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(54) CONNECTING DEVICE FOR MULTICORE CABLES

(71) We, E. I. Du Pont De Nemours and Company, a corporation organized and existing under the laws of the State of Delaware, located at Wilmington, State of Delaware, United States of America, 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:—

The invention relates to a connecting device for a multicore cables which have a plurality of separately insulated conductors.

In modern electronic applications, e.g. computer and communication techniques, use is made nowadays, for signal transmission, of multicore signal cables, which consists of a bundle of separately insulated signal cores, which are kept bundled by a common sheath. In order to connect such signal cables to a contact block, the ends of these cores are separated and each individual conductor is connected to a corresponding contact of the contact block. A major drawback of present contact blocks is, however, that to each contact and its corresponding place in the contact block belongs a matching length of conductor. This means that each signal core must be treated separately, namely stripped, cut to size and connected, so that the connection of such a contact block to a signal cable is a time-consuming operation and automation thereof is difficult.

According to one aspect of the present invention there is provided a connecting device for a cable having a plurality of separately insulated conductors, the device comprising a body portion of insulating material, a plurality of contacts mounted in the body portion, each contact having projecting from one face of the body portion a bifurcated conductor-engaging portion with one or more pairs of cutting teeth for penetrating the insulation of the conductor to be engaged thereby, a lid portion having, in a face thereof for engagement with said one face of the body portion, recesses for receiving respective ones of the conductor-engaging contact portions, bores extending through said lid portion each communicating with a respective channel in said face which channel extends from the bore via a respective one of the recesses to the edge of that face whereby cable conductors positioned to extend through the bores and along the channels will, upon the bringing together of the lid and body portions with their respective faces in abutment, be engaged by respective ones of the conductor engaging contact portions.

For assembling and connecting such a device, the separately insulated cores of a cable are passed from a top side of the lid portion through the bores, bent 90° at the under side and placed in the channels: preferably the channels are capable of holding these cores partially clamped. Then the lid portion is pressed on the body portion and finally any protruding ends of the signal cores are cut off at each side: this can take place in one single operation. Preferably means are provided to lock the lid body portions together.

As noted above, connectors according to the invention employ contacts having bifurcated toothed conductor-engaing portions. In use, the cutting teeth of these portions cut through the core insulation, whereafter the core is held in contact between the cutting teeth. In order to provide more reliable contact, use can be made of double bifurcated contacts, which each have two of such pairs of cutting teeth in line with each other.

Although the connecting device according to the invention may have only one row of contacts, it is particularly suitable for more row of contacts, in which case the body portion may be provided with a number of parallel rows of contacts, the bifurcated conductor engaging contact portions of each one row being displaced with respect to those of the other rows in such a way that conductors engaged thereby can extend transversely to one of the sides of the body portion without meeting the contact portions of the other rows, and that the recesses in the lid portion are arranged in corresponding rows. Because of these provisions, the invention allows contact to several rows of cores next to each other in the same way and equally fast and easily as one single row. A contact casing

may be provided which is subdivided by internal partitions into substantially rectangular passages extending therethrough and arranged according to a rectangular matrix, and each contact is arranged in a respective one of said passages. Another possibility is e.g. that the lower ends of the contact are contact plugs or sockets, which protrude at the under side of the body portion.

With a connecting device according to the invention with two rows of contacts, the embodiment may be such that the contact casing has two juxtaposed rows of contacts and the corresponding rows of bores in the lid portion are displaced inwardly in transverse direction relative to the rows of passages. During contacting, two rows of conductors may thus be bent away from each other at the under side of the lid portion towards opposite sides of the lid portion.

An efficient embodiment of connecting device with three rows of contacts can be such that the body portion has three juxtaposed rows of contacts, the bifurcated conductor-engaging contact portions of the two outer rows being in line with each other in transverse direction, the bifurcated conductor engaging portions of the middle row being displaced by half a pitch with respect to those of the outer rows in longitudinal direction, and that in the lid portion the rows of bores corresponding to the two outer rows are displaced inwardly in transverse direction and are in line, whilst the bores corresponding to the middle row are located laterally outwardly of one of the rows of bores of said outer rows, and are displaced in the longitudinal direction by half a contact pitch. Thus the third row of signal cores can be contacted in the same way as the two other rows, without the risk that cores of different rows could come into an undesired contact with contacts meant for the other rows. The asymmetrical arrangement, which is inevitably necessary at the top side of the lid portion, is converted in the body portion itself into a symmetrical position, so that at the under side of the contact casing the three rows of contacts are arranged regularly beside each other, which is of course necessary because of standardization.

For a connecting device for four rows of contacts, it is proposed according to a further embodiment of the invention that the body portion has four juxtaposed rows of contacts, the bifurcated contacts of the two even rows as well as the bifurcated contacts of the two odd rows, are in line in transverse direction, the bifurcated contacts of the two even rows are displaced in the longitudinal direction by half a pitch with respect to those of the odd row, and that in the lid portion the two rows of bores which correspond to the two even rows are displaced inwardly in transverse directions with respect to these even rows, whilst the rows of bores which correspond to the two odd rows are displaced inwardly in transverse direction with respect to these odd rows, and are displaced in the longitudinal direction by half a pitch. It is possible to keep these four rows of contacts arranged regularly beside each other at the underside of the body portion.

With such an embodiment with three or four rows, in which the body portion is subdivided according to a rectangular matrix of rectangular passages, use can be made of contacts which consist of oblong conducting means punched from one piece of metal plate, of which the one end is a female plug and the other end a bifurcated piercing contact, which with respect to the longitudinal axis of the contact in question is displaced over about half a width in the direction at a right angle to the direction of a signal core to be contacted in this piercing contact. Such an embodiment of the contact means offers the advantage that now one and the same type of contact means can be used for all rows of contacts, whereas in adjacent rows the contact means need only be turned over 180°, so that the bifurcated piercing contacts will be arranged alternately.

In order to assure a good locking between the body and lid portions the lid portion may have oblique cams at is sides, which cams can be locked in snap brackets with slots attached to the upper part of the sides of the bodv portion.

A preferred embodiment of the invention provides a casing in combination with one or more connecting devices of the above-described type. Such a casing may consist of two side portion which can be locked to each other, and which are provided with recesses which correspond to lugs provided on the sides of the connecting devices, so that one or more connecting devices can be secured between the two side portions. Such a casing or holder offers the important advantage that sub-units, consisting of a connecting device according to the invention, can be extended and combined into larger composite units, which still remain a compact unit. In an efficient way the embodiment may be such that each side portion has at its upper side a protruding approximately half-cylindrical part, which when the side portions are closed on each other, form a hollow cylindrical tube, in which the end part may be held of a signal cable connected to the connecting device(s). These half-cylindrical tube-halves can be lockable to each other and thus serve to lock the two halves of the casing together.

Some exemplary embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 shows a perspective, exploded view of two connecting devices according to the invention with a common casing;

Figure 2 shows an enlarged detail of one of the connecting devices of figure 1;

Figure 3 shows a schematic view of the lid portion of one of the connecting devices of figure 1; and

Figure 4 shows such a schematic view of a lid portion of another embodiment.

Figure 1 shows two connecting devices according to the invention, which each have a body portion 1 and a lid portion 2. The body portion 1, has side walls 3 and 4 and front and rear walls 5 and 6. Internally, the body portion is subdivided by longitudinal partitions 7 and transverse partitions 8 into rectangular passages 9 for receiving contacts 10*a*, 10*b* and 10*c*. These contacts have at their upper ends double, bifurcated conductor engaging portions 11*a*, 11*b* and 11*c*, each provided with two pairs of cutting teeth 12.

The lid portion 2 has in its underside recesses 13*a*, 13*b* and 13*c* for receiving the pairs of cutting teeth of the bifurcated conductor engaging contact portions. The lid also has bores 14*a*, 14*b* and 14*c*, which communicate at the underside of the lid portion into transverse channels 15*a*, 15*b* and 15*c*. The above-mentioned references a, b and c are meant to indicate that the parts in question belong to or co-operate with respective ones of the three row of contacts. Thus the recesses 13*a*, the bores 14 and the cross recesses 15*a* co-operate with the contacts 10*a* of the foremost row shown in the drawing, etc.

As Figure 1 shows, the bifurcated portions 11*b* of the middle row of contacts are displaced over half a pitch (core-to-core-distance of the contacts in one single row) with respect to those of the bifurcated portions 11*a* and 11*c* of the two outer rows. In fact, the contacts used for the middle row are of the same pattern as for the two outer rows, but turned through 180°, so that the desired result is obtained, since the bifucated portions are displaced from the longitudinal axis of the contacts themselves. With the two outer rows of bifurcated portions 11*a* and 11*c* are associated the rows of bores 14*a* and 14*c* in the lid portion, which, as shown in Figures 1 and 3, are displaced inwardly with respect to these rows. The transverse recesses 15*a* and 15*c* at the underside of the lid portion extend from these pairs of bores towards the sides 16 and 17 of the lid portion, thereby crossing the recesses 13a and 13*c*. In this way it has been obtained that conductors guided through the bores 14*a* and 14*c*, can be bent sideways to the sides 16 and 17 via the transverse recesses 15*a* and 15*c*, without coming into contact with undesired contact means. The connection of conductors, each consisting of a core 21 and insulation 22, in these bores is shown in Figure 2. The conductors are guided through the bores 14*a* and 14*c* and pressed into the transverse recesses 15*a* and 15*c*, and the cutting teeth 12 of the bifurcated contact portions 11*a* and 11*c* penetrate through the core insulations and contact the cores when the lid is closed. The row of bores 14*b*, which corresponds to the row of contacts 10*b*, is offset therefrom in a direction toward the side 17, so that the bores in question come to lie between the two rows 14*b* and 14*c*. As can be seen in Figure 3, the cores which are guided through these bores 14*b* are bent towards the side 16 and extend along the transverse channels 15*b*. As also shown Figure 3, it is arranged that the cores in question are guided kept clear of the contacts of the other two rows.

The lid portion is further provided at its sides 16 and 17 with locking lugs 18 (see Fig. 1), which can snap into slots 20 of snap brackets 19, which are attached to the upper parts of the sides 3 and 4 of the contact casing.

For assembly, the insulated conductors of a cable are inserted in the bores in the lid, bent and pressed into the corresponding transverse recesses, and the lid is then pressed on the casing and locked by means of the locking lugs, whereupon any ends of the cables which protrude at the sides are cut off: this can take place in one single operation. In this way a good connection is obtained, and the connecting devices, which may for example have female plugs at their undersides, can be used for further contacting purposes. With reference to Figures 1 and 3, there has been described an embodiment of connecting device in which three rows of contact means are arranged regularly beside each other, and in which the bifurcated contact portions, which protrude upwards from the connector body, are displaced alternately by half a pitch for the three subsequent rows. In principle, such an embodiment can be extended to a four-row embodiment, in which the contact device has been enlarged with a fourth row of rectangular passages, and in which four regularly arranged rows of contacts are accommodated in the connector body. The forth row of means then alternates with the third and is in alignment with the second, the first and the third are likewise aligned. This can be seen in Figure 4 by means of the position of the recesses 13*b* in the lid, which recesses form the receiving holes for the fourth row of bifurcated portions. This four-row embodiment is in fact an extension of the three-row embodiment, in which in the lid portion the rows of bores 14*b* and 14*d* are displaced inwards with respect to the corresponding recesses 13*b* and 13*d* in the same way as is the case for the bores 14*a* and 14*c* with respect to the recesses 13*a* and 13*c*. In this way a structure is obtained again, in which the cross recesses 15*a*, 15*b*, 15*c* and 15*d* lead from the mouths of the bores 14*a*, 14*b*, 14*c* and 14*d* to one of the sides via only its respective recess 13*a*, 13*b*, 13*c* and 13*d*. Here too, it is therefore possible to insert conductors in the four rows of bores, to bend them and to clamp them in the cross recesses

in the underside of the lid and to assure subsequently a good connection by pressing the lid portion on the body portion.

Figure 1 further shows a casing, formed in two halves between which two juxtaposed connecting devices can be clamped and combined into a larger unit. These havles have front surfaces 22, 24 respectively, which each have recesses 25, corresponding to fitting lugs 26 provided at the sides of the body portions of the connecting devices. Both front surfaces further have finger grip ribs 27, which facilitate the handling and placing of the assembled unit. Each casing half has an upwardly extending, narrowed lower edge 28 and corresponding, rising side edge parts 29 and 30, which are enlarged at the top side into side edges 31 and 32. The supporting eges formed at this transition constitute supporting surfaces 33, 34 for the connecting devices placed against them. At the upper side the enlarged side edges 31 and 32 merge into equally wide obliques edges 35 and 36, of which the oblique edge 35 is longer than the oblique edge 36. On the short oblique edges 36, there are semi-tube-shaped projections 37, which are meant to accommodate the cable which is connected to the connecting devices when the two halves of the casing are assembled with two connecting devices. These semi-tubes can be locked to each other in an efficient way, either by an external auxiliary means, or by locking lugs (not shown), whereas a second locking of the halves is provided at the underside of the long oblique edges 35, the one lid having a locking lug 38 and the other lid having a corresponding locking slot 39.

The embodiment of casing shown in Figure 1 is meant for the assembly of two juxtaposed connecting devices with each three rows of contacts. It will be obvious, however, that the embodiment can also be such that more than two contact devices can be placed beside each other.

Further, the invention is not restricted to the described block-shaped embodiment of the contact devices, in which the contact casing shows a regular matrix pattern. In principle, it is also possible to carry out devices according to the invention in a cylindrical way, in that e.g. two cylindrically arranged arrays of contacts are arranged and displaced concentrically with respect to each other on a cylindrical body.

It will thus be seen that the present invention can provide a connecting device, which enables a fast, easy and partially automated connection of cores of such a multicore cable.

It is not longer necessary to connect each conductor separately. The only operation which has to take place separately for each conductor is the insertion in the corresponding bore in the lid and the bending therebehind in the channel. The subsequent operations are common for all conductors and consist only of closing the lid and of the common trimming of the conductors.

Use of the casing can result in a solid and reliable connecting device, in which a multicore cable can be connected in an efficient and easy way to a number of contacts, which at the underside can be arranged and connected regularly for further connections.

WHAT WE CLAIM IS:—

1. A connecting device for a cable having a plurality of separately insulated conductors, the device comprising a body portion of insulating material, a plurality of contacts mounted in the body portion, each contact having projecting from one face of the body portion a bifurcated conductor-engaging portion with one or more pairs of cutting teeth for penetrating the insulation of the conductor to be engaged thereby, a lid portion having, in a face thereof for engagement with said one face of the body portion, recessses for receiving respective ones of the conductor engaging contact portions, bores extending through said lid portion each communicating with a respective channel in said face, which channel extends from the bore to the edge of that face via a respective one of the recesses, whereby cable conductors positioned to extend through the bores and along the channels will, upon the bringing together of the lid and body portions with their respective faces in abutment, be engaged by respective ones of the conductor engaging contact portions.

2. A connecting device acording to claim 1 in which the body portion is provided with a plurality of mutually parallel rows of contacts, the bifurcated conductor engaging contact portions of each one row are placed with respect to those of the other rows in such a way that conductors engaged thereby can extend transversely towards one of the sides of the body portion without meeting the contact portions of the other rows, and the recesses in the lid portion are arranged in corresponding rows.

3. A connecting device according to claim 2, in which the body portion is subdivided by internal partitions into substantially rectangular passages extending therethrough, which passages are arranged according to a rectangular matrix, and each contact is mounted in a respective one of said passages.

4. A connecting device according to claim 1, 2 or 3 in which each contact has, at its end remote from the conductor engaging portion connector means.

5. A connecting device according to claim 4, in which said connector means ia female plug.

6. A connecting device according to claim 2, 3, 4, or 5 in which the body portion has two juxtaposed rows of contacts and the corresponding rows of bores in the lid portion are displaced inwardly in transverse direction relative to the rows of passages.

7. A connecting device according to claim 2, 3, 4 or 5 in which the body portion has three juxtaposed rows of contacts, the bifurcated conductor engaging portions of the two outer rows are transversely aligned, the bifurcated conductor engaging portions of the middle row are displaced in the longitudinal direction by half a contact pitch with respect to those of the outer rows, and in the lid portion the rows of bores which correspond to the two outer rows are displaced inwardly in transverse direction and are in line, whilst the bores corresponding to the middle row are located laterally outwardly of one of the rows of bores corresponding to the outer rows and are displaced in the longitudinal direction by half a contact pitch.

8. A connecting device according to claim 2, 3, 4 or 5 in which the body portion has four juxtaposed rows of contacts, the bifurcated contacts of the two even rows, as well as the bifurcated contacts of the two odd rows, are in line in transverse direction, the bifurcated contacts of the even rows are displaced in the longitudinal direction by half a pitch with respect to those of the odd rows, and that in the lid portion the rows of bores which correspond to the two even rows are in transverse direction displaced inwardly with respect to these even rows, whilst the rows of bores which correspond to the two odd rows are in transverse direction displaced inwardly with respect to these odd rows, and are displaced by half a pitch in the longitudinal direction.

9. A connecting device according to any one of the preceding claims, in which the lid portion has lugs projecting from its sides, which lugs can be locked in snap brackets with slots, attached to the upper part of the sides of the body portion.

10. The combination of one or more connecting devices according to any one of the preceding claims with a casing comprising two side portions which can be locked to each other and which are provided with recesses which correspond with lugs provided on the sides of the connecting devices so that said one or more connecting devices can be secured between the two side portions.

11. A combination according to claim 10, in which each side of the casing portion has at its upper side a protruding, approximately half-cylindrical part, which two half-cylindrical parts, when the side portions are closed on each other, constitute a hollow cylindrical tube in which may be held a single cable connected to the connecting device(s).

12. A combination according to claim 11, in which said approximately half-cylindrical parts can be locked to each other.

13. A contact when used with the connecting device according to claim 6 or 7, in which the contact is an elongate conducting means punched from one single piece of metal plate, of which the one end constitutes a female plug and the other end a bifurcated core-piercing portion which with respect to the longitudinal axis of the means is displaced in the direction at a right angle to the direction of a conductor to be contacted by the piercing contact.

14. Connecting devices substantially as herein described with reference to Figures 1 to 3 or 1, 2 and 4 the accompanying drawings.

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3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

FIG.1

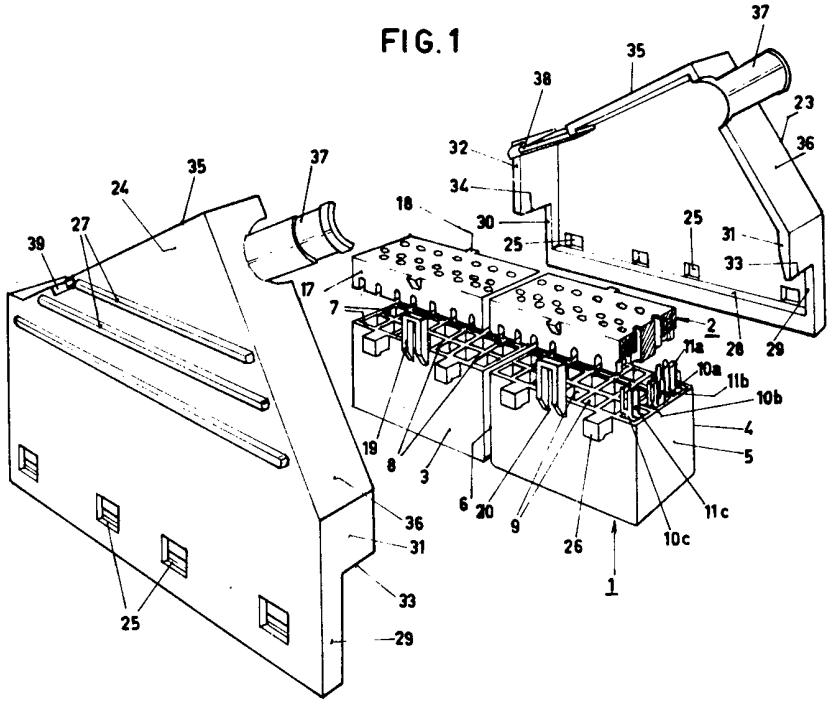


FIG. 2

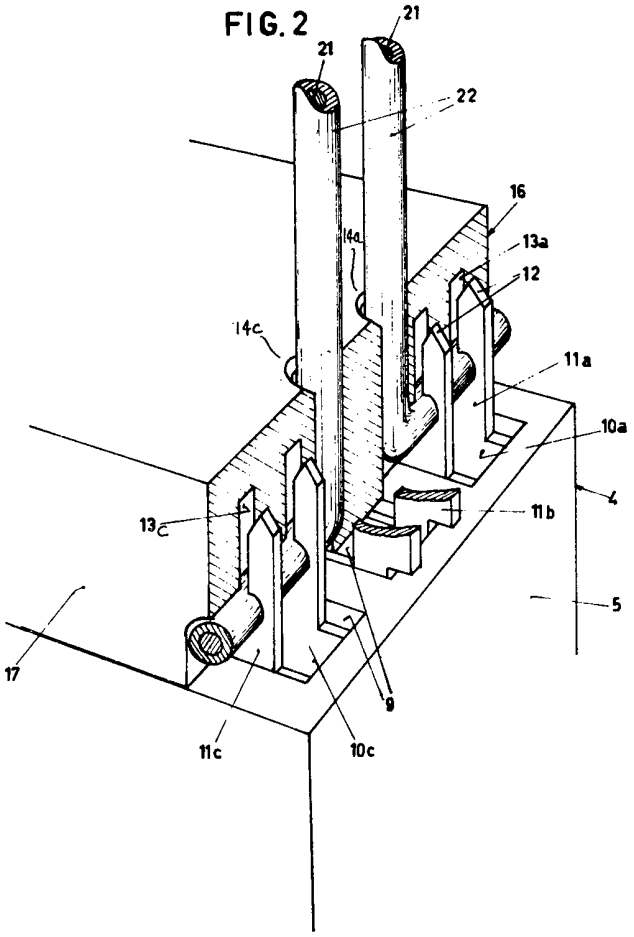


FIG. 3

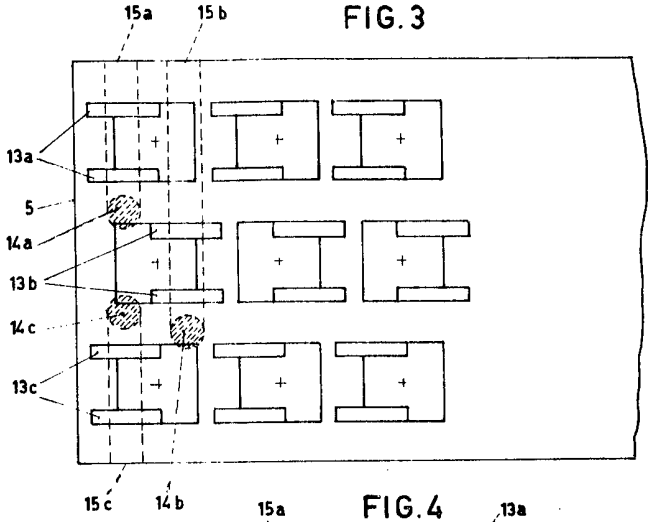
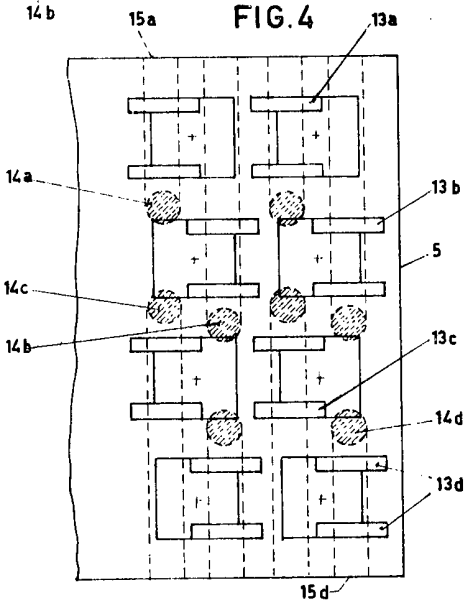

15a
15b
13a
5
14a
13b
14c
13c
15c
14b

FIG. 4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