

CONNECTION DEVICE AND CONNECTION SYSTEM FOR INSULATED ELECTRICAL CONDUCTORS

The invention concerns a connection device and a connection system for a plurality of electrically insulated conductors.

For the connection of telephone- or data lines in telephone exchanges or distribution systems, frequently connection devices, for example, connector blocks
5 are provided. These as a rule comprise a plurality of guides for first lines ("incoming lines"), a plurality of guides for second lines ("outgoing lines") as well as contact elements for the connection of each of a first with a second line. Preferred are connection devices, which are provided solder-free for insulated conductors and which are based on the 'Insulation Displacement Contact' (IDC) -
10 technology. The contact elements then in preference each possess at least two insulation displacement contacts or - less preferably - two piercing contacts or one insulation displacement contact and one piercing contact.

Devices of this kind are known in diverse embodiments, and many of these are available on the market. Mentioned as documents, which demonstrate devices of
15 this kind, shall be, for example, EP-A-0 321 151, DE-A-2 301 398, and DE-A-196 52 422.

From the European disclosure document 0 994 528 a multiple connector block is known, which is based on the insulation displacement contact technology and which is characterised by the fact that the housing is in one part. Assigned to the contact elements, apart from the insulation displacement contacts on one side (on the side of the incoming lines), is also a cutting edge. This makes it possible upon connecting a conductor to be connected to simultaneously cut the conductor to the necessary length, without this requiring an elaborate tool. A one piece terminal box is also known from US 4,964,812.

In case of connection devices of the type mentioned, at least some of the following problem fields respectively come to bear.

1. Cross-talk behaviour between adjacent contact element pairs. This is of significance in particular in case of data transmission. The higher the data transmission rate, the greater the problems become. In order to assure the data transmission security, therefore the contact elements of connection devices for higher transmission frequencies have to be arranged as far apart as possible or all contact banks have to be equipped with compensating functionalities. This, however, is undesirable, or in many cases not possible for reasons of space and cost.
2. Easy connectability. Naturally there is the need to make the connection procedure as easy and as comfortable as possible. The necessity of complicated tools is to be avoided.
3. Manufacturing costs. In the market, there is an enormous pressure on prices for telecommunications equipment.

In the US - patent document 5,556,296 and the US - patent document 5,160,273 a connection device with a disconnecting contact is disclosed. A disconnecting contact of this kind consists of two separate contact elements each with an insulation displacement contact and a spring-loaded end contact, wherein the
5 spring-loaded end contacts of both contact elements are pressed against one another by the spring force. Between the two end contacts a separate element may now be inserted. Such an element may be electrically insulating, as a result of which the electric circuit is capable of being disconnected. It is also possible that a separate element of this kind, for example, is designed as a printed circuit and takes over a
10 certain function, e.g., as an overload protection or for receiving signals. In accordance with the two documents mentioned, the two contacts elements now are asymmetrically shaped, so that the distance between the end contacts within a disconnection contact pair is smaller than the distance between adjacent end contacts between disconnection contact pairs, which results in a reduced cross-talk.

15 Similar connection devices may be found in US 5,967,826, where apart from this a variant is demonstrated, in which the two contact elements opposite one another are connected by a bridge and therefore form a one-piece, U-shaped connection contact element.

Connection devices of this type with disconnecting contacts are advantageous for
20 special applications on the basis of their versatile functionality, they are, however, elaborate to manufacture, consist of many individual components and for geometrical reasons require a housing made out of several parts. Apart from this - also for geometrical reasons - the incoming and outgoing line are conducted on the same side of the housing and in the same direction, which calls for a precise
25 cutting-off of the lines by a separate cutter and which may lead to uncontrolled contacts between conductors.

Common to all devices in accordance with the documents mentioned above, is that they would not be suitable for high transmission rates of, for example, 100 Mbit/s or more on the basis of the cross-talk behaviour, unless they would be dimensioned to be very large. In addition they are partially very complex (i.e., expensive) in
5 manufacture and in part elaborate in the wiring.

It is consequently the objective of the invention to create a connection device, which also for high transmission rates and with small dimensions assures a satisfactory data transmission security according to the standards. An easy connectability and low manufacturing costs should in preference also be assured.

- 10 The device in accordance with the invention possesses a housing, which is in one part and in which there are a plurality of one-piece contact elements, each of which respectively comprises at least one first and at least one second insulation displacement - or piercing contact. Between the first and the second contact of each contact element there is a transition section. The contact elements are arranged in
15 pairs in an as such known manner. In accordance with the invention, the contact elements are now asymmetrical in such a manner, that the transition section is constructed in such a way, that the transition sections of both the contact elements of the pairs are closer together than the transition sections of adjacent contact elements of different pairs.
- 20 As a result of these differing distances between the transition sections, the cross-talk behaviour between adjacent pairs is reduced with fixed distances between the contacts. The differing distances between the transition sections are the result of an asymmetrical design of the contact elements. This results in a range of advantages. A first advantage is the fact, that the insulation displacement -, or piercing contacts

if so required may be arranged equidistantly. The asymmetrical shaping ensures, that the sections of the contact elements mainly relevant for the cross-talk behaviour - these are those, in which current flows - are nonetheless optimised, i.e., are arranged as far apart from one another as possible between the different pairs.

5 This makes it possible, without any change of dimensions in comparison with existing connection devices, to fulfil the requirements of a higher data transmission rate. For example, on the basis of the invention it is possible that a connection device corresponds to the category 5 according to ISO/IEC 11801 (2002), and this with dimensions, as are known from an existing device of the category 3. Plugs,

10 sockets, etc., of the existing system therefore may be utilised for the higher category 5. With the invention also connection devices of the category 6 are capable of being implemented in a tight space, wherein for this purpose preferably screening plates are utilised between the contact element pairs.

By the approach in accordance with the invention it is made possible, that the

15 housing is a single part. The manufacturing of the housing as a single, for example, injection-moulded part, has significant advantages: The manufacturing costs are lower than in case of multi-part housings. The construction in accordance with the invention enables the simple inserting of the contact elements into the single part housing. For the assembling of the connection device, therefore in the single part

20 housing solely chambers for the contact elements have to be provided.

Apart from this, as a further advantage the contact elements may be designed as plane and it is possible that they lie in a common plane. This is particularly favourable for the manufacture: all contact elements or at least groups of contact elements can be jointly stamped out of one metal sheet. Following possible

25 deformations, in particular by embossing and/or shearing, they are able to be inserted into the housing together, held together by a transport strip (bridge).

If the contact elements comprise at least one essentially plane section, they are, for example, asymmetrical with respect to that plane, which connects the two insulation displacement - or piercing contacts and which runs vertically to the plane section.

- 5 It is possible that the contact elements comprise elements protruding from the contact element plane and deviating from the plane configuration, produced, e.g., by embossing. Such elements may be designed as latching catches, which prevent a longitudinal displacement of the contact elements inserted into the housing. As further contact plane elements protruding from the contact element plane,
- 10 reinforcements may be present, which at critical points increase the mechanical stability and which therefore permit the utilisation of very thin metal sheets. Reinforcements of this type may in particular serve to assure the forces of the two forks of an insulation displacement contact.

- 15 It is possible that the first and second conductors run essentially parallel to one another and vertical to the contact elements, in an as such known manner in the area, in which they are contacted. Apart from this, they are conducted in general at opposite sides ("front" and "back") of the housing, when they are contacted. Although a construction of this kind is preferred, it is also possible to utilise the invention for connection devices, in which the first and second conductors are not
- 20 parallel (angled connection device). This may be implemented, for example, with bent contact elements.

Frequently the contact elements of each pair corresponding to one another (i.e., all "left-hand" or all "right-hand" contact elements of each pair) are designed identically. Every pair then contains respectively a first and a second contact

element, wherein the first and the second contact element differ by their shaping or their orientation. Within the contact element pair therefore the contact elements with a defined orientation are in accordance with the invention not identical. In the case of many preferred embodiments, however, the first and the second contact
5 element of each pair of contact elements are mirror inverted to one another.

Therefore it is possible, that so-to-say two types of contact elements, "right-hand" and left-hand" ones, or first and second ones are present. The first and the second contact elements may have an identical shape and solely differ with respect to their orientation. I.e., the second contact elements are then first contact elements, which,
10 for example, are rotated by 180 degree around a longitudinal axis. This is applicable in particular in those cases, in which contact elements do not comprise any elements protruding from the plane (latching catches, reinforcements, etc.).

Into the - for this purpose enlarged - intermediate spaces between the transition sections of contact elements of adjacent pairs, it is possible for screening elements
15 to be inserted. These are advantageous in particular in case of connection devices, which are foreseen for high data transmission rates: they make a more compact construction possible, while adhering to the standards (for example, category 6).

The housing in an as such known manner may comprise insertion slots for the conductors. By the insertion of insulated conductors into the insertion slots and the
20 subsequent pressing into the contact, the conductors are contacted, because the cutting terminals or piercing tips of the contacts protrude into these slots. It is possible that the sliding-in of the conductors – i.e. the connection - takes place with the help of a wiring tool.

It is possible, that the housing furthermore comprises catches for the attachment to an installation channel. These may be asymmetrical in such a manner, that it is possible to latch on to the installation channel in two orientations. In a first orientation then a first side (for the wiring of the first, here the "incoming" lines) and in the other orientation a second side (for the wiring of the second, here the "outgoing" lines) is located at the front and as a result of this is easily accessible. Catches of this type are known, for example, from EP-A-0 994 528, to which document reference is explicitly made here, in particular to Figure 1 and to its description.

- 10 In accordance with a preferred embodiment, the contact elements are each assigned at least one, frequently two cutters. By means of this or these, an over-length of a conductor is cut off directly during the wiring. As a result of the fact that the cutter is integrated into the connection device, the wiring tool is able to be designed in a very simple manner. Nonetheless, for the wiring and the cutting-off of over-lengths
15 only a single working step is necessary. Solutions, in the case of which a cutter is provided on the wiring tool, in contrast are more complicated.

The cutter or at least one cutter may be provided as a component separate from the contact element. This has advantages with respect to manufacturing technology: the cutter (or its cutting edge) naturally has to fulfil the prerequisite, that it is provided
20 in a different plane than the insulation displacement contact or the piercing contact. From prior art it is known, that the cutter is constructed as a single piece together with the contact element. In this case it is only possible to comply with the prerequisite mentioned, if the contact element (with cutting edge) is three-dimensionally shaped, therefore not in a single plane. Following the manufacture
25 by punching out from a metal sheet, in accordance with prior art therefore some reshaping of the element still has to be carried out, which is expensive. A further

advantage of having the cutter as a separate component is that the selection of materials in case of the components contact element and cutter may be optimised. Thus, for example, in the case of the cutter it is possible to select a harder material than for the contact element itself.

- 5 Especially preferred is a construction, in the case of which the contacted conductors do not touch the cutter anymore following the wiring operation. Then the cutter does not contribute to the cross-talk behaviour and the capacitance of the arrangement becomes smaller, which also minimises losses. Also the electrical potential of the cutter is not relevant then, and in principle it is possible that an
- 10 electrical contact exists between the cutters of adjacent contact elements. The connection device may even be designed in such a manner, that a cutting element forms several cutters and possibly comprises a single, common cutting edge running transverse to the direction of the conductor, which cuts off the over-lengths of several adjacent conductors.
- 15 Apart from the housing, the contact elements if so applicable the cutters, it is possible that the connection device still comprises further components.

For example, on one of the sides (typically on the side of the second "outgoing" conductors) there may be a wiring lid serving as a covering, on which it is possible to write or print. With this component the insertion slots can be covered and the

20 pairs of conductors may be written or printed on in accordance with their function.

As a further additional component, it is possible that the connection device - typically for the side of the first "incoming" conductors - is provided with a second cover, which may comprise a tension relieving element for a multi-strand cable.

Also additionally in one of the wiring lids and/or coverings or directly in the insertion slots for the conductors it is possible that a gel or a weather protection grease is present, which acts as a corrosion protection.

In the following, embodiments of the invention are described on the basis of
5 drawings. These drawings illustrate:

- Figure 1 a representation of a connection device in accordance with the invention with two coverings,
- Figure 2 an illustration of a connection device in accordance with the invention with in some areas uncovered contact elements and cutters,
- 10 - Figure 3 a connection device in cross section,
- Figure 4 an arrangement of two contact element pairs within a connection device in accordance with the invention,
- Figure 5 a depiction, on the basis of which the relative positions of contact element, cable and cutter following the wiring operation is evident,
- 15 - Figure 6 primary products manufactured by punching out and embossing with a multitude of contact elements and cutters for a connection device in accordance with the invention, together with a housing,

- Figure 7 an illustration of two connection devices in an installation channel,
- Figure 8 a housing and screening element of an embodiment of the connection device in accordance with the invention with screens between contact element pairs,
- 5 - Figure 9 a contact element pair for a variant of a connection device in accordance with the invention, in which incoming and outgoing conductors are positioned at an angle to one another,
- Figure 10 a plug for a patch cable for connecting to a connection device in accordance with the invention,
- 10 - Figure 11 a plug contact for a plug according to Figure 10 in three separate views.

The connection device 1 according to **Figure 1** complies with the category 5. It comprises a housing 2, which in an as such known manner comprises a plurality of chambers for contact elements. The chambers are located between insertion slots 2.1, which serve as guides for electrically insulated conductors to be contacted (not illustrated). The contact elements are arranged in pairs. In the depicted embodiment, the contact element pairs 11 are provided with a numbering 2.2. The insertion slots 2.1 in the embodiment illustrated are arranged equidistantly, i.e., the distances between two insertion slots 2.1 of a pair are at the same distance from one another as the distance from one insertion slot to the closest insertion slot of an adjacent pair. Laterally relative to the contact elements the housing comprises

catches 2.3, which serve for the attachment in an installation channel. Apart from the housing and the contact elements, the connection device comprises cutters 4, 5. Their function will be explained further below. In addition shown are a marking covering 6 for second lines (outgoing) lines) as well as a cable covering 7 for first lines (incoming lines). The cable covering 7 comprises a tension relief shackle 7.1, on which an incoming cable comprising several conductors may be mechanically guided and/or attached.

In **Figure 2** the housing 2 is illustrated only in part. Therefore one can see the contact elements 3 arranged in pairs next to one another as well as first cutters 4 and second cutters 5. Per contact element there is a first cutter 4 and a second cutter 5. The contact elements are essentially plane and define a contact element plane. The cutters in preference are arranged parallel to this contact element plane and are electrically insulated from the contact elements. The construction and arrangement of the contact elements in contact element pairs 11 are particularly well visible in the **Figures 3 and 4**. Each contact element forms a first insulation displacement contact 3.1, a second insulation displacement contact 3.2 and a transition section 3.3 running in between. It is possible that the insulation displacement contacts 3.1, 3.2 are shaped in an as such known manner and are provided for the multiple contacting of insulated conductors of a certain diameter or diameter range. In the illustrated embodiment, the insulation displacement contacts possess reinforcements 3.4, which have been produced by embossing and which ensure a mechanical stability and sufficient clamping forces also in case of the utilisation of very thin sheet metal. The also visible embossings (here as rectangular elements) in the area on the tightest point of the insulation displacement contact serve for the adjustment of the width of the contact slot, independent of the punching tool. In the area of the transition section 3.3 the contact elements comprise latching catches 3.5 formed by shearing, which following the insertion of the contact elements into the chambers of the housing 2 latch with a latching cog 2.4 of the housing and prevent

a displacement of the contact elements in the direction of their longitudinal axis. During "shearing" contrary to punching, the material is not completely removed; here simultaneously the latching catch is bent over. Depicted are two latching catches 3.5 per contact element. If the chambers are asymmetrical and shaped in
5 such a manner, that during the insertion they form a stop for the latching elements, then one latching catch per latching element is sufficient.

The contact elements are asymmetrically shaped and in particular in such a manner, that also in the case of an equidistant arrangement of the insulation displacement
contacts the transition sections 3.3 of the two contact elements of a contact element
10 pair are closer to one another than to the transition section of a contact element of an adjacent pair. This is in contrast to the prior art, in accordance with which the contact elements are respectively symmetrical (in this, the plane of symmetry is the plane extending in longitudinal direction, vertically to the contact element plane).

On the basis of the elements provided by embossing (latching catches 3.5,
15 reinforcements 3.4), the first and the second contact element 3 of every contact element pair are not only different with respect to their orientation, but they also differ geometrically. In the illustrated example, the first and the second contact elements are mirror inverted to one another.

During the wiring operation, conductors are inserted into the insertion slots 2.1 of
20 the housing from the outside, as a result of which in an as such known manner the insulation is locally cut through and displaced by the cutters of the insulation displacement contacts 3.1, 3.2, so that the insulation displacement contacts contact the conducting insides of the conductors. During the wiring simultaneously over-lengths of the conductor are cut off by the cutters 4, 5. The cutters are constructed

and arranged in such a manner, that following the wiring operation they are not contacted by the conductors. This is illustrated particularly clearly in **Figure 5**, where a wired conductor 12, a section of a contact element 3 and a cutter 4 are depicted. The cutter in the illustrated embodiment comprises an indentation 4.1, on
5 the basis of which a safety distance between the conductor and the cutter is assured, as a result of which it is also ensured, that no electrical contacting between the conductor and the cutter takes place.

Figure 6 illustrates how the utilisation of essentially plane contact elements makes possible a particularly simple manufacturing of the device in accordance with the
10 invention. The housing 1 is in preference manufactured as a single injection-moulded part. For the manufacturing of the contact elements 3, of the first cutters 4 and of the second cutters 5, by punching and subsequent embossing respectively out of a metal sheet - for example sheet steel - a primary product is manufactured. This comprises a plurality of contact elements/cutters, which are held together by
15 bridges 13, 14, or 15. The primary products if so required are cut to a length, which corresponds to the length of the connection device and subsequently in the orientation according to **Figure 6** are pressed into the chambers of the housing provided for this purpose. Thereupon the bridges are broken off. The cutters are held in the housing by wedging the cutters in the plastic housing (by barbs).

20 The contact elements - for example, in contrast to the contact elements in accordance with EP 0 994 528 - do not comprise any sections, which are bent over by more than 90 degrees relative to the contact element plane. It is only this circumstance that makes it possible for the contact elements (and also the cutters) to be manufactured solely by punching and embossing.

Figure 7 illustrates two connection devices, in the case of which the coverings 6, 7 are affixed, in an installation channel 21. The catches 2.3 engage in opening 21.1 provided for this purpose on the side walls of the cable channel, by means of which the connection devices are attached.

5 In **Figure 8** the housing 31 of an alternative embodiment of the connection device in accordance with the invention is illustrated. This connection device differs from the one described above by the fact, that between the contact element pairs (not illustrated) respectively a screening element is present. This is formed by screening walls 32.1, which are present on a screening element 32. For the screening walls in
10 the housing 31, special insertion slots 31.1 between contact element pairs are provided. As a result it is also possible to insert the screening element into the housing from the outside. The screening walls 32.1 screen the contact elements of adjacent pairs, in particular in the zone, where the insulation displacement contacts are spatially closer together than in the zone of the transition sections. The
15 screening walls 32.1 are all electrically connected with one another. Apart from this, the screening element 32 as a whole is grounded through fork contacts 32.2, which in the installed condition of the device make contact with side walls of the installation channel 21.

The embodiment according to **Figure 8**, for example, corresponds to the category 6.
20 The contact elements may be identical with the contact elements illustrated in **Figure 4**, wherein the distances between the contact element pairs possibly are greater than in the case of the embodiment described above. Of course the utilisation of different types of asymmetrical contact elements is also possible. In contrast to the device of the category 5 with 10 contact element pairs described
25 above, in the device with the same overall width according to **Figure 8** only 8 pairs are provided.

In **Figure 9** a contact element pair of an embodiment is illustrated, in which the incoming and outgoing conductors are at an angle relative to one another. Even if for the manufacturing of these angled contact elements 42 one additional processing step is necessary than in the case of the above embodiments and the housing possibly is not in a single piece, the idea in accordance with the invention is still implemented also in this embodiment. The transition sections 41.3 of the two contact elements of a pair also here on the basis of the asymmetrical construction (with respect to a plane, which connects the insulation displacement contacts together and runs vertically to the plane sections) are closer together than the distance to the adjacent contact element of a different pair amounts to.

The **Figures 10 and 11** illustrate a plug of a connection system, which instead of the direct contacting of cable cores (corresponding to the conductors) is capable through the insulation displacement contacts of being utilised to make a contact between a two-core cable and a contact element pair. The plug possesses a plug housing 51 with at least two plug contacts 52. The plug, for example, can be plugged into the connection device on the side of the outgoing conductors, wherein the housing, e.g., comprises holding tongues 51.1, which are inserted into the connection device and there guide and hold the plug. During the insertion into the connection device, a contact between the plug contacts 52 and the contact elements is made. This can be seen particularly clearly in Figure 11, where apart from a plug contact 52 also a section of a contact element 2 is illustrated. In Figure 11 the drawing A depicts a side view of a contact element with plug contact. Drawing B is a view of this arrangement obliquely from above, while drawing C represents the arrangement in a section along the line C-C (in drawing A) in a view from above.

The plug contact at the end side comprises a wire-like section 52.1, which for the purpose of forming the electric contact is brought between the forks of the

insulation displacement contact 3.2. The wire-like section in cross-section, for example, is round or rectangular. It has, for example, a diameter, which corresponds to that of a conductor with its insulation stripped off. It extends between two parallel tongues 52.3, which form a plane. Here, this plane extends
5 vertically to the contact element plane. At the other end the plug contact comprises a cable contacting section 52.4, which on its part may comprise at least one insulation displacement contact 52.5.

Conceivable are also plugs with more than two plug contacts, for example, with four plug contacts.

CLAIMS

1. Connection device for insulated electrical conductors, with a single piece housing (2, 31) and with a plurality of single piece contact elements (3) held by the housing, each of which comprising at least a first insulation displacement - or piercing contact (3.1) for the contacting of a first conductor,
5 at least a second insulation displacement - or piercing contact (3.2) for the contacting of a second conductor and with a transition section (3.3) extending between the first and the second insulation displacement - or piercing contact, wherein the contact elements form contact element pairs (11), **characterised**
10 **in** that the contact elements (3) are asymmetrically shaped in such a manner, that the transition sections (3.3) of the two contact elements of at least one contact element pair (11) at least in certain areas are located closer together than the transition section (3.3) of one of the two contact elements to the transition section (3.3) of a next contact element of an adjacent contact
15 element pair (11).
2. Connection device in accordance with claim 1, **characterised in** that the contact elements comprise a plane section and are asymmetrical with respect to that plane, which connects the insulation displacement - and/or piercing contacts (3.1, 3.2) and which extends vertically to the plane section.
- 20 3. Connection device in accordance with claim 1 or 2, **characterised in** that by the housing (2) a row of first insertion slots (2.1) and a row of second insertion slots (2.1) are formed, and that the contact elements (3) are arranged in such a manner, that a first insulated conductor is capable of being contacted by a first insulation displacement - or piercing contact, in that it is

inserted into a first insertion slot and a second insulated conductor is capable of being contacted by a second insulation displacement - or piercing contact, in that it is inserted into a second insertion slot.

4. Connection device in accordance with one of the preceding claims,
5 **characterised in** that to every contact element at least one cutter (4, 5) for cutting off an over-length of a conductor is assigned.
5. Connection device in accordance with claim 4, **characterised in** that to every contact element a first cutter (4) for cutting off the over-length of a first conductor and a second cutter (5) for cutting off the over-length of a second
10 conductor is assigned.
6. Connection device in accordance with claim 4 or 5, **characterised in** that the cutter assigned to a contact element (4, 5) or at least one of the cutters (4, 5) assigned to the contact element is constructed as a separate component.
7. Connection device in accordance with claim 6, **characterised in** that the at
15 least one cutter (4, 5) constructed as a separate component is plane and is arranged parallel to a first contact element plane.
8. Connection device in accordance with claim 6 or 7, **characterised in** that the housing (2) and the cutter (4, 5) constructed as a separate component are shaped and mutually arranged in such a manner, that a contacted conductor
20 does not contact the cutter after the cutting off of the over-length.

9. Connection device in accordance with one of the preceding claims, **characterised by** a covering (6, 7) for covering the contacts following the wiring operation.
- 5 10. Connection device in accordance with claim 9, **characterised in** that the covering (7) or at least one covering comprises a fixing element (7.1) for the attachment of a cable as tension relief device.
- 10 11. Connection device in accordance with one of the preceding claims, **characterised in** that the contact elements (3) comprise latching catches (3.5) for the prevention of longitudinal movements of the contact element (3) arranged in the housing (2).
- 15 12. Connection device in accordance with one of the preceding claims, **characterised in** that the first and the second insulation displacement - or piercing contacts (3.1, 3.2) are arranged in such a manner, that the first and the second conductors are guided on sides of the housing located opposite one another.
13. Connection device in accordance with claim 12, **characterised in** that the contact elements constructed as plane and are located in a common plane.
- 20 14. Connection device in accordance with claim 12 or 13, **characterised in** that the contact elements (3) are flat except for possible elements produced by embossing and/or shearing of a punched out metal sheet.

15. Connection device in accordance with one of the preceding claims, **characterised by** electrically conductive screening walls (32.1) arranged between the contact element pairs.
- 5 16. Connection device in accordance with claim 15, **characterised in** that the housing (31) comprises insertion slots (31.1), into which it is possible to insert screening walls (31.1) from the outside.
- 10 17. Connection device in accordance with claim 15 or 16, **characterised in** that the screening walls (32.1) are formed on a single screening element (32), and that the screening element (32) in preference comprises contact means (32.2) for grounding the screening walls (32.1).
- 15 18. Connection system comprising a connection device in accordance with one of the preceding claims, wherein at least the second contact (3.2) of every contact element (3) is an insulation displacement contact, as well as a plug for the connection of a cable containing at least two conductors, **characterised in** that the plug comprises plug contacts (52), which are capable of being directly contacted by the second contacts (3.2).
19. Connection system in accordance with claim 18, **characterised in** that the plug contacts comprise a section with a wire-like shape (52.1) for the insertion between cutters of the second contact (3.2).