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A ConnectorField of Invention

5 The present invention relates to a connector for carrying a cable such as an electrical cable, at a location where the cable is crossed by another cable.

Background to the Invention

10 In the construction industry, it is known for conduits for electrical and telephone cables to be laid and then subsequently embedded within a concrete floor. This technique is most frequently employed in high density
15 multi-storey construction.

 In a typical installation, each floor is partially formed from pre-cast slabs which are placed in position. Conduit which is to carry the electrical and
20 telephone cables is then laid. The cables are covered with a wire reinforcing mesh and an overlayer of cement is poured which covers the conduits and the wire mesh in order to complete formation of the floor.

25 It will be appreciated that the cement overlayer will need to be thick enough to cover the conduits and wire mesh. Thus, the thickness of the floor will depend on the thickness of the conduits. As conduits will
30 usually need to cross other conduits at several locations, the floor overlayer will need to be thick enough to cover not just one, but a pair of conduits.

 Therefore, it would be advantageous to reduce the combined thickness of the conduits where they cross.

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Summary of the Invention

Accordingly the invention provides a connector for carrying a cable at a location where said cable is intended to be crossed by another electrical cable, said connector having:

a first connecting portion adapted to be connected to a first section of conduit for carrying said cable;

a second connecting portion adapted to be connected to a second section of conduit for carrying said cable; and

a cross-over portion intermediate said first and second connecting portions, said cross-over portion being shaped so as to be flatter relative to said sections of conduit at the location where said cable is intended to be crossed by said another cable while having an internal cross-sectional area sufficient to prevent said cable from overheating.

Thus, another conduit crossing the connector will provide a reduced profile compared to the profile of two conduits crossing one another.

Preferably, said cross-over portion has an internal cross-sectional area substantially the same as the internal cross-sectional area of said sections of conduit.

Preferably, each connecting portion has a socket for receiving a section of conduit to thereby connect said connector to said section of conduit.

Preferably, the external cross-section of said cross-over portion is shaped so as to be complementary to the external cross-section of the cross-over portion of another connector carrying said another cable.

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Preferably, said connector is further adapted to carry cables in two directions which cross each other, wherein said first and second connecting portions
5 corresponding to a first directions and said connector has third and fourth connecting portions corresponding to said second direction and, wherein said cross-over portion has two layers, each said layer corresponding to a respective one of said directions.

10 Preferably, said connector is adapted to carry a plurality of cables in each direction, said connector having a plurality of pairs of first and second connecting portions, each pair adapted to carry a cable.

15 Brief Description of the Drawings

Preferred embodiments of the invention will now be described in relation to the accompanying drawings in
20 which:

Figure 1 shows a floor structure of the prior art;

Figure 2 is a perspective view of a connector of a first embodiment of the invention;

25 Figure 3 is a side view of half of the connector;

Figure 4 shows two connectors of the first embodiment crossing;

Figure 5 is an exploded view showing a connector of a second embodiment;

30 Figure 6 is a perspective view showing the two halves of the connector of the first embodiment;

Figure 7 shows a wiring arrangement employing the connectors of the first and second embodiments;

35 Figure 8 shows a variation of the connector of the second preferred embodiment;

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Figure 9 is a partial top sectional view of one half of the connector of the first embodiment;

Figure 10 is an exaggerated partial sectional view of the connector of the second embodiment which illustrates the water proofing of the lid; and

Figure 11 is a cross-section through the connector of the second embodiment.

Description of the Preferred Embodiment

Figure 1 shows the floor structure 101 employed in the prior art. When the floor structure 101 is constructed, a pre-cast slab 103 is first placed in position. The pre-cast slab 103 has a thickness of approximately 70mm as indicated by arrows 111. Conduit 105 for carrying cable, such as electrical cable, is then laid on top of the pre-cast slab 103. Where necessary, further conduit 105b must cross the first conduit 105a. In the prior art such conduit is typically 20mm in diameter. Thus the combined height of two conduits where they cross is 40mm. Mesh 107 is placed on top of the conduit 105. When all these items are *in situ*, an overlayer of concrete 109 is poured in order to complete formation of the floor structure 101.

It will be apparent that the overlayer of concrete 109 must have a thickness which is sufficient to embed both conduits 105a, 105b and the layer of mesh 107. Further, this thickness must be the same for the entire floor if the floor is to be even. In the prior art, such a layer is typically about 80mm thick as indicated by arrows 113. This means that the total floor thickness is about 150mm.

It will be appreciated that any reduction in the thickness 113 of the overlayer 109 of concrete will lead to savings in the cost of construction. If the thickness

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of the overlayer to be poured *in situ* were to be reduced by 15mm, this would result in a 20% saving in concrete for the overlayer 109 and also lead to a fast drying time and hence faster construction times. The reduced weight of
5 the floor will also reduce the burden on columns and load bearing walls.

Accordingly, the first preferred embodiment provides a connector 1 which is designed to be flatter,
10 and hence to have a lower profile at the crossing point, while still allowing for effective heat dispersion from the cable.

In the first preferred embodiment connector 1 has
15 a pair of connecting portions 5a, 5b which each have a socket 11 which is adapted to receive a section of conduit, whereby the connector can join two sections of conduit and carry the cable carried by the sections of conduit.

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As is evidenced by seam 9, the connector 1 is formed from first and second halves 3a, 3b which are snap-fitted together to form connector 1.

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Connecting portion 5 are generally circular in external cross section and a cross-over portion 7 located between the connection portion 5 is generally trapezoidal in external cross section. As is shown best by Figure 3, the cross-over portion, is flatter than the connecting
30 portions 5a, 5b and the conduit which the connecting portions are adapted to receive. The sockets 11 are sized such that the ends of sections of conduit 15 will press fit into them and be held in place. The sockets have a step 10, which is designed to have the same dimensions as
35 the wall of the conduit 15 so that the inner surface of the conduit 33 is contiguous with the inner surface of the connector 34 to allow for smooth passage of the cable when

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it is fed past the transition from conduit to connector. Also the inner surface of the connector 34 is curved to make it easier to feed cable 8 through connector 1.

5 Figure 3 illustrates that the passage 13 through the connector, narrows in the vertical plane at the cross-over portion but widens in the horizontal plane as shown in Figure 9. Thus, while the shape of the passage 13 varies as it passes through the connector, it has a
10 substantially uniform cross-sectional area. In the preferred embodiment, the cross-sectional area of the passage is substantially the same as the internal cross-sectional area of the conduit throughout.

15 Figure 4 illustrates how a pair of connectors 1 may be used to form a cross joint which is thinner than a pair of conduits. Each connector 1 is attached to first and second sections of conduit 15a, 15b and the connectors are placed with one upside down relative to the other so
20 that the external surface of the cross-over portions abut one another. As indicated by arrow 17, the combined thickness of the two connectors indicated by arrow 17 is only marginally greater than the thickness of the conduit. In the first preferred embodiment, the combined thickness
25 of two connectors is 25mm - a substantial reduction from the combined thickness of two 20mm ducts.

 Thus, in the preferred embodiment the thickness of each cross-over portion is about 62.5% of the thickness
30 of each conduit. It is preferred that the cross-over portion be approximately 60-80% as thick as the conduit.

 Figure 6 illustrates in further detail how two halves 3a may be brought together to form a connector.
35 Each half has a peg 12 at one end and a hole 14 at the other so that the pegs may be inserted into the holes of the respective halves in order to snap fit the halves of

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the connector together. The two parts 3a, 3b also include a pair of catches 51 and recesses 53 to firmly connect the two parts together. It will be noted that the connector 1 illustrated in Figure 6 includes a step 10, although it
5 need not include a step 10. Connectors without steps are acceptable variations on the preferred embodiments illustrated.

Figure 5 shows a connector of the second
10 preferred embodiment. In this embodiment, the connector 21 is adapted to carry cables in two directions which cross each other. In this embodiment, the connector is in the form of a junction box 21 having a base 23 with twelve connecting portions 25 - six for each direction - so that
15 three conduits for carrying electrical cable may be connected in each direction. The base 23 is divided into three sections 27 by central ribs 29 which have curved ends, and straight side ribs 30. The ribs not only keep electrical cables separate but also guide the electrical
20 cable through connecting portions 25 when cable is being fed through the junction box 21. Thus, the ribs 29, 30 act as guides to make it easier for a damaged cable to be replaced. Further guide means 13 are provided by curved cable guiding portions 32, 35 provided on the separator
25 plate 31 as well as the base 23 and lid 33 which assist in guiding cable through junction box 21. This is best illustrated in Figure 12 which shows how the curved guiding portions 32, 35 guide cable 8 through the aperture 38 which connects the connecting portions 25 to the lower
30 layer of the junction box.

The ribs 29, 30 also support the separator plate 31 which divides the cross-over portion into two layers.

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Cables corresponding to a first direction are carried by a first (lower) layer and cables corresponding to a second direction are carried by a second (upper) layer. The plate 31 is also divided into a number of sections 27, one for each conduit, and also has ribs 29, 30 which like the ribs 29, 30 in the base act as guide means, as well as acting as a partial support for lid 33. The lid 33 also rests on the outer walls of the base portion 21 of the junction box and is secured to the base 21 by threaded screws 45 and nails 46. The support provided by the ribs 29, 30 assists in preventing the junction box 21 from being damaged by the weight of concrete poured on top of it.

Figure 10 shows the waterproofing features of the junction box 21. It will be appreciated that before the overlayer of concrete has dried it will be possible for moisture to penetrate the join 40 between the lid 33 and base 21. There is also a possibility of moisture penetration in the region of screw recess 41. To this end steps 42 and 44 are provided to prevent moisture entering the interior of the box.

Figure 7 shows how a number of connectors 1 and junction boxes 21 may be used to form a wiring layout.

Various modifications to the present invention will be apparent to persons skilled in the art. For example, Figure 8 illustrates an 8-cable junction box capable of carrying four cables in separate directions. Figure 8 also illustrates an embodiment in which no curved guiding portions are provided which results in an alternative configuration of ribs 29. Another possible variation is for all the ribs 29 to be carried by the plate.

Further, it will be apparent to persons skilled

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in the art that appropriate dimensions for the connectors of the invention can be chosen depending on the dimensions of the conduit to be connected. Suitable dimensions of the conduit will depend, for example, on the type of cable being carried. If an electrical cable consisting of three wires: live, neutral and earth is to be carried, each wire would typically have a cross-sectional area of 2.5mm^2 and an outside diameter of around 3.4mm. When the wires are bundled together, the effective height will be around 6.34mm. To prevent localised overheating of the wires, the height of the cross over portion should be at least 1.5 times the combined height of the three wires - e.g. approximately 9.5mm in height. This determines the minimum height of the cross-over portion 7.

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Other modifications will be apparent to persons skilled in the art and should be considered as falling within the scope of the invention described herein.

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CLAIMS

1. A connector for carrying a cable at a location where said cable is intended to be crossed by another
5 electrical cable, said connector having:
a first connecting portion adapted to be connected to a first section of conduit for carrying said cable;
a second connecting portion adapted to be
10 connected to a second section of conduit for carrying said cable; and
a cross-over portion intermediate said first and second connecting portions, said cross-over portion being shaped so as to be flatter relative to said sections of
15 conduit at the location where said cable is intended to be crossed by said another cable while having an internal cross-sectional area sufficient to prevent said cable from overheating.
- 20 2. A connector as claimed in claim 1, wherein said cross-over portion has an internal cross-sectional area substantially the same as the internal cross-sectional area of said sections of conduit.
- 25 3. A connector as claimed in claim 1 or claim 2, wherein each connecting portion has a socket for receiving a section of conduit to thereby connect said connector to said section of conduit.
- 30 4. A connector as claimed in any one of claims 1 to 3, wherein the external cross-section of said cross-over portion is shaped so as to be complementary to the external cross-section of the cross-over portion of another connector carrying said another cable.
- 35 5. A connector as claimed in any one of claims 1 to 4, wherein said connecting portions have a substantially

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triangular external cross-section and said cross-over portion has a substantially trapezoidal external cross-section.

5 6. A connector as claimed in any one of claims 1 to 4, adapted to carry a plurality of cables, said connector having a plurality of sets of first connecting portions, second connecting portions, and cross-over portions, each set adapted to carry electrical cable.

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7. A connector as claimed in any one of claims 1 to 5, wherein at least one of said connecting portions has connecting means to enable said connector to be connected in series with another connector.

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8. A connector as claimed in any one of claims 1 to 3, further adapted to carry cables in two directions which cross each other, wherein said first and second connecting portions corresponding to a first directions and said
20 connector has third and fourth connecting portions corresponding to said second direction and, wherein said cross-over portion has two layers, each said layer corresponding to a respective one of said directions.

25 9. A connector as claimed in claim 8, further adapted to carry a plurality of cables in each direction, said connector having a plurality of pairs of first and second connecting portions, each pair adapted to carry a cable.

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10. A connector as claimed in claim 9, wherein said cross-over portion has guide means for guiding said cables into said connecting portions.

35 11. A connector as claimed in claim 10, wherein said guide means also separates each cable from every other electrical cable.

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12. A connector as claimed in claim 10 or claim 11, wherein said guide means is provided by ribs which also provide structural support to said connector.

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13. A connector as claimed in any one of claims 4 to 6, wherein said cross-over portion is 60 to 80% as thick as said conduit.

10 14. A connector as claimed in claim 13, wherein said cross-over portion is about 62.5% of the thickness of said conduit.

15 15. A connector as claimed in any one of claims 8 to 12 wherein said cross-over portion is 60 to 80% as thick as the combined thickness of a pair of conduits crossing each other.

20 16. A connector as claimed in claim 15, wherein said consumer portion is about 62-5% of the thickness of said pair of conduits.

17. A connector as claimed in any one of claims 1 to 16 adapted to carry an electrical cable.