

PATENT SPECIFICATION

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(54) TERMINATION OF ELECTRIC CABLES

(71) We, BICC LIMITED (formerly BRITISH INSULATED CABLES LIMITED), a British Company of 21 Bloomsbury Street, London, WC1B 3QN, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to the termination of electric cables and conduits containing electric conductors and in particular to glands and adaptors for this purpose; more especially (but not exclusively) it is concerned with the termination of cables of a kind that cannot be adequately sealed (for particular purposes) by the use of 'mechanical' cable glands of the kind to which British Standard 6121 relates. Currently it is the practice in such circumstances to terminate the cable into a compound chamber that is separate from but attached to the electrical apparatus to which the cable conductors are connected. This arrangement occupies significantly greater space than a gland-type termination and has the disadvantage that in most cases the cable cannot be disconnected from the apparatus without breaking the seal.

In accordance with one aspect of the invention, a gland for a cable or conduit comprises a first gland member having a passage for the cable or conduit; an enlarged section at the forward end of the passage; means for securing cable or conduit to the first gland member; a second gland member having a passage with an enlarged section at its rear end so engageable with the first gland member that one of them enters the enlarged section of the passage in the other; a third gland member engageable with the second gland member so as to surround it with a flame gap between them and to bear on it for urging it towards the first gland member; and means for drawing the first and third gland members towards one another.

When the gland of the invention is used to

terminate a wire-armoured cable, the cable end is preferably secured in the gland by securing the armour wires to the first gland member.

The first and third gland members may be drawn together in various ways. Thus they may be directly engaged by a screw thread to enable them to be drawn together without the intervention of separate members. Another possibility is for them to be drawn together by an additional gland member in screw-threaded engagement with one of them and bearing on the other, the screw-threaded engagement being either direct or by drawbolts or equivalent threaded means, the latter arrangement resembling conventional practice on the European mainland. When a further gland member is directly screwed to the third gland member used, it will normally form a gland barrel and the third gland member will be a gland body.

The enlarged section of the passage in the first gland member preferably has a frustoconical base; and for the same purpose the passage in the second gland member preferably comprises two parallel end portions joined by a frustoconical tapered portion. In this case the wall thickness of the second gland member is preferably generally uniform (i.e. uniform over all or most of it) and the third gland member bears on the exterior of the tapered portion to provide a self-centring action.

The cable or conduit may be secured to the first gland member by a standard gland (by which is meant a gland that is not flameproof) and the invention includes an adaptor for mounting on such a gland to form a gland of the kind defined above.

Preferably the second gland member projects forwardly of the third gland member and any other gland member so that its presence can be confirmed by visual inspection, and similarly the quantity of insulating compound used in preferably sufficient to protrude at the front end of the second gland member.

Other preferred features of the invention will

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be apparent from the drawings and the description thereof which follows.

The invention includes terminations made by means of the glands or adaptors described.

5 The invention will be further illustrated, by way of example, with reference to the accompanying drawings in which;

10 Figure 1 is a longitudinally sectioned view of one form of cable termination made with a gland in accordance with the invention;

Figure 2 is a similar view of a modified termination;

Figure 3 is a cut-away view of another modified termination;

15 Figures 4 and 5 each show another modified form of termination;

20 Figures 6 and 7 are a longitudinal section and end-view respectively of a termination made with a draw-bolt gland in accordance with the invention;

Figure 8 is a longitudinally sectioned view of a termination made with a standard gland and an adaptor in accordance with the invention; and

25 Figure 9 is a longitudinal section of another termination.

30 In making the termination shown in Figure 1 the end of a cable is cut back in the conventional way to expose, besides the outer sheath 2, appropriate length of armour wire 3, bedding (or inner sheath) 4 and insulated conductor 5. A gland barrel 6 carrying a conventional outer seal assembly 7, not yet tightened, is slid over the prepared cable end, followed by an armour gripping ring 8. The armour wires are now splayed out to the position shown and a first gland member 9 is inserted with its armour cone 10 radially beneath the armour wires, which are gripped by temporarily screwing a gland body 11 (the third gland member) into the barrel.

35 The gland body 11 is now removed, and a suitable quantity of a cold-setting resinous insulating "compound" 12 is pressed by hand or otherwise into an enlarged portion with a frustoconical base 13 at the forward end of the passage through first gland member 9 so as to completely fill it and stand proud of it to a considerable extent. While the hardening compound is still in a pasty or viscous condition, a second gland member 14 is passed over the cable conductors 5 and fitted inside the first gland member 9. This second gland member has parallel end-parts 15 and 16, the front end part 15 being smaller in diameter than the rear end-part 16 and the two end parts being joined by a frustoconical intermediate part 17. When the gland body 11 is again screwed into the gland barrel 6, the intermediate part 17 engages a correspondingly tapered shoulder 18 to urge the first and second gland members together and so generate pressure in the compound, and to centre the second gland member in the third (the gland body) to form a flame-gap 19 between them.

The outer seal may now be tightened, and the termination may be secured to the electrical apparatus by screwing the spigot 20 on the body into a threaded aperture in the usual way. It will be observed that the second gland member 14 and the compound 12 are both visible at the front end of the gland.

70 The termination of figure 2 differs only in having the first gland member 9 enter the rear part 16 of the second gland member 14. This reduces the risk that compound leaking between the first and second gland members will bond them to the body 11.

75 Figure 3 illustrates another modification, in which the first and second gland members 9 and 14 are themselves screwed together at 21. The outer surface 22 is knurled to facilitate turning or alternatively (not shown) two or more flats may be provided to allow use of a spanner.

80 The termination of figure 4 is similar to that shown in figure 2 except that a flameproof sealing ring is inserted between the second gland member 14 and the gland body 11, and that of figure 5 is similar except that the ring 23 is housed between square shoulders 24, so that the parts are no longer self-centering. In both these cases the sealing ring is preferably bonded in the factory to the second (or the third) gland member to avoid accidental loss. Both these designs can be modified by using a ring of a suitable cold setting resinous compound (applied in a pasty or viscous condition) instead of the ring.

85 Figures 6 and 7 show a "continental style" termination which is similar to that shown in figure 2 except that there is no outer seal and the gland barrel and body (6 and 11 respectively in figure 2) are replaced by two further gland members 25, 26 which are drawn together by bolts 27 instead of directly screwing together.

90 Figure 8 shows a form of termination which is similar to figure 2 except that the first gland member 9, instead of being directly mounted on the cutback cable end, is secured to it by a standard (non-flameproof) gland 33. For illustration a type E1W gland (British Standard 6121:1973) has been shown, but many other suitable types can be used. The third gland member is shown at 35, and a further gland member 34 performs the main functions of gland barrel (6, figure 2).

95 Figure 8 shows another form of termination, generally similar to that of figure 2 but for an unarmoured cable. The first gland member 9 is secured to the cable in a first operation by screwing into it a compressor 38, both these components 9, 38 having flats, knurled surfaces or similar means for the purpose. This compresses an elastomeric ring 43, a skid washer 39 being interposed between the ring and the compressor in the usual way. After introduction of the compound 12 and assembly of the remaining parts, the first and second gland

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members 9, 14 are drawn together by screwing the gland nut 40 onto the body 11 (the third gland member). In this instance the spigot 41 is shown with a tapered thread 42 for engagement with a standard taper-threaded conduit, but it will be understood that a parallel thread, as in the other drawings, can be used. Equally the other designs illustrated could be made with a tapered thread if required.

In most cases a fluid-tight seal between the second gland member and the third gland member is advantageous provided it does not compromise the length of the flame gap, but there may be special cases in which it is undesirable. In this case, a continuous flame-gap may be ensured by providing ribs or another suitable spacer or spacers on either of these members at an appropriate position or positions along the length of the flame-gap. For example, figure 3 shows grooves 36 in the external frustoconical surface of the second gland member to ensure a continuous pressure equalising passages from the front of the gland to the space 37 in which the armour wires are terminated. Similar provision may be made in other terminations, when appropriate.

Working of the invention described in this specification may infringe the patent to be granted on our copending application nos. 44415/77, 44416/77, 44417/77 and 44418/77 (Serial No. 1524684).

WHAT WE CLAIM IS:—

1. A gland for a cable or conduit comprising a first gland member having a passage for the cable or conduit; an enlarged section at the forward end of the passage; means for securing a cable or conduit to the first gland member; a second gland member having a passage with an enlarged section at its rear end, so engageable with the first gland member that one of them enters the enlarged section of the passage in the other; a third gland member engageable with the second gland member so as to surround it with a flame gap between them and to bear on it for urging it towards the first gland member; and means for drawing the first and third gland members towards one another.

2. A gland as claimed in Claim 1 in which the first and third gland members have screw threads for direct engagement with one another.

3. A gland as claimed in Claim 1 including an additional gland member which may be screwed on the third gland member to engage the first and draw the first and third gland members together.

4. A gland as claimed in Claim 1 including an additional gland member which bears on the first drawbolts or equivalent screw-threaded means for drawing the third gland member and the additional gland member together.

5. A gland as claimed in Claim 3 in which the third gland member is a gland body and the additional gland member is a gland barrel, the body and the barrel having co-operating screw

threads.

6. A gland as claimed in Claim 5 in which the said securing means includes an armour gripping ring engageable between the barrel and the first gland member.

7. A gland as claimed in any one of the preceding Claims in which the second and third gland members engage self-centringly to form the flame gap between them.

8. A gland as claimed in any one of the preceding Claims in which the first gland member has a frustoconical base.

9. A gland as claimed in any one of the preceding Claims in which the said securing means comprises a ring that can surround an armour-gripping cone forming part of the first gland member and urge armour-wires of a cable into engagement with it.

10. A gland as claimed in any one of the preceding Claims in which the passage in the second gland member comprises two parallel portions joined by a frustoconically tapered portion.

11. A gland as claimed in Claim 10 in which the second gland member is of generally uniform wall thickness and in which the third gland member bears on the exterior of the tapered portion.

12. A gland as claimed in any one of the preceding Claims in which the first member is slidable inside the second.

13. A gland as claimed in any one of the preceding Claims in which, when the parts are fully assembled, the second gland member projects beyond the third gland member and any further gland member(s).

14. A gland substantially as described with reference to and as shown in any one of figures 3-5 or with reference to and as shown in Figures 6 and 7 of the drawings, but excluding the cable end and insulating compound also shown in that figure or those figures.

15. A gland for an armoured cable comprising: a first gland member having a cable passage with an enlarged section at its forward end; means for securing cable armour to the first gland member; a second gland member having a passage with an enlarged section at its rear end so engageable with the first gland member that one of them enters the enlarged section of the passage in the other; a third gland member engageable with the second gland member so as to surround it with a flame gap between them and to bear on it for urging it towards the first gland member; and at least one further gland member engageable with the first and third gland members to draw them towards one another.

16. A gland as claimed in Claim 15 comprising a further gland member between which and the third gland member the first and second gland members are engageable to draw them together.

17. A gland as claimed in Claim 16 in which the third gland member comprises a

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members 9, 14 are drawn together by screwing the gland nut 40 onto the body 11 (the third gland member). In this instance the spigot 41 is shown with a tapered thread 42 for engagement with a standard taper-threaded conduit, but it will be understood that a parallel thread, as in the other drawings, can be used. Equally the other designs illustrated could be made with a tapered thread if required.

In most cases a fluid-tight seal between the second gland member and the third gland member is advantageous provided it does not compromise the length of the flame gap, but there may be special cases in which it is undesirable. In this case, a continuous flame-gap may be ensured by providing ribs or another suitable spacer or spacers on either of these members at an appropriate position or positions along the length of the flame-gap. For example, figure 3 shows grooves 36 in the external frustoconical surface of the second gland member to ensure a continuous pressure equalising passages from the front of the gland to the space 37 in which the armour wires are terminated. Similar provision may be made in other terminations, when appropriate.

Working of the invention described in this specification may infringe the patent to be granted on our copending application nos. 44415/77, 44416/77, 44417/77 and 44418/77 (Serial No. 1524684).

WHAT WE CLAIM IS:-

1. A gland for a cable or conduit comprising a first gland member having a passage for the cable or conduit; an enlarged section at the forward end of the passage; means for securing a cable or conduit to the first gland member; a second gland member having a passage with an enlarged section at its rear end, so engageable with the first gland member that one of them enters the enlarged section of the passage in the other; a third gland member engageable with the second gland member so as to surround it with a flame gap between them and to bear on it for urging it towards the first gland member; and means for drawing the first and third gland members towards one another.

2. A gland as claimed in Claim 1 in which the first and third gland members have screw threads for direct engagement with one another.

3. A gland as claimed in Claim 1 including an additional gland member which may be screwed on the third gland member to engage the first and draw the first and third gland members together.

4. A gland as claimed in Claim 1 including an additional gland member which bears on the first drawbolts or equivalent screw-threaded means for drawing the third gland member and the additional gland member together.

5. A gland as claimed in Claim 3 in which the third gland member is a gland body and the additional gland member is a gland barrel, the body and the barrel having co-operating screw

threads.

6. A gland as claimed in Claim 5 in which the said securing means includes an armour gripping ring engageable between the barrel and the first gland member.

7. A gland as claimed in any one of the preceding Claims in which the second and third gland members engage self-centringly to form the flame gap between them.

8. A gland as claimed in any one of the preceding Claims in which the first gland member has a frustoconical base.

9. A gland as claimed in any one of the preceding Claims in which the said securing means comprises a ring that can surround an armour-gripping cone forming part of the first gland member and urge armour-wires of a cable into engagement with it.

10. A gland as claimed in any one of the preceding Claims in which the passage in the second gland member comprises two parallel portions joined by a frustoconically tapered portion.

11. A gland as claimed in Claim 10 in which the second gland member is of generally uniform wall thickness and in which the third gland member bears on the exterior of the tapered portion.

12. A gland as claimed in any one of the preceding Claims in which the first member is slidable inside the second.

13. A gland as claimed in any one of the preceding Claims in which, when the parts are fully assembled, the second gland member projects beyond the third gland member and any further gland member(s).

14. A gland substantially as described with reference to and as shown in any one of figures 3-5 or with reference to and as shown in Figures 6 and 7 of the drawings, but excluding the cable end and insulating compound also shown in that figure or those figures.

15. A gland for an armoured cable comprising: a first gland member having a cable passage with an enlarged section at its forward end; means for securing cable armour to the first gland member; a second gland member having a passage with an enlarged section at its rear end so engageable with the first gland member that one of them enters the enlarged section of the passage in the other; a third gland member engageable with the second gland member so as to surround it with a flame gap between them and to bear on it for urging it towards the first gland member; and at least one further gland member engageable with the first and third gland members to draw them towards one another.

16. A gland as claimed in Claim 15 comprising a further gland member between which and the third gland member the first and second gland members are engageable to draw them together.

17. A gland as claimed in Claim 16 in which the third gland member comprises a

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- gland body and the further gland member comprises a gland barrel, the body and the barrel having co-operating screw threads.
- 5 18. A gland as claimed in Claim 17 including an armour gripping ring engageable between the barrel and the first gland member.
- 10 19. A gland as claimed in any one of Claims 16-18 in which the second and third gland members engage self-centringly to form a flame gap between them.
- 20 20. A gland as claimed in any one of Claims 17-19 in which the barrel supports at its rear end means for forming a seal to a layer of the cable outside the armour.
- 15 21. A gland as claimed in any one of Claims 15-20 in which the first gland member has a frustoconical base.
- 20 22. A gland as claimed in any one of Claims 15-21 in which the armour-securing means comprises a ring that can surround an armour-gripping cone forming part of the first gland member and urge armour-wires into engagement with it.
- 25 23. A gland as claimed in any one of Claims 15-22 in which the passage in the second gland member comprises two parallel portions joined by a frustoconically tapered portion.
- 30 24. A gland as claimed in Claim 23 in which the second gland member is of generally uniform wall thickness and in which the third gland member bears on the exterior of the tapered portion.
- 35 25. A gland as claimed in any one of Claims 15-24 in which the first member is slidable inside the second.
- 40 26. A gland as claimed in any one of Claims 15-25 in which, when the parts are fully assembled, the second gland member projects beyond the third gland member and any further gland member(s).
- 45 27. A gland substantially as described with reference to and as shown in Figure 1 of the drawings, but excluding the cable end and insulating compound also shown in that figure.
28. A gland as claimed in any one of Claims 1-9 and 15-26 including a sealing ring for forming a flameproof seal between the second and third gland members.
29. A gland as claimed in Claim 28 in which the sealing ring is bonded either to the second or to the third gland member.
- 50 30. A flameproof adaptor for a cable or conduit gland comprising a first adaptor member having a passage for the cable or conduit; an enlarged section at the forward end of the passage; means for securing a cable adaptor member having a passage with an enlarged section at its rear end so engageable with the first gland member that one of them enters the enlarged section of the passage in the other; a third adaptor member engageable with the second gland member so as to surround it with a flame gap between them and to bear on it for urging it towards the first gland member; and means for drawing the first and third adaptor members towards one another.
- 55 31. A cable or conduit gland as claimed in any one of Claims 1-13 or 28 or 29 in which the means for securing the cable or conduit to the first gland member is a gland that is not flameproof.
- 60 32. A gland substantially as described with reference to and as shown in figure 8 of the drawings, but excluding the cable end and insulating compound also shown in that figure.
- 65 33. A cable gland substantially as described with reference to and as shown in Figure 2 of the drawings, but excluding the cable end and insulating compound also shown in that figure.
- 70 34. A cable or conduit termination made by means of a gland claimed in any one of Claims 1-13.
- 75 35. A cable termination made by means of a gland claimed in any one of Claims 15-26.
- 80 36. A cable or conduit termination made by means of an adaptor claimed in Claim 30 or a gland claimed in Claim 31.
- 85 37. A cable gland substantially as described with reference to and as shown in figure 9 of the drawings, but excluding the cable end and insulating compound also shown in that figure.
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