May 29, 1956 H. J. DIXON ET AL 2,748,361

ELECTRIC CABLE COUPLING DEVICES

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FIG. 1.

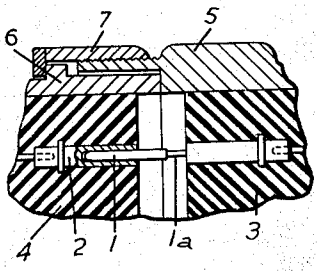


FIG. 2.

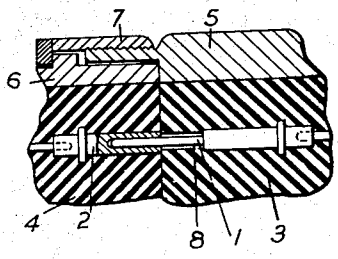


FIG 3

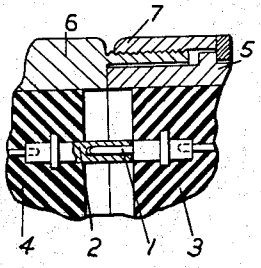


FIG. 4.

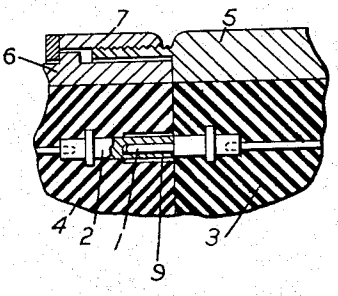


FIG. 5.

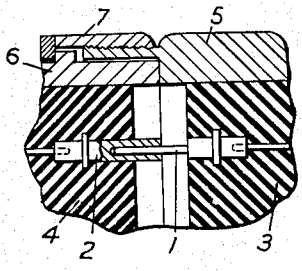
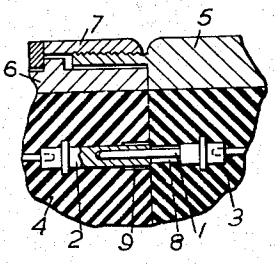


FIG. 6.



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ELECTRIC CABLE COUPLING DEVICES

Filed June 13, 1950 2 Sheets-Sheet 2

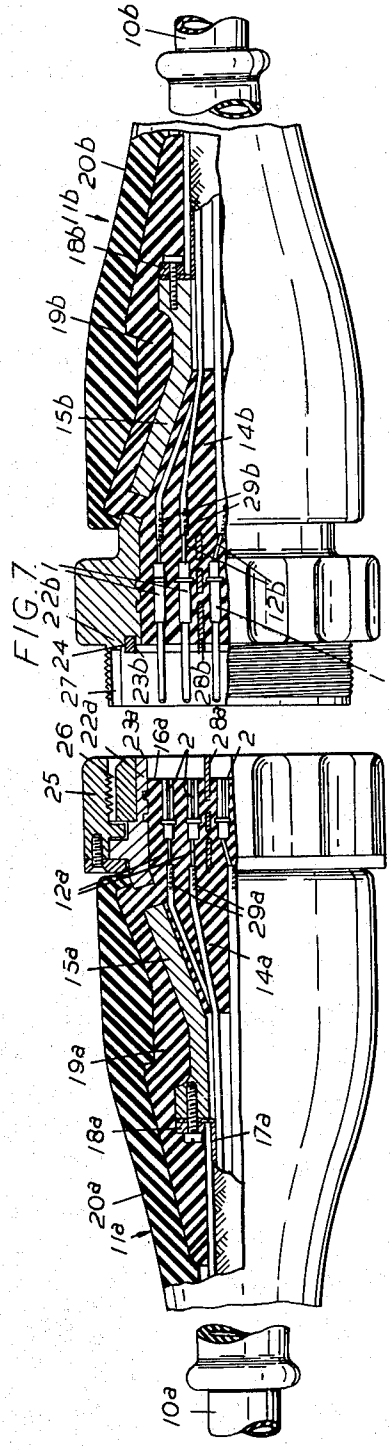


FIG. 7.

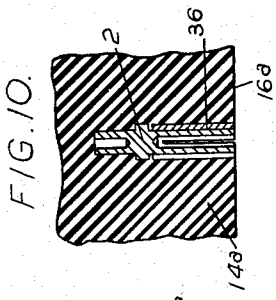


FIG. 10.

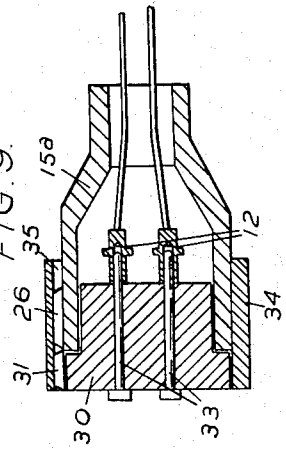


FIG. 9.

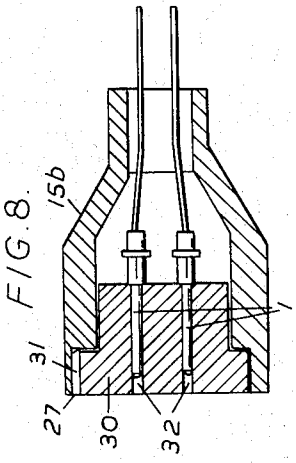


FIG. 8.

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United States Patent Office 2,748,361 Patented May 29, 1956

2,748,361

ELECTRIC CABLE COUPLING DEVICES

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Application June 13, 1950, Serial No. 167,744

Claims priority, application Great Britain July 4, 1949

13 Claims. (Cl. 339—64)

This invention relates to detachable two-part multiple conductor couplings of the kind in which the parts comprise moulded bodies of inelastic insulating material, in one of which bodies are partially embedded a multiplicity of pin contacts which are adapted to enter and make electrical connection with a corresponding number of socket contacts which are held in the other moulded body of inelastic insulating material, when the two parts of the coupling are brought into engagement. The term "inelastic" is here used to mean not having the property of soft rubber and rubber-like materials of stretching readily under light loads. In some cases it is found that although the pins and sockets may be accurately spaced for proper engagement at the beginning of the moulding operation, subsequent shrinkage of the moulded insulating material in which the contacts are held causes a disturbance of the spacing of the pins and also of the spacing of the sockets, with the result that when it is required to bring the pins and sockets into engagement difficulty is experienced in doing so. In some cases the disturbance of the spacing is such that very considerable pressure is required in order to force the pins into their respective sockets.

In accordance with the present invention, the difficulty in making and breaking the coupling that is caused by such shrinkage of the moulded insulating material is avoided by arranging that when the two parts of the couplings are fully in engagement there is a substantial length of each pair of engaging contacts which is laterally unsupported by the moulded insulating material. The term "substantial length" is used to indicate a length somewhat less than, equal to, or greater than the axial length of the socket. We have found that this construction generally provides sufficient resiliency between the pins and sockets to compensate for any inaccuracies of spacing set up by the shrinkage of the insulating material, so that no difficulty is experienced in bringing the two parts of the coupling into proper engagement.

The invention will be more fully described with the aid of the accompanying drawings wherein—

Figures 1 to 6 inclusive are fragmental sections showing various ways of arranging for a substantial length of each pair of engaged contacts to be left laterally unsupported by the moulded bodies by which the pair is held;

Figure 7 is a view partly in elevation and partly in section of an example of a two-part cable-to-cable coupling constructed in accordance with the invention;

Figures 8 and 9 show means for supporting contacts during the operation of making the moulded body in which they are held;

Figure 10 is an enlarged section showing a socket with slit walls which are reinforced by a spring sleeve.

As the pin contacts of a coupling will have a smaller overall diameter than that of the corresponding socket contacts, it will generally be preferable to arrange for a substantial length of each pin contact to be unsupported by the moulded insulating material in which the contact is held and for the whole length of the corresponding socket

contact to be embedded in the moulded insulating material in which it is held. This may be achieved by arranging that when the two parts of the coupling are mated there is a substantial space between the neighbouring faces of the two moulded bodies in which the contacts are held, as is shown in Figure 1 of the drawings, where it will be seen that the projecting part of each pin contact 1 is approximately twice the axial length of the socket of the socket contact 2 which receives it. This leaves a substantial length of the projecting part of the pin contact, namely, the rear half, unsupported laterally either by the moulded body 3 in which it is held or by the moulded body 4 in which the socket is embedded. The moulded body 3 is moulded in a metal casing 5 and the body 4 in a metal casing 6 which is secured to the casing 5 by a captive nut 7. The same result may be achieved by providing an annular clearance 8 between a part of each pin contact 2 and the surrounding moulded body 3 of insulation in which the contact is held, as shown diagrammatically in Figure 2 of the drawings. An alternative way of arranging for a substantial length of each pair of engaged contacts to be left without lateral support by the moulded insulating material is to arrange for the socket part of each socket contact 2 to project beyond the face of the moulded body in which the contact is held, as shown diagrammatically in Figure 3. In this case the plug contact 1 will project beyond the face of the moulded body 3 in which it is held by a length approximating to the axial length of the socket receiving it and the adjacent faces of the two moulded bodies 3 and 4 will be spaced apart by approximately the same distance when the contacts are in full engagement. It will be apparent that a similar effect will be obtained by providing, as shown in Figure 4, a clearance 9 between the wall of the socket 2 and the moulded body 4 in which the socket contact is held, the axial length of this clearance corresponding to the axial length of the socket.

As will be apparent from Figure 5 a substantial length of each pair of engaged contacts can be left without lateral support by making the projecting part of each pin contact 1 of greater length than the axial length of the socket receiving it and also allowing the socket contact 2 to project beyond the face of the moulded body 4 in which it is held. For example, as will be seen in Figure 5, the projecting part of each pin contact 1 may have a length approximately equal to one and a half times the axial length of the socket receiving it and the socket contact 2 may project beyond the body in which it is held by a distance approximately equal to half the length of the socket. As will be seen from Figure 6 a similar effect will be obtained by providing a clearance 8 between each pin 1 and the body 3 in which it is held and a clearance 9 between each socket 2 and the body 4 in which each socket is held, the axial length of each clearance approximating to half the axial length of the socket.

Of the various forms of construction described above, those shown in Figures 1 and 2 are most effective. However, still greater resiliency may be obtained, when necessary or desirable, by making the whole or a part of the unsupported portion of the pin of smaller cross-sectional area than the engaging portion, as shown at 1*a* in Figure 1. This may also be done where, as shown in Figure 5, the socket contact projects from the face of the moulding in which it is held by a distance which is substantially less than the distance between the faces of the moulded bodies 3 and 4, and also in the equivalent form shown in Figure 6. Where the socket contacts projects from the face of its supporting moulding by a distance greater than the axial length of the socket resiliency may be increased by making a part of the contact between the

inner end of the socket and the face of the supporting moulding of reduced cross-section.

The two-part cable-to-cable coupling shown in Figure 7 is designed for coupling together two lengths of multiple conductor polyethylene insulated cable, **10***a* and **10***b*. The socket part **11***a* of the coupling comprises a number of socket contacts **2** to the rear ends of which are connected the tail ends **12***a* of the conductors of cable length **10***a*. The socket contacts and their conductors are embedded in a mass of polyethylene **14***a* moulded in a funnel shaped metal sleeve **15***a*, the front ends of the sockets being flush with the end face **16***a* of the polyethylene moulding. The metal braid screen **17***a* of the cable length **10***a* is clamped to the rear end of the sleeve **15***a* by a clamping ring **18***a*. This and the neighbouring part of the sleeve is enclosed in an outer moulding **19***a* of the polyethylene which is protected by a rubber muff **20***a* of which the smaller end grips the cable **10***a*. The other part **11***b* of the coupling is similar to the first part as so far described (except that the contacts are pin contacts) and corresponding parts have been given corresponding reference numerals, accompanied by the suffix "*b*." As will be seen the pins **1** project beyond the end face of the moulding in which they are held by a distance approximately equal to twice the axial length of the socket which receives them.

The socket contacts of the part **11***a* are protected by a shroud **22***a* formed by the front end of the sleeve **15***a* which projects beyond the front face of the moulding **14***a*. The pins of the other part are similarly shrouded but in this case the internal surface of the shroud **22***b* which is of greater axial length, is stepped to provide a joint face **23***b* for engagement by the end face **23***a* of the shroud **22***a* of the first part when the two parts are mated. Preferably a rubber sealing ring **24** is placed in a groove in the face **23***b*. The external surface of the forward end of the shroud **22***b* is screw threaded and a captive nut **25** is provided on the sleeve **15***a* so that the two coupling parts may be pulled together and held in the mating position. In this position each pin is left laterally unsupported for about half its projecting length. It has been found that with this form of coupling, even when there are no less than twenty-three pairs of contacts, in spite of the disturbance in the spacing of the pins and sockets caused by shrinkage of the moulded insulating material, satisfactory engagement of the pins and sockets can be readily obtained without the exertion of considerable force.

To ensure registration of the two parts a key **26** is fitted on the front end of the sleeve **15***a* of the socket part of the coupling and a key-way **27** is cut in the internal surface of the shroud **22***b* of the other coupling part.

For some purposes it is desirable to screen certain contacts or groups of contacts from other contacts or groups of contacts. To this end metal screen plates **28***a*, **28***b* may be provided. These are embedded in the mouldings, each of the screens **28***a* and **28***b* extending rearwardly far enough to overlap axially the cut-back tubular braids **29***a*, **29***b*, respectively which screen the individual conductors **12***a*, **12***b* from one another, and extending forwardly to a point that is flush with the front face **23***a* of the shroud **22***a* or the joint face **23***b*, as the case may be, so that when the two parts **11***a* and **11***b* are mated, the front edges of the screen plates **28***a*, **28***b* abut or almost abut.

During the operation of moulding-in the contacts they are positioned by means of a jig which forms a wall of the mould casing, the sleeve **15***a* or **15***b* forming the remaining part of the mould casing. As will be seen in Figure 8 the jig consists of a metal block **30** which fits in the shroud portion of the sleeve **15***b* and is angularly positioned relative to the sleeve by being provided with a key **31** which fits the key-way **27** of the sleeve. In the block are a number of appropriately spaced holes **32** for the reception of the projecting portions of the pin contacts **1** of which for the sake of simplicity of drawing only two are shown. The same block **30** may be used to form a jig to support the socket contacts **2**, in which case the holes in the block are fitted with dowels **33** which support the socket contacts during the moulding operation, as shown in Figure 9. In this case the angular position of the jig relative to the sleeve **15***a* is controlled by a sleeve **34** provided with a key-way **35** which receives the key **31** on the block **30** and the key **26** on the sleeve **15***a*.

The sockets **2** preferably have slit walls which are reinforced by a spring sleeve **36** as shown more clearly in Figure 10 (which is drawn to a larger scale than Figure 7) and each dowel **33** has a diameter equal to the diameter of the part of the pin which enters the socket. Consequently, during the operation of moulding-in the socket contacts, the sockets are held to the same diameter to which they are held by the pin contacts when the coupling is made. After the completion of the moulding operation and withdrawal of the dowel pins, the sockets close to their minimum working dimensions. As the socket wall does not adhere to the polyethylene moulding a tiny gap appears round each socket wall into which the socket can expand when its pin is inserted.

What we claim as our invention is:

1. A detachable two-part multiple pin and socket coupling comprising a pair of moulded bodies of inelastic insulating material, a multiplicity of pin contacts having socket-engaging parts of solid circular section and held by being embedded in one of said bodies, a corresponding number of socket contacts each embedded substantially throughout the length of its socket portion in the other of said bodies, said pin contacts having elastically deflectable portions projecting beyond a face of the body in which they are held by a distance approximately at least equal to twice the axial length of the sockets which receive them, whereby when the two parts of the coupling are fully engaged, at least the rear half of the projecting part of each pin contact is left laterally unsupported by the moulded insulating material, the diameter of the laterally unsupported rear half being small relative to its length.

2. A detachable two-part multiple pin and socket coupling comprising a pair of moulded bodies of inelastic insulating material, a multiplicity of pin contacts held by being embedded in one of said bodies, a corresponding number of socket contacts held by being embedded in the other of said bodies, said pin contacts having elastically deflectable portions projecting beyond a face of the body in which they are held by a distance approximately equal to the axial length of the sockets of the socket contacts and a clearance being provided between a part of each pin contact that is adjacent to the projecting part and the surrounding insulating material of the moulded body, said clearance having an axial length at least approximately equal to the axial length of the sockets of the socket contacts, whereby when the two parts of he coupling are fully engaged a substantial length of each pin contact between a socket-held front portion and the embedded rear end is left laterally unsupported by the surrounding moulded insulating material, the diameter of the laterally unsupported length of each pin having a diameter that is small relative to its length.

3. A detachable two-part multiple pin and socket coupling comprising a pair of moulded bodies of inelastic insulating material, a multiplicity of pin contacts having socket-engaging parts of said circular section and held by being embedded in one of said bodies, a corresponding number of socket contacts held by being embedded in the other of said bodies, and receiving front portions of said pins, a substantial length of each pin contact between the socket-held front portion and the embedded rear end of the pin contact being, when the two parts of the coupling are fully engaged, left laterally unsupported by the sur-

rounding moulded insulating material and, as compared with the socket-held front portion, of reduced solid circular cross-section throughout at least part of its length.

4. A detachable two-part cable-to-cable coupling, each part comprising a funnel-shaped metal casing surrounding the end of one of two lengths of multiple conductor cable, a multiplicity of socket contacts connected one on the end of each conductor of the said one of the cable lengths, a body of inelastic insulating material moulded in said casing and about said sockets and the ends of the cable conductors connected thereto, a second funnel-shaped casing surrounding the end of the other of the two lengths of cable, a multiplicity of pin contacts having socket-engaging parts of solid circular section and connected one on the end of each conductor of the said other of the cable lengths, a body of inelastic insulating material moulded in said second casing and about the rear parts of said pin contacts, whereby to leave projecting from said moulded body an elastically deflectable length of pin contact of solid circular section approximately equal to at least twice the axial length of the socket of each socket contact, a shroud on said second funnel-shaped casing surrounding the projecting ends of said pin contacts, a screw thread on said shroud and a captive nut on the first said casing for engaging said screw threaded shroud whereby to draw said coupling parts together and hold them in the fully engaged position.

5. A detachable two-part coupling as specified in claim 4, wherein metal plates are embedded in each moulded body for screening contacts of one group from those of other groups, the edges of said plates projecting beyond the front end face of each moulded body, whereby to screen the part of each pair of engaged contacts of one group that is left laterally unsupported by moulded insulating material from that of each pair of engaged contacts of other groups.

6. A detachable two-part multiple pin and socket coupling comprising a pair of moulded bodies of inelastic insulating material, a multiplicity of moulded-in socket contacts located in one of said bodies and each comprising a socket portion lying substantially wholly within and closely surrounded by said one of said bodies, and a multiplicity of complementary pin contacts, each comprising a portion embedded in the other of said bodies and an adjoining unembedded elastically deflectable portion of solid circular section which includes a socket-engaging part and has a length of small diameter approximately at least equal to twice the axial length of the socket-engaging part, whereby when the two parts of the coupling are fully engaged, at least the rear half of the said adjoining unembedded portion of each pin contact is left laterally unsupported by the moulded insulating material so that said solid circular section pin contacts are sufficiently resilient to compensate for any inaccuracy of spacing due to shrinkage of said molded bodies.

7. A detachable two-part multiple pin and socket coupling comprising a pair of moulded bodies of inelastic insulating material, a multiplicity of socket contacts each having a socket with a circumferential wall which is embedded over its whole length in one of the said bodies, and a multiplicity of complementary pin contacts, each comprising a portion embedded in the other of said bodies and an adjoining unembedded elastically deflectable portion of solid circular section of small diameter which includes a socket-engaging part and has a length approximately at least equal to twice the axial length of the socket-engaging part, whereby when the two parts of the coupling are fully engaged, at least the rear half of the said adjoining unembedded portion of each pin contact is left laterally unsupported by the moulded insulating material.

8. A detachable two-part multiple pin and socket coupling comprising a pair of moulded bodies of inelastic insulating material, a multiplicity of moulded-in socket contacts located in one of said bodies and each comprising a socket portion lying substantially wholly within and closely surrounded by said one of said bodies, and a multiplicity of complementary pin contacts, each comprising a portion embedded in the other of said bodies and an elastically deflectable portion of solid circular section of small diameter projecting beyond an end face of the other of said bodies, said projecting portion including a socket-engaging part and having a length approximately at least equal to twice the length of said socket engaging part, whereby when the two parts of the coupling are fully engaged, at least the rear half of the said projecting portion of each pin contact is left laterally unsupported by the moulded insulating material.

9. A detachable two-part multiple pin and socket coupling, comprising a pair of moulded bodies of inelastic insulating material, a multiplicity of moulded-in socket contacts in one of said bodies each of said bodies comprising a socket portion lying substantially wholly within and closely surrounded by the said one of said bodies, and a multiplicity of complementary pin contacts, each comprising a portion embedded in the other of said bodies and an elastically deflectable unembedded portion comprising a socket-engaging part and between said socket-engaging part and said embedded portion a part of relatively small diameter compared with its length lying in a recess in the said other of said bodies, said recess being of greater diameter than the part of said pin contact lying within it, and said unembedded portion having a length approximately at least equal to twice the length of said socket-engaging part, whereby when the two parts of the coupling are fully engaged, at least the rear half of the said unembedded portion of each pin contact is left laterally unsupported by the moulded insulating material.

10. A detachable two-part multiple pin and socket coupling comprising a pair of moulded bodies of inelastic insulating material, a multiplicity of moulded-in socket contacts located in one of said bodies and each comprising a socket portion lying substantially wholly within and closely surrounded by said one of said bodies, and a multiplicity of complementary pin contacts, each comprising a portion embedded in the other of said bodies and an adjoining unembedded portion of solid circular section which includes a socket-engaging part and a part of reduced solid circular cross-section as compared with the socket-engaging part of solid circular section, said unembedded portion having a length approximately at least equal to twice the axial length of the socket-engaging part, whereby when the two parts of the coupling are fully engaged, at least the rear half of the said adjoining unembedded portion of each pin contact is left laterally unsupported by the moulded insulating material.

11. A detachable two-part cable-to-cable coupling, each part comprising a funnel-shaped metal casing surrounding the end of one of two lengths of screened multiple conductor cable, a multiplicity of socket contacts connected on the end of each conductor of one of the said cable lengths, means for mechanically and electrically connecting the screen of the cable length surrounded by said metal casing to the smaller end of said casing, a body of inelastic insulating material molded in and around said casing and around the end of the cable screen connected thereto and about said sockets and the ends of the cable conductors connected thereto, a second funnel-shaped casing surrounding the end of the other of the two lengths of cable, a multiplicity of pin contacts connected one on the end of each conductor of the said other of the cable lengths, means for mechanically and electrically connecting the screen of the said other of the cable lengths to the smaller end of said second funnel-shaped casing, a body of inelastic insulating material molded in and around said second casing and around the end of the cable screen connected thereto and about the rear parts of said pin contacts and the ends of the cable conductors connected thereto, whereby to leave projecting from last said molded body a length of pin contact approximately equal to at least twice the axial length of the socket of each socket con-

tact, a shroud on said second funnel-shaped casing surrounding the projecting ends of said pin contacts, a screw thread on one of said funnel-shaped casings and a captive nut in other of said casings for engaging said screw thread whereby to draw said coupling parts together and hold them in the fully engaged position.

12. A detachable two-part multiple pin and socket coupling comprising a pair of moulded bodies of inelastic insulating material, a multiplicity of pin contacts having socket-engaging parts of solid circular section and held by being embedded in one of said bodies, a corresponding number of socket contacts each embedded substantially throughout the length of its socket portion in the other of said bodies, said pin contacts projecting beyond a face of the body in which they are held by a distance which is approximately at least equal to twice the axial length of the sockets which receive them, whereby when the two parts of the coupling are fully engaged, at least the rear half of the projecting part of each pin contact is left laterally unsupported by the moulded insulating material, the length of the laterally unsupported part of each pin contact being at least four times its diameter.

13. A detachable two-part multiple pin and socket coupling comprising a pair of moulded bodies of inelastic insulating material, a multiplicity of moulded-in socket contacts located in one of said bodies and each comprising a socket portion lying substantially wholly within and closely surrounded by said one of said bodies, and a multiplicity

of complementary pin contacts, each comprising a portion embedded in the other of said bodies, a socket-engaging portion of solid circular section and an intermediate portion uniting said socket-engaging portion to said embedded portion, said intermediate portion being of solid circular section and having a length equal to at least four times its diameter and at least equal the axial length of the socket-engaging portion, whereby the intermediate portion of each pin contact is elastically deflectable and when the two parts of the coupling are fully engaged is left laterally unsupported by the moulded insulating material so that said pin contacts are able to deflect to compensate for any inaccuracy of spacing due to shrinkage of said moulded bodies.

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