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**PATENT OFFICE**

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(54) Data transfer cable

**DE 297 19 866 U 1**

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Data transfer cable

The present invention relates to a data transfer cable consisting of at least  $n$ -pairs,  $n$  being an even-numbered multiple of 1, of two isolated conductors in each case, a shielding of the conductor pairs that consists of an electrically conductive material, and an outer cable sheath.

Data transfer cables of this kind typically consist of four pairs of two stranded isolated copper conductors or wires. These cables are used primarily in communications networks which demand optimized transfer properties, in particular, a defined wave impedance and low coupling resistance, low damping, and low crosstalk. In order to achieve these properties, the individual conductor pairs are in each case surrounded by a shielding consisting of a metal foil or the like. This individual shielding of the conductor pairs requires significant production outlay, such that data transfer cables of this kind are relatively expensive.

The problem addressed by the present invention, proceeding from the data transfer cable described at the outset, is that of designing said cable such that the production costs can be reduced without the transfer properties, in particular, in a transfer range of from 1 to 100 MHz or 1 to 600 MHz, being impaired compared with those cables having single-shielded conductor pairs.

According to the invention, this is achieved in that the electrical shielding divides the cable cross section into at least two shielding sectors, and one conductor pair extends in each shielding sector, such that the two conductor pairs are shielded from one another and from the outside.

The invention is accordingly based on the fundamental concept that the cable cross section is divided into sectors by means of the shielding, in which sectors the conductor pairs extend in a manner shielded from one another and substantially from the outside. The arrangement of the shielding according to the invention furthermore makes it possible for the

application or introduction of the shielding into the cable to take place by means of the stranding and/or the longitudinally extending deformation of the conductor pairs. This allows for cost-effective production in a continuous production process.

The dependent claims contain further advantageous embodiments of the invention which are explained in greater detail with reference to the embodiments shown in the accompanying drawings, in which:

- Fig. 1                    is a cross section through a data transfer cable according to the invention,
- Fig. 2                    is a cross section through a further embodiment of the transfer cable according to Fig. 1,
- Fig. 3                    is a cross section through a further embodiment of the transfer cable according to Fig. 2,
- Fig. 4                    is a cross section through a further embodiment of a data transfer cable according to the invention,
- Fig. 5                    is a cross section through another embodiment of a data transfer cable according to the invention.

Identical parts are provided with the same reference signs in Fig. 1 to 5.

A data transfer cable according to the invention, shown in Fig. 1, comprises four pairs 1, each consisting of two isolated, stranded copper conductors 2 or wires. Optionally, these copper conductors or wires may comprise a conductor coating, for example, of tin. The effective diameter of said copper conductors or wires is in particular 0.4 to 0.66 mm. The copper conductors or wires preferably have an insulation 3 consisting of a thermoplastic polymer, in particular polyethylene, cell polyethylene, foam-skin polyethylene, skin-foam-skin polyethylene, polypropylene, or cell polypropylene. The wall thickness of the insulation 3 is preferably in the range of from approximately 0.15 to 0.7 mm. The stranding of the pairs 1 can consist in what is known as a helix stranding or in an SZ stranding (alternating, right-left stranding). In the case of an SZ stranding of the pairs, preferably, the spacing of the reversal points of the stranding direction can be dimensioned such that the transfer frequency corresponding

to the spacing of the reversal points is above the defined upper frequency limit. A data transfer cable according to the invention is suitable for a maximum transfer frequency of 100 or 600 MHz, in particular, of 100 or 350 MHz. A transfer cable according to the invention comprises, as outer mechanical protection, a cable sheath 4 which consists of conventional thermoplastic sheath materials. Particular EMC protection measures can additionally be provided by applying metal foils and/or shielding braids under the cable sheath, although this is not shown. The structure described above is common to all embodiments of the data transfer cable according to the invention. However, it is possible not only, as shown, for four pairs 1 to be provided, but rather that a data transfer cable according to the invention can also comprise just two pairs of stranded conductors. Any desired n-pairs can be provided, n being an even-numbered multiple of 1.

As shown in Fig. 1, an electrical shielding 5 is formed within the cable cross section. As a result, in the embodiment shown, the cable cross section is divided into four shielding sectors 6 to 9. One conductor pair 1 extends in each of the shielding sectors 6 to 9, such that the conductor pairs are shielded from one another and from the outside. In the embodiment shown, the shielding 5 is formed of two mutually independent partial shieldings 11, 12. Each of said partial shieldings is associated in each case with two conductor pairs 1 that are arranged so as to be offset at 90° relative to one another. In the embodiment shown, the two partial shieldings 11, 12, viewed in the cross section of the cable, are in the shape of the number "6". One of the conductor pairs 1 is arranged inside the round portion 13, and one conductor pair is arranged outside said portion 13, surrounded by the curved end portion 14. In the embodiment shown, in the case of a design of four conductor pairs, the partial shieldings 11, 12 are arranged rotationally symmetrically within the cable cross section.

The design of a data transfer cable according to the invention according to Fig. 2 differs from the embodiment according to Fig. 1 in that the round portion 13 of the partial shielding 11, 12 is completely closed, such that the end region of the round portion is contacted by the curved portion 14. The design according to Fig. 3 of a data transfer cable according to the invention differs from that according to Fig. 2 in that the round portions 13 of the two partial shieldings 11, 12 extend within the cable cross section in such a way that they touch approximately in the center of the cable. In this case, according to the invention, the two partial shieldings

11, 12 can be adhesively bonded.

The shielding 5 or the partial shieldings 11, 12 preferably consist of metal foils, in particular, aluminum foils or aluminum foils laminated with plastics material. The metal layer thickness is preferably a few 10  $\mu\text{m}$ , for example 20 to 60  $\mu\text{m}$ , when aluminum is used.

Fig. 4 shows an alternative embodiment of the partial shieldings 11, 12. In this case, the partial shieldings 11, 12, viewed in the cross section of the data transfer cable, are in the shape of the number "8". The conductor pairs are in each case located in the two round portions 15 of the partial shieldings 11, 12.

Fig. 5 shows a further alternative embodiment of a data transfer cable according to the invention. While in Fig. 4 the two partial shieldings 11, 12, having the shape of an "8" when viewed in cross section, are arranged rotationally symmetrically, in Fig. 5, a single partial shielding 17 having the shape of an "8" in cross section is provided. Said partial shielding 17 surrounds, by its round regions 15, two opposing conductor pairs 1 in each case. In contrast thereto, in Fig. 1 to 4, conductor pairs that are offset relative to one another by  $90^\circ$  are surrounded by the partial shieldings 11, 12 in each case. The two other conductor pairs in Fig. 5 are in each case arranged in the gusset regions of the partial shieldings 17, and overall the conductor pairs 1 are surrounded again by a circular partial shielding 18.

As can be seen from the above Fig. 1 to 5, in the case of a data transfer cable according to the invention consisting of four pairs, in each case, two partial shieldings 11, 12 or 17, 18 are present, such that in total, four shielding sectors are formed, viewed over the cable cross section. The design according to Fig. 4 can also be developed based on the design in Fig. 3 such that the two partial shieldings 11, 12 are adhesively bonded to one another, approximately in the cable center, in the transition region between the two round portions 15 of each partial shielding.

The production of a data transfer cable according to the invention, as described above, can take place such that the partial shieldings 11, 12 or 17, 18 are applied together with the stranding or the conductor pairs 1 and/or the longitudinally extending deformation of the conductor pairs 1. In particular, in the case of the stranding of the conductor pairs in the

SZ stranding method, the laying tools provided for the partial shieldings 11, 12 can assist the change in the stranding direction in each case.

The present invention is not restricted to the embodiments shown, but rather includes every embodiment that is identically acting within the meaning of the invention.

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**Claims:**

1. Data transfer cable, consisting of at least n-pairs, n being an even-numbered multiple of 1, of two isolated conductors in each case, comprising a shielding (15) of the conductor pairs (1) that consists of an electrically conductive material, and an outer cable sheath, characterized in that the electrical shielding (15) divides the cable cross section into at least two shielding sectors, and one conductor pair (1) extends in each shielding sector, such that the two conductor pairs (1) are shielded from one another and from the outside.

2. Data transfer cable according to claim 1, characterized in that four conductor pairs (1) are arranged symmetrically with respect to one another in cable cross section, and in that the shielding consists of two independent partial shieldings (11, 12) of which each partial shielding (11, 12) is associated with two conductor pairs (1) such that four shielding sectors (6, 7, 8, 9) are formed.

3. Data transfer cable according to either claim 1 or claim 2, characterized in that the electrical shielding (15) or partial shieldings (11, 12), viewed in the cross section of the cable, forms the shape of the number "6", one conductor pair (1) being arranged inside the round portion (13), and one conductor pair being arranged outside said portion (13), surrounded by the curved portion (14).

4. Data transfer cable according to claim 3, characterized in that two partial shieldings (11, 12), shaped as the number "6" when viewed in cross section, are provided, the two partial shieldings (11, 12) being arranged rotationally symmetrically with respect to one another, and each partial shielding being associated in each case with two conductor pairs (1) that are offset relative to one another by 90°.

5. Data transfer cable according to either claim 3 or claim 4,

characterized in that the round portion (13) of the partial shielding (11, 12) is closed.

6. Data transfer cable according to either claim 4 or claim 5, characterized in that the two partial shieldings (11, 12) are interconnected, in particular, adhesively bonded to one another, in the region of the round portion (13).

7. Data transfer cable according to either claim 1 or claim 2, characterized in that the shielding (5) or the partial shielding (11, 12), viewed in the cross section of the cable, is or are in the shape of the number "8", and the conductor pairs (1) extend in each case inside the two round portions (15).

8. Data transfer cable according to claim 1, characterized in that two partial shieldings, having the shape of the number "8", are arranged rotationally symmetrically within the cable cross section, and conductor pairs (1) offset by 90° in each case extend in the round portions (15) of each partial shielding.

9. Data transfer cable according to claim 7, characterized in that a partial shielding (17), shaped according to the number "8" when viewed in cross section, is formed, and in each case, two conductor pairs (1) offset relative to one another by 180° are arranged in the round portion (15) of the partial shielding (17), and the two other conductor pairs (1) extend in the gusset regions (19), and a circular partial shielding (18) is arranged in the periphery.

10. Data transfer cable according to one or more of claims 1 to 9, characterized in that the shielding (5) or the partial shielding (11, 12; 17, 18) consist of metal foils, in particular, aluminum foils or plastics-laminated aluminum foils.

11. Data transfer cable according to one or more of claims 1 to 10, characterized in that the conductor pairs (1) are stranded in a helical or SZ-like manner.

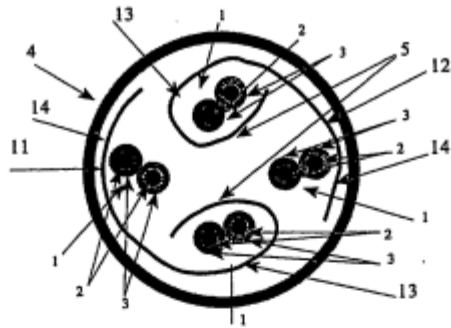


Figure 1

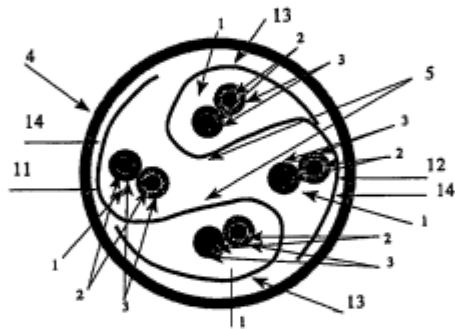


Figure 2

Adhesive bond

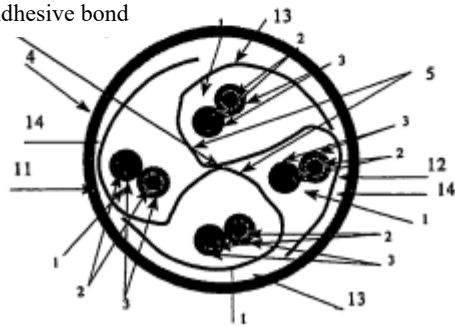


Figure 3

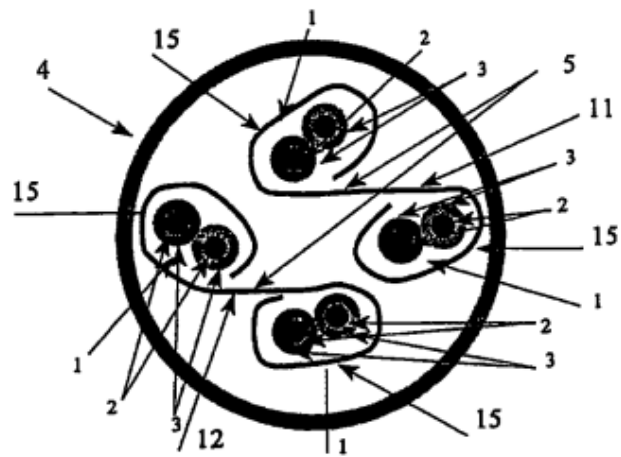


Figure 4

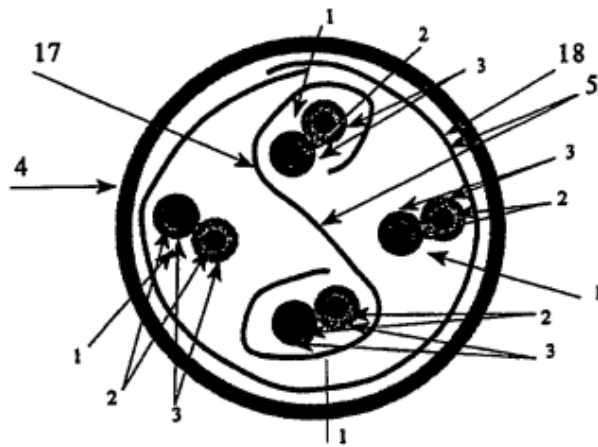


Figure 5

## TRANSLATOR DECLARATION

Date: June 13, 2023

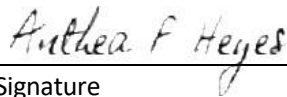
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The document is designated as:

- DE 297 19 866 U1

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