Strain Relief Adaptors

Field of Invention

[0001] The present invention relates to strain relief adaptors. In particular, it is directed to strain relief adaptors for flexible conduits, optical cables, hoses, and the like, to minimise such flexible conduits, optical cables and hoses from being bent beyond a minimum radius.

Background

[0002] A communication headset allows a user to wear a microphone and earphones, and frees the user's hands, for example, a receptionist or an aerobic instructor, for other activities. As technology progresses, these microphones and earphones are becoming smaller and non-intrusive. As a result, headsets are also becoming light-weight and more comfortable to wear. FIG. 1A shows a typical light-weight headset 10. As shown in FIG. 1A, the headset 10 has a wire frame 14 shaped and dimensioned to fit around the back of a user's head. In addition, each of the two ends of the wire frame 14 is also shaped and dimensioned to fit over an ear of the user. The headset cable 18 leading from a jack 22 is supported by the wire frame 14. As shown in FIG. 1A, the left hand end of the wire frame 14 is extended by a flexible gooseneck 24, which terminates with a microphone 30. The flexible gooseneck 24 allows a user to position and/or re-position the microphone 30, for example, to a comfortable position close to one's mouth.

[0003] Often, these light-weight headsets are put to rough use. For example, a user may stuff a headset into one's backpack and thereafter simply pull out the headset. Such rough handling tends to break parts of the headset, such as the gooseneck 24. In use, the joint between the gooseneck 24 and the wire frame 14 are subject to additional bending and twisting. As a result, the joint between the gooseneck 24 and the wire frame 14 becomes a weak part of the headset 10.

[0004] In another application, a long hose or conduit 50 is usually coiled up for storage. Often, the hose or conduit 50 is stretched during use before being un-coiled. As a result, portions of the hose 50 become bent beyond a minimum radius and become kinked 54, as shown in FIG. 1B, and fluid passage in the hose is hampered. In a similar manner, optical cables have minimal bend radius; bending an optical cable beyond the minimum bend radius would break the optical core and render it useless. Such a conduit may also include an electric cable. Known strain relief adaptors for hoses, electrical cables and optical cables are moulded or mounted inside part of a plug, socket or bulkhead associated with the hoses, conduits or cables. There do not appear to be any known strain relief adaptor that can be installed or replaced by a user on a portion of a conduit, hose or cable.

[0005] Attempts have been made to provide a flexible and resilient joint between the gooseneck or microphone boom and the frame. For example, US patent no. 5,381,486, assigned to ACS Communications, discloses the use of both a ball and socket and a universal joint at a proximal end of a microphone boom. US patent no. 4,987,592, assigned to David Clark Company Inc., discloses a microphone boom having three sections. A rigid section mounted at an ear dome permits rotation about a first axis and translation about a second axis; the second axis is transverse to the first axis. An intermediate section is connected to the rigid section by a hinge joint. The hinge joint permits rotation of the intermediate section about a third axis, which is transverse to the first axis. An outer section is bendable and is connected to the intermediate section by a socket. The socket allows the microphone to be rotated.

[0006] It can thus be seen that there exists a need to provide a strain relief device for a flexible conduit, be it a gooseneck, a hose, an optical cable, and so on. Preferably, the strain relief is an adaptor and is suitable for application by a user.

Summary

[0007] The following presents a simplified summary to provide a basic understanding of the present invention. This summary is not an extensive overview of the invention, and is not intended to identify key features of the invention. Rather, it is to present some of the inventive concepts of this invention in a simplified form as a prelude to the detailed description that is to follow.

[0008] According to an embodiment of the present invention, an in-line strain relief adaptor for a flexible conduit is provided. The strain relief adaptor comprises a spiral sleeve and an elongate sleeve. The spiral and elongate sleeves are integrally connected. The elongate sleeve has a longitudinal split along its elongate axis. The elongate sleeve is adapted to clamp onto a portion of the conduit whilst the spiral sleeve is adapted to wrap around an adjoining portion of the conduit to minimise a local portion of the conduit from being bent beyond a predetermined minimum bend radius.

[0009] According to another embodiment of the present invention, a method of strain relieving a flexible conduit is provided. The method comprises: fitting an elongate split sleeve of an in-line strain relief adaptor onto a portion of the conduit and wrapping a resilient spiral band integrally connected to the elongate split sleeve onto an adjoining portion of the conduit to provide a transition in flexure stiffness to a local portion of the conduit to minimize bending of the conduit beyond a predetermined minimum bend radius.

[0010] According to a further embodiment of the present invention, a kit for strain relieving a flexible conduit is provided.

[0011] Preferably, the spiral sleeve has a component spiral length L along its longitudinal axis and a thickness T. The component spiral length L and the thickness T

may be constant or varying. The cross-sectional area of the spiral may be rectangular, oval, trapezoidal, inverse trapezoidal or parallelogram in shape. The spiral may be left or right hand in direction. Further, the spiral sleeve may comprise two or more spirals. The penultimate loop of each spiral may comprises a recess and the end of the spiral is bent to fit and lock snugly within the recess.

[0012] Preferably, the longitudinal split at the elongate sleeve has a profile edge. The profile may be saw-tooth, square-wave or sine-wave in shape. Further, the elongate sleeve may comprise a tangential plate.

[0013] Preferably, the strain relief adaptor comprises a first spiral sleeve, an elongate sleeve, and a second spiral sleeve.

[0014] Preferably, the strain relief adaptor comprises a plastic moulding. It may also comprise a metal insert.

Brief Description of the Drawings

[0015] This invention will be described by way of non-limiting embodiments of the present invention, with reference to the accompanying drawings, in which:

[0016] FIG. 1A illustrates a typical light-weight headset having a gooseneck microphone; FIG. 1B illustrates a flexible conduit that is bent and kinked;

[0017] FIG. 2 illustrates a strain relief adaptor in accordance with a first embodiment of the present invention;

[0018] FIG. 3 illustrates another strain relief adaptor in accordance with a second embodiment of the present invention;

[0019] FIG. 4 illustrates another strain relief in accordance with a third embodiment of the present invention;

[0020] FIG. 5 illustrates another strain relief adaptor in accordance with a fourth embodiment of the present invention; and

[0021] FIG. 6 illustrates yet another strain relief adaptor in accordance with a fifth embodiment of the present invention.

Detailed Description

[0022] One or more specific and alternative embodiments of the present invention will now be described with reference to the attached drawings. It shall be apparent to one skilled in the art, however, that this invention may be practised without such specific details. Some of the details may not be described at length so as not to obscure the invention. For ease of reference, common reference numerals or series of numerals will be used throughout the figures when referring to the same or similar features common to the figures.

[0023] FIG. 2 shows an in-line strain relief adaptor 100 according to a first embodiment of the present invention. As shown in FIG. 2, the strain relief adaptor 100 has an elongate sleeve 110 and a spiral sleeve 120. The elongate sleeve 110 is integrally connected to the spiral sleeve 120. The spiral sleeve 120 is made up of a spiral band. As shown in FIG. 2, the spiral band has a constant longitudinal length L except for the ending spiral band on the left hand side of the strain relief adaptor 100. The elongate

sleeve 110 has a longitudinal cut or split 114 and permits the elongate sleeve 110 to open and clamp onto a portion of a conduit, such as the wire frame 14 of the headset set 10 or hose 50. The spiral sleeve 120 can then be twisted and wound onto a further portion of the conduit, such as the gooseneck 24, to provide a transition in flexure stiffness, such as the joint between the wire frame 14 and the gooseneck 24. As shown in FIG. 2, the elongate sleeve 110 and spiral sleeve 120 has a constant material thickness T.

[0024] The spiral gap 124 in the spiral section shown in FIG. 2 has been exaggerated. In one embodiment of the strain relief adaptor, the strain relief adaptor 100 is moulded from a plastic material, such as, nylon, PVC, high-density polyethylene, PET, polypropylene, and similar plastics, and glass-fibre reinforced composites thereof. The spiral gap of a plastic moulded strain relief adaptor may be unobvious and appears as a spiral line. In another plastic moulding, the spiral gap is visible. In use, the spiral sleeve 120 may be twisted and wound tightly onto the conduit, such as the wire frame 14 and gooseneck 24, so that there is no spiral gap; alternatively, the spiral sleeve 120 may be twisted and wound loosely onto the conduit so that the spiral gap 124 is visibly obvious. In another embodiment, the strain relief adaptor 100 is formed with a metallic insert and the strain relief adaptor is encapsulated in the plastic moulding described above. In another embodiment, a metallic insert may be made from a metal strip or strand(s) of wire. In yet another embodiment, the strain relief adaptor may be formed with the metallic insert by coating it with the plastic material.

[0025] FIG. 3 shows another strain relief adaptor 200 according to a second embodiment of the present invention. The strain relief adaptor 200 is a modification of the first embodiment 100. As shown in FIG. 3, strain relief adaptor 200 also has an elongate sleeve 210 and a spiral sleeve 220. The longitudinal length L of each component turn of spiral in the spiral sleeve away from the elongate sleeve is progressively shorter. For example, as shown in FIG. 3, L1>L2>L3>L4. By providing a

progressively varying longitudinal length L of each turn of spiral, the lateral stiffness of bending of the strain relief adaptor varies. This provides a desired effect in that the bending moment imposed on the conduit, such as the gooseneck 24, increases towards the joint between the wire frame 14. The strain relief adaptor 200 provides a similar increase in flexure stiffness to counter the increase in bending moment.

[0026] FIG. 4 shows another strain relief adaptor 300 in accordance with a third embodiment of the present invention. The strain relief adaptor 300 is also a modification from the first embodiment 100. As shown in FIG. 4, the strain relief adaptor 300 also has an elongate sleeve 310 and a spiral sleeve 320. The thickness T of the spiral sleeve 320 from the elongate sleeve 310 to the terminal end of the spiral sleeve 320 is progressively thinner. As shown in FIG. 4, T1>T2>T3. The strain relief adaptor 300 also provides a progressive variation of lateral stiffness as in the second embodiment. In a variation, a strain relief adaptor with a combination of varying spiral length L and thickness T is also possible. In addition, the penultimate loop of the spiral has a recess 330 and the end of the spiral is bent 340 to fit and lock snugly within the recess.

[0027] FIG. 5 shows a strain relief adaptor 400 according to a fourth embodiment of the present invention. The strain relief adaptor 400 is also modification of the first embodiment. As shown in FIG. 5, the strain relief adaptor 400 has an elongate sleeve 410 and a spiral sleeve 420. The elongate sleeve 410 has a longitudinal cut or split as in the above embodiments but the split edges have saw-teeth profiles. In a further embodiment, the split edges may have other profiles, such as, a square-wave or a sine-wave profile.

[0028] In the above strain relief adaptors, the spiral may have a round cross-sectional area. In other embodiments, the cross-sectional area may be oval, trapezoidal, reverse trapezoidal, parallelogram, and so on. The edges of some of these sectional shapes, such

as the trapezoidal, reverse trapezoidal and parallelogram, are complementary. When a spiral, with these complementary edges, is wound on a conduit, the complementary edges of adjacent spirals interlock and reinforce each other.

[0029] In the above strain relief adaptor embodiments, a single spiral is illustrated and described. In a further embodiment, two or more starts of spirals are provided. Further, the spiral(s) may turn in a right hand or left hand direction. In yet a further embodiment, a strain relief adaptor with a second spiral sleeve is provided on a second end of the elongate sleeve opposite that as the first spiral sleeve. The first and second sleeve may have identical spiral construction. Alternatively, the first and second sleeves may have different spiral construction. In addition, the first and second sleeve may have spirals in the same or different directions.

[0030] FIG. 6 illustrates yet another strain relief adaptor 500 according to a fifth embodiment of the present invention. The strain relief adaptor 500, as shown in FIG. 6, has a plate 530. The plate 530 is connected to the elongate sleeve in a tangential manner. As shown in FIG. 6, the plate 530 is quadrilateral in shape and has a first dimension substantially equal to the length of the elongate sleeve. In another embodiment of the strain relief adaptor 500, the plate 530 is integrally moulded with the elongate sleeve.

[0031] In one embodiment of the strain relief adaptor 500, the plate 530 provides a surface area to reduce the contact pressure of the wire frame 14 on a cheek of a user and provides more comfort to the user. In another embodiment, the plate 530 may have an additional fabric to increase the comfort level of a user. The additional fabric may even be replaceable. In another embodiment, the plate 530 is separate from the elongate sleeve 510.

[0032] In another embodiment of the strain relief adaptor 500, the plate 530 has one or more fastener holes 534. The fastener holes may allow a user to fasten or secure the plate 530 onto an external surface with a fastener, such as a screw, nail, and so on.

[0033] While specific embodiments have been described and illustrated, it is understood that many changes, modifications, variations and combinations thereof could be made to the present invention without departing from the scope of the invention. For example, a strain relief adaptor with a spiral sleeve on each of the two ends of the elongate sleeve may have spirals in different directions and the longitudinal cut in the elongate sleeve is minimized such that the longitudinal cut is no longer obvious and the spirals meet each other.

CLAIMS:

1. An in-line strain relief adaptor for a flexible conduit, the strain relief adaptor comprising:

a spiral sleeve; and

an elongate sleeve, said elongate sleeve having a longitudinal split along its elongate axis;

wherein the spiral and elongate sleeves are integrally connected; and the elongate sleeve is adapted to clamp onto a portion of the conduit whilst the spiral sleeve is adapted to wrap around an adjoining portion of the conduit to minimise a local portion of the conduit from being bent beyond a predetermined minimum bend radius.

2. An in-line strain relief adaptor according to claim 1, wherein the spiral sleeve has a component spiral length L along its elongate axis.

3. An in-line strain relief adaptor according to claim 2, wherein the component spiral length L is constant except for an ending spiral thereof.

4. An in-line strain relief adaptor according to claim 2, wherein the component spiral length L is varying.

5. An in-line strain relief adaptor according to any one of the preceding claims, wherein the spiral sleeve has a constant thickness T.

6. An in-line strain relief adaptor according to any one of claims 1-4, wherein the spiral sleeve has a varying thickness T.

7. An in-line strain relief adaptor according to any one of the preceding claims, wherein a cross-section of the spiral is selected from the following shape: rectangular, oval, trapezoidal, inverse trapezoidal, and parallelogram.

8. An in-line strain relief adaptor according to any one of claims 1-7, wherein the longitudinal split at the elongate section has a profile edge.

9. An in-line strain relief adaptor according to claim 8, wherein the profile edge is selected from the following shape: saw-tooth, square-wave and sine-wave.

10. An in-line strain relief adaptor according to any one of the preceding claims, wherein the spiral sleeve comprises one or more spirals.

11. An in-line strain relief adaptor according to any one of the preceding claims, wherein edges of the cross-sections of adjacent spirals are complementary.

12. An in-line strain relief adaptor according claim 10 or 11, wherein the spiral turns in a left-hand direction.

13. An in-line strain relief adaptor according to claim 10 or 11, wherein the spiral turns in a right-hand direction.

14. An in-line strain relief adaptor according to any one of the preceding claims, further comprising a plate tangential to the elongate sleeve.

15. An in-line strain relief adaptor according to claim 14, wherein the tangential plate further comprises one or more fastener mounting holes.

16. An in-line strain relief adaptor according to claim 14 or 15, further comprising a pad attachable to the tangential plate.

17. An in-line strain relief adaptor according to claim 16, wherein the pad is selected from the following: a sponge; a fabric and an adhesive pad.

18. An in-line strain relief adaptor according to any one of claims 14-17, wherein the tangential plate is separate from the elongate sleeve.

19. An in-line strain relief adaptor according to any one of the preceding claims, further comprising a second spiral integrally formed with the elongate sleeve at an end opposed to the first spiral.

20. An in-line strain relief adaptor according to claim 19, wherein the first and second spiral have identical constructions in accordance with any one of claims 1-7 or claims 9-13.

21. An in-line strain relief adaptor according to claim 19, wherein the two spirals have different constructions.

22. An in-line strain relief adaptor according to any one of the preceding claims, wherein the strain relief adaptor comprises a plastic moulding.

23. An in-line strain relief adaptor according to any one of the preceding claims, further comprising a metal insert.

24. An in-line strain relief adaptor according to any one of the preceding claims, wherein a penultimate loop of the spiral has a recess and the end of the spiral is bent to fit and lock snugly within the recess.

25. An in-line strain relief adaptor according to any one of the preceding claims, wherein the flexible conduit is any one of the following: a microphone gooseneck extension; an optical cable; an electric cable; and a hose.

26. A method of relieving strain of a flexible conduit, the method comprising:

fitting an elongate split sleeve of an in-line strain relief adaptor onto a portion of the conduit; and

wrapping a resilient spiral band integrally connected to the elongate split sleeve onto an adjoining portion of the conduit to provide a transition in flexure stiffness to a local portion of the conduit to minimize bending of the conduit beyond a predetermined minimum bend radius.

27. A method according to claim 26, wherein the in-line strain relief adaptor is in accordance with any one of claims 1-25.

28. A kit for strain relieving a flexible conduit, the kit comprising:

a strain relief adaptor according to any one of claims 1-25.

29. A kit for strain relieving a flexible conduit, the kit comprising:

a strain relief adaptor according to any one of claims 1-13 or claims 19-25; and

a tangential plate.

30. A kit according to claim 29, wherein the tangential plate has two or more fastening holes; said kit further comprising:

two or more fasteners matching said fastening holes.