

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number:

0 251 158
A2

(12)

EUROPEAN PATENT APPLICATION

(21) Application number: 87109022.1

(51) Int. Cl.4: H01R 9/05 , H01R 17/12

(22) Date of filing: 23.06.87

(30) Priority: 02.07.86 DE 3622116

(43) Date of publication of application:
07.01.88 Bulletin 88/01(84) Designated Contracting States:
BE CH DE ES FR GB LI NL SE(71) Applicant: Walter Rose GmbH & Co. KG
Lütkenheider Strasse 2
D-5800 Hagen 1(DE)(72) Inventor: Fremgen, Dieter, Dipl.-Ing.
Hans-Böckler-Strasse 46
D-5603 Wülfrath(DE)
Inventor: Penz, Heinz
Kleine Strasse 22
D-5800 Hagen 1(DE)(74) Representative: Patentanwälte Meinke und
Dabringhaus Dipl.-Ing. J. Meinke Dipl.-Ing. W.
Dabringhaus
Westenhellweg 67
D-4600 Dortmund 1(DE)

(54) Device for contacting a substrate.

(57) A device for contacting a substrate, preferably an electrical conductor, with spring parts that are in contact with the substrate at a plurality of points. Substrates of different diameters can be contacted without problem and for electrical conductors a high HF-impermeability is guaranteed. The device comprises at least one helical spring (5) arranged substantially annularly in a housing (1), with the helical windings (9) of the spring inclined at an angle α to the radial plane (10) perpendicular to the contact axis (11)

When different sized substrates are inserted the windings turn, changing the angle α . This requires little force. Also the spacing of adjacent helical windings is maintained so that for electrical conductor substrates the same high HF impermeability is guaranteed for all conductor diameters.

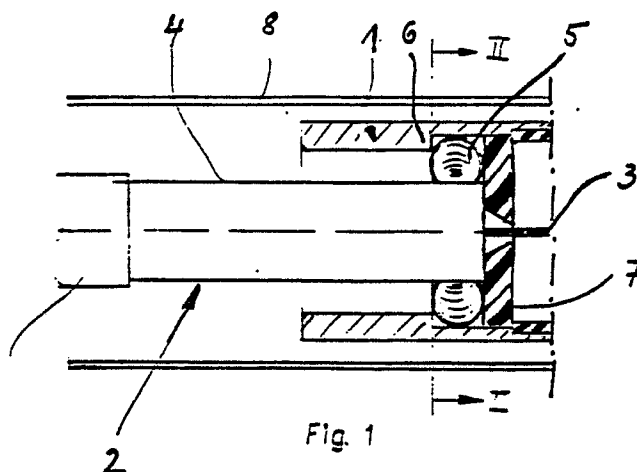


Fig. 1

EP 0 251 158 A2

Device for Contacting a Substrate

The invention relates to a device for contacting a substrate with spring parts that are in contact with the substrate at a plurality of points. The device is particularly, but not exclusively used for contacting one or more electrical conductors, for example coaxial cables.

It is known to cut back coaxial cables appropriately for introduction into housings, couplings or other elements and to push the cut-back ends into contact sockets having substantially cage-shaped contact springs in their interiors. These contact springs are punched out of sheet metal and provided with tongues which, in the position of use, rest on the surface of the conductor being contacted. There may be mentioned here, merely by way of example, DE-GM 85 18 813. A particular disadvantage of such contact springs is that so-called HF-leakage may occur between the region (sic) not covered by the contact tongues. For this reason, screening elements are typically provided, as is described, for example, in DE-GM 86 00 598.

Another problem which arises in practice is that, as a rule, only a limited number of different outer diameters of conductors can be held by such contact cages, that is to say, depending on the field of application in which the contact elements are used, the user has to carry around with him a large number of different contacting devices. Another disadvantage with this prior art solution is that they have a comparatively great overall length. If, in addition, screening elements are provided, as a rule, the overall length of those screening elements is added to the overall length of the contact cages which is already comparatively great.

Another type of contact spring for contacting the outer conductor of a coaxial cable is described in DE2252026. This describes an annular spring which can be pressed against the outer conductor of the coaxial cable. The spring may be preselected for a particular diameter coaxial cable, or can expand or contract according to the diameter of the coaxial cable. Where a large diameter cable is used the spring is stretched so that the turns thereof are widely spaced. This is a disadvantage where high frequency (HF) protection is required. Also where a large cable is used, and the spring needs to be stretched a relatively large amount, the spring and/or cable may disadvantageously be damaged.

It is an object of the present invention to provide a device for contacting a substrate with which, firstly, substrates of different diameters can be contacted without problem and, secondly, where the substrate is electrically conductive a high HF-impermeability is guaranteed, whilst, at the same time, a great saving in space is involved.

The present invention provides a device for contacting an elongate substrate with spring parts that are in contact with the substrate at a plurality of points, comprising at least one helical spring arranged substantially annularly in a housing, the spring having helical windings which are set at an angle α to the radial plane perpendicular to the substrate middle axis, which can notionally be assigned to each helical winding.

The invention is particularly useful for contacting electrical conductive substrates such as cables, for example the outer conductor of a coaxial cable. Much of the discussion which follows addresses this application. However the device can also be used for other applications, for example to provide a centralising function for any elongate substrate, or to transfer stresses and provide strain relief for such a substrate. Thus the invention is also applicable for substrates other than conductive cables.

The term "housing" as used herein is not intended to refer to a limited component. For example, the contact helix can be provided in a cable coupling, in inlet and outlet sockets of branches, distributors, in the case of terminal elements of cables, and so on.

The invention achieves a great number of advantages. Firstly, the helical spring can be wound comparatively tightly so that, assuming a metallic spring, high HF-impermeability is guaranteed for the annular cross-section in which the helical spring is arranged between the substrate and housing element. This may be important when the substrate is electrically conductive, and shielding is desirable. Because the helical windings of the spring are set at an angle, when substrates of different diameters are inserted the windings can simply change their angle of operation to adopt to the different sized substrates. Thus for a larger inserted substrate the angle α is increased. Whatever the size of substrate the outer diameter of the spring remains unchanged while the internal diameter varies to accommodate the substrate size range. The distance between adjacent turns of the spring remains unchanged regardless of the outer diameter of the substrate. This is important when the substrate is a cable and spring metallic since it means the same high frequency protection can be

maintained. This is in contrast to the spring described in DE2252026 in which the spring expands (rather than the windings turning) to accommodate the larger size cable. In this prior art solution the windings therefore become more widely spaced when a larger cable is inserted and the high frequency protection is consequently reduced. Another advantage of the present invention is that when a large substrate is inserted a smaller force needs to be exerted to rotate the spring windings in the present invention, than to stretch them as in the prior art solution. Thus there is less likelihood of damage to the substrate or spring in the present invention than in the prior art. A final advantage is that a helical spring occupies a comparatively small space inside a housing, so that the entire element can be of a small size.

It has been found that a disadvantage of conventional contact cages and the spring contact of DE 2252026.9 is that the contacting points may be deformed when there is rotational movement of the substrate (which in the prior art is a cable) during insertion into the contact cage. One disadvantage of this is that any HF-impermeability that existed previously can both not be guaranteed. In principle, such rotational movement when inserting the substrate should be avoided. It can not, however, in practice, be eliminated. The angled winding of the helical contact spring according to the invention is able to accommodate the rotational movement on insertion of the substrate. Thus whether or not the substrate is briefly turned makes no difference. Consider for example what happens when a rotating substrate meets a winding of the contact spring of the present invention. This winding already has a pre-formed inclined position with respect to the radial plane correspondingly located on the middle axis. It is thus able to deform perpendicular to the insertion movement of the substrate. In other words, this corresponding winding automatically leans to the side when the substrate having an outer diameter greater than the inner diameter of the helical contact spring formed by the annular helical spring is inserted.

In one embodiment, particular preferred where the device is for contacting coaxial cables, the helical spring is accommodated in an electrically conductive housing. Preferably the housing is one generally known in the field of cage-shaped contact springs.

The contact spring may extend in any suitable shape. For example it may extend annularly, angularly, elliptically, polygonally or in any other shape.

The windings themselves of the helical spring may also take any suitable shape. For example they may be circular, elliptical or angular, for example triangular. Shapes other than circular generally take up less space, and may also give better contact, depending on the shape of the substrate to be contacted.

There may be applications in which a plurality of cables, for example, are inserted into a distributor housing. Typically, the distributor housing is of electrically conductive construction and the outer conductors of the inserted coaxial cables are all electrically connected to each other via the housing. In this case, it may be desirable to use a common helical contact spring according to the invention for a plurality of cable inlet sockets. This may provide advantages in terms of production engineering. Such a construction is similarly provided according to the invention.

The invention is now described by way of example with reference to the accompanying drawings in which:

Figure 1 is a section through a contact socket having the helical contact spring according to the invention and an inserted coaxial cable,

Figure 2 is a section along the line II-II in Figure 1; and

Figure 3 is an elementary representation of the enlargement of the inner diameter of the helical contact spring.

A coaxial cable 2 is inserted in a cylindrical housing consisting of electrically conductive material and generally designated 1 in Figure 1. The inner conductor 3 meets a contacting element which is not shown, whilst the outer conductor 4 is surrounded on the outside by a helical contact spring 5 constructed in accordance with the invention. This helical spring 5 is supported on a shoulder 6 of the housing 1 and is additionally held by an insulating plate 7.

Figure 2 shows how the helical contact spring 5 is accommodated inside the housing 1 in the annular space formed by the shoulder 6 and the insulating plate 7, without showing the shrinkable tube piece 8, still shown in Figure 1, which surrounds the entire unit.

Figure 3 shows the particular shaping and arrangement of the individual windings, designated 9, of the helical spring 5. The left-hand side of Figure 3 shows the helical spring 5 in the installation state as a relaxed spring, whilst the right-hand half of the Figure shows the same spring in one of the possible contacting positions. As will be apparent from the left-hand side of Figure 3, in the relaxed state, the helical winding 9 is set at an angle, designated α , to a notional radial plane extending through the conductor middle axis 11, which plane is designated 10. The arrangement is such that also the

portion of the backwinding, shown by a dotted line in Figure 3, has a certain angle to that plane 10, which is other than 0 and faces in the same direction as the angle α .

The right-hand side of Figure 3 shows the enlargement of the inner diameter, for example as a result of inserting a corresponding cable. The angle has now become greater and the back winding also has a greater angle to the corresponding radial plane designated 10' therein. As a result of this angled position, a rotational movement when inserting a cable to be contact is unnecessary. The helical spring automatically "leans" to the side to take account of the respective larger outer diameter of the inserted cable. It will be appreciated that a very great band width of cable outer diameters can be held here without contacting being thereby impaired.

The possible ways in which the helical springs can be arranged inside a housing or the like in a shape other than the annular shape are not shown. If extremely high HF-impermeability is required, it is also possible for two helical springs having a differing inclination of the windings to be arranged in a housing one behind the other; this possibility also is not shown.

Claims

1. A device for contacting an elongate substrate with spring parts that are in contact with the substrate at a plurality of points, comprising at least one helical spring (5) arranged substantially annularly in a housing (1), the spring having helical windings (9) which are set at an angle α to the radial plane (10) perpendicular to the substrate middle axis (11), which can notionally be assigned to each helical winding (9).

2. A device for contacting an elongate substrate with helical springs parts that are in contact with the substrate at a plurality of points, wherein in the position of use, the helical spring (5') extends substantially angularly, elliptically, polygonally or in any shape other than an annular shape for the purpose of contacting correspondingly shaped substrates.

3. A device according to claim 2, wherein the spring has helical windings (9) which are set at an angle α to the radial plane (10) perpendicular to the substrate middle axis (11) which can notionally be assigned to each winding.

4. A device according to any preceding claim for contacting an electrical conductor, wherein the spring comprises electrically conductive material.

5. A device according to any preceding claim wherein the helical spring (5) is accommodated in an electrically conductive housing (1).

6. A device according to any one of the preceding claims, wherein the helical spring (5') surrounds a plurality of cable inlet sockets at least in regions for the purpose of contacting the respective outer conductors of coaxial cables.

7. A device according to any preceding claim, wherein the spring comprises helical windings (9) which are circular elliptical or angular, for example triangular in shape.

8. A device according to any preceding claim, wherein the helical spring 5 provides a closed loop.

9. A device according to any preceding claim arranged such that the outer diameter of the spring remains constant and only the inner diameter of the spring changes when substrates of different diameter are inserted within the spring.

10. A device according to any preceding claim wherein the spacing of adjacent windings of the helical spring remain constant when substrate of different diameter are inserted therein.

