), caractérisé en ce que le manchon à sertir (10) possède une rainure de circonférence (11) située entre ses extrémités axiales afin de fournir un profil axial convexe vers l'intérieur du manchon, lorsqu'il est serti, et en ce que la rainure est située sur l'extérieur du manchon à sertir.

2. Réducteur de tension selon la revendication 1, caractérisé en ce que le manchon à sertir (10) et la paroi du boîtier de l'appareil (20) sont conçus pour fournir une connexion étanche au rayonnement électromagnétique du câble (1) à l'intérieur du boîtier, le câble comprenant un blindage (3) entourant ladite pluralité de conducteurs (24).

3. Réducteur de tension selon la revendication 1 ou 2, caractérisé en ce que le manchon à sertir (10) s'engage sur le blindage (3)

4. Réducteur de tension selon la revendication 3, caractérisé en ce que la paroi du manchon à sertir (10) comporte une ouverture d'inspection (13) permettant l'inspection du blindage (3).

5. Réducteur de tension selon la revendication 4, caractérisé en ce qu'une partie d'extrémité (3') du blindage (3) est repliée sur la gaine du câble (4) et en ce que le manchon à sertir (10) est serti sur ladite partie d'extrémité du blindage (3).