(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 168 319**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **85401356.2**

(51) Int. Cl.⁴: **H 01 R 13/422**

(22) Date of filing: **04.07.85**

(30) Priority: **06.07.84 FR 8410769**

(43) Date of publication of application:
15.01.86 Bulletin 86/3

(84) Designated Contracting States:
DE GB IT SE

(71) Applicant: **ITT COMPOSANTS ET INSTRUMENTS**
157, rue des Blains
F-92220 Bagneux(FR)

(72) Inventor: **Tournier, Gilles François André**
20, rue du Lauragais
F-31490 Leguevin(FR)

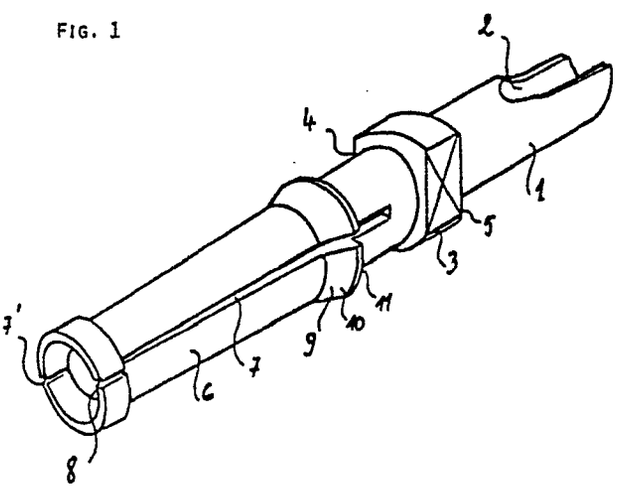
(74) Representative: **Kohn, Philippe et al,**
ITT Data Systems France S.A. Tour Maine-Montparnasse
33, avenue du Maine
F-75755 Paris Cedex(FR)

(54) Electrical connector.

(57) The invention is related to an electrical connector comprising an insulating block (14) containing, in housings (13), socket contact elements (12). Each housing comprises a front shoulder (23) and a rear shoulder (24) on which the contact element (12) bears and which holds it axially.

For this purpose the contact element comprises a flange (3) which holds it to the front and a holding relief (9) which holds it to the back. This relief (9) is tapered forwards (in 10) and the socket (6) is equipped with slots (7) extending beyond the relief (9). This enables the holding relief (9) to pass through the shoulders when inserting the contact element.

FIG. 1



EP 0 168 319 A2

The invention is related to electrical connector and more precisely to an electrical connector comprising an insulating block in a single part in which housings are provided for socket contact elements, each one provided with a shoulder facing forwards to prevent a backward movement of a socket contact element fully inserted into its housing. Each socket contact element is comprised of a contact body of generally cylindrical and hollow form in view of housing a plug contact pin, together with stop means cooperating with the housing to limit the forward insertion movement of the contact element in its housing.

Such electrical connectors are known, for example from the connector sold under the designation DBM 25S by the Applicant of this application. In these connectors, the socket contact elements comprise, starting from the back of the connector, a connection lug, for example a hollow pin for soldered connection, a rear flange acting as stop and cooperating with a shoulder facing towards the back, made to protrude inside the housing, a retractable device designed to cooperate with the said shoulder facing forward to prevent a backward movement of the contact element when it is fully inserted into its housing, a socket of generally cylindrical and hollow form, provided in front, with an inside chamfered sleeve to house plug pins of suitable dimensions and prevent the entry of overlarge pins, and behind this sleeve, a cylindrical body in which a window is made and on which a rolled spring adapts, one end of which protrudes inside of the window, so as to bear against a plug pin inserted into the socket and make an electrical contact with a given pressure on the latter.

Said retractable device is a split spring ring which, when the contact element is inserted into its housing, through the back of the connector, retracts so as to pass through said shoulder facing backwards; when the contact element is fully inserted, this ring protrudes radially to the outside just before said shoulder facing forwards and prevents any movement backards.

This contact element, although it proves technically satisfactory, is relatively costly, because it is made of three parts, produced separately, then assembled.

The object of this invention is an electrical connector comprising socket contact elements each produced in one single part, quite satisfactory but less costly.

This objective is attained in the connector subject of the invention, by a socket contact element comprising a contact body of generally cylindrical and hollow form provided with at least two axial slots which divide it into two contact parts at least that can be radially and elastically deformed towards the inside, together with a holding relief located and formed so as to cooperate with the said shoulder facing forwards, to prevent any backward withdrawal movement of the fully inserted contact element, said slots extending from the front end of the contact element to beyond said holding relief, so that the latter can retract elastically on insertion and pass through said shoulder.

An advantage of said holding relief is that it contains a conical front section so as to pass through said shoulder more easily.

Moreover, said contact parts have been radially curved towards the inside to generate a contact pressure on a plug pin inserted between them.

To prevent the entry of a plug contact pin of excessive size, the outside diameter of the said cylindrical body and the elasticity characteristics of said contact parts are defined in relation with the inside diameter of the housing so that an attempt to insert an overlarge plug pin separates said contact parts until they bear against the wall of the housing, before their yield strength point is passed and permanent distortion develops.

According to a variant of the invention, the outside dia meter of the said body is enlarged, forming a bearing collar at its front end, so as to limit the thickness of the said body over a part of its length.

Moreover, according to a practice applied in the connector already referred to, the housing contains at least one flat section at the point at which the flange is placed and the latter contains a corresponding flat section cooperating with that of the housing to

lock the contact element in rotation.

The contact element of the invention also contains a flat section along the cylindrical body, which gives to the flat section a considerable depth without preventing the entry of the contact element into its housing.

The different objects and features of the invention will now be detailed in the following description of a non limitative embodiment, by referring to the figures appended which show:

- Figure 1, a perspective view of the socket contact element used in the connectors subject to the invention.

- Figures 2a to 2c, three partial cross-sectional views illustrating the gradual entry of the contact element of Figure 1 in the body of the connector subjet to the invention.

Figure 1 shows a perspective view of an embodiment of the socket contact element of this invention. This contact element, in one single part of conductive metal, with elasticity, such as bronze or brass, includes from rear, on the right of the drawing, to front, on the left, a connecting lug 1, in the form of a hollow cylindrical solderable pin containing a notch 2, then a flange 3, whose diameter is greater than that of the lug and provided with two opposite flat sections 4 and 5, and lastly a cylindrical body 6, hollow and split over practically the whole of its length, the diametral slots 7 and 7' extending from its front end 8 to the vicinity of flange 3. Between the front end 8 and flange 3, this cylindrical body comprises a holding relief 9 with a generally tapered form, with an inclined front side 10 and a straight rear side 11.

Referring to Figure 2, whose parts 2a, 2b and 2c illustrate three successive stages in the insertion of a contact element 12 such as the one in Figure 1, in a housing 13 of an insulator 14 of a socket connector only partially visible, we shall now examine the role of each of the parts of this contact element and how they cooperate with housing 13.

Figure 2a shows contact element 12 complying with the one in Figure 1, side view, at the start of insertion according to arrow 15 in housing 13, before any distortion. It can be seen that the two

contact parts 16, 17 are squeezed towards each other and that slot 7, initially of a certain width, at its base 18, for example 0.4 mm, is reduced to nothing at its left hand end 19.

This is obtained starting from a hollow cylindrical body with cylindrical internal (20) and external (21) walls, in which two diametrically oppposite slots 7 and 7' of uniform width are made.

Then, one of the contact parts, 16 for example, is forced radially towards the other, 17, until the yield strength is exceeded, which permanently distorts it radially to the inside, whereas it is made certain that the yield strength of the other part is not exceeded. The same process is also applied to contact part 17. This results in a bending of the two contact parts against each other with controlled force.

Slot 7 extends almost to flange 3. It stops at a short distance from it, imposed by manufacturing facility considerations. In particular it is necessary to be able to fettle the base of the slot.

The presence of a collar 22 will be noted at the front end of the contact element. Its role will be seen later on. For the moment it suffices to indicate that its outside is such that it does not impede the insertion of the contact element up to the position shown in Figure 2a.

In fact, housing 13 contains inside two shoulders 23 and 24 limiting a reduced diameter cylindrical projection 25 in which collar 22 must pass then contact parts 16 and 17 up to the position shown where the holding relief 9 comes in contact with the shoulder facing backwards 24.

At this stage, pressure being applied in the direction of the arrow 15, the conicality of side 10, the existence of slots 7 and 7' separating contact parts 16 and 17, together with the flexibility of these contact parts, make the holding relief 9 slip against the edge of shoulder 24, the two contact parts 16 and 17 being squeezed toward each other, then go beyond this edge which leads it to the position illustrated by Figure 2b where it can be seen that the slot 7 is enclosed over a part of its length.

The movement continues until flange 3 comes to bear against

shoulder 24, via its front edge 26, as shown in Figure 2c. At the point where flange 3 is housed, housing 13 contains flat sections adapted to those of the flange. It is therefore necessary that the orientation given to contact element 12 be such that the flat sections of the two parts coincide, after which they will prevent the contact element being able to turn in its housing.

Moreover, the distances between the rear side 11 of relief 9 and the front side 26 of flange 5 is adapted to that which separates shoulders 23 and 24 from each other, in such a way that, also due to the elasticity of the two contact parts 16 and 17, holding relief 9 and return radially to the outside, its rear side 11 passing in front shoulder 23. Now, the contact element 12 is held axially in both directions inside housing 13. This result is obtained without any additional part, through relief 9 and slots such as 7. The sizing of these elements for the different types of connectors can be determined experimentally.

Moreover, the bending of the contact parts and their elasticity are such that, as has been seen previously, an elastic force biasses these parts to each other. A contact pin inserted between them will therefore be pressed by these contact parts with a force which can be selected so as to procure the contact quality required. It is therefore not necessary to provide a part reserved for this purpose.

Lastly, the diameter of housing 13, the outside diameter of collar 22 and the thickness of this collar 22 up to wall 20 are such, on entry of the socket contact element 12 that, for a plug pin of maximum permitted diameter, which separates parts 16 and 17, via chamfer 27 (Figure 2a), these contact parts are forced radially towards the outside until they come in contact with the inner wall of housing 3, nevertheless preserving a functional clearance between them and cavity 13. The deformation of contact parts 16 and 17 is then such that their yield strength is not exceeded. A larger plug pin than the maximum permitted could not enter into the contact elements nor cause the elastic limit of the contact part to be exceeded owing to the fact that then the contact parts 16 and 17,

pressed against the wall of housing 13, would prevent its insertion. The case of a smaller plug pin skew inserted and liable to fatigue the contact element produces the same conclusions. The contact element is always protected against excessive deformations by cooperation between the form of its outer surface and the inner surface of the housing.

Lastly, although this is not shown on the figures, cylindrical body 6 of the contact element is, if required, provided with a flat section coplanar with each flat section of flange 3. In fact, the size of the contact element, in front of flange 3, cannot at any point exceed the surface of the flat sections of the flange; this would prevent the insertion of the contact element on the flat sections of the housing.

It is quite obvious that the above descriptions have been provided as non exhaustive example and that numerous versions can be envisaged without going outside the context of the invention.

CLAIMS

1. Electrical connector containing an insulating block (14) in one single part in which housings (13) are provided for socket contact elements (12), each one provided with a shoulder facing forwards (23), to prevent movement backwards of a contact element fully inserted into its housing, together with socket contact elements each comprising a contact body (6) of generally cylindrical and hollow form and stop means (3) cooperating with the housing to limit the forward insertions movement of the contact element in its housing, wherein said cylindrical body contains at least two axial slots (7, 7') which divide it into at least two contact parts (16, 17) that can be radially and elastically deformed towards the inside, together with a holding relief (9) located and formed so as to cooperate with the said shoulder facing forward (23) to prevent a backward withdrawal movement of the fully inserted contact element, said slots (7, 7') extending from the front end of the contact element to beyond said holding relief (9) so that the latter can retract elastically on insertion and pass through said shoulder.

2. Electrical connector as claimed in claim 1, wherein said holding relief contains a tapered front section (10).

3. Electrical connector as claimed in claim 1 and 2, wherein said contact parts (16, 17) have been curved radially towards the inside and bear against each other, or the others, to generate a given contact pressure on a socket pin inserted between them.

4. Electrical connector as claimed in claim 1, 2, or 3, wherein the inside diameter of housing (13) and the outside diameter of the contact element (12) at its front end are such that the maximum radial spacing of the contact parts (16, 17) cannot produce any permanent distortion on them.

5. Electrical connector as claimed in claim 4, wherein a collar (22) is provided at the front end of the contact element, to increase the outside diameter locally without increasing the thickness of the cylindrical body (6) over the whole length.

6. Electrical connector as claimed in any one of the preceding claims and containing at least one flat section in each housing, cooperating with a flat section (5) provided on the contact element, wherein a coplanar flat section extends, as far as required, over the whole length of said cylindrical body.

0168319

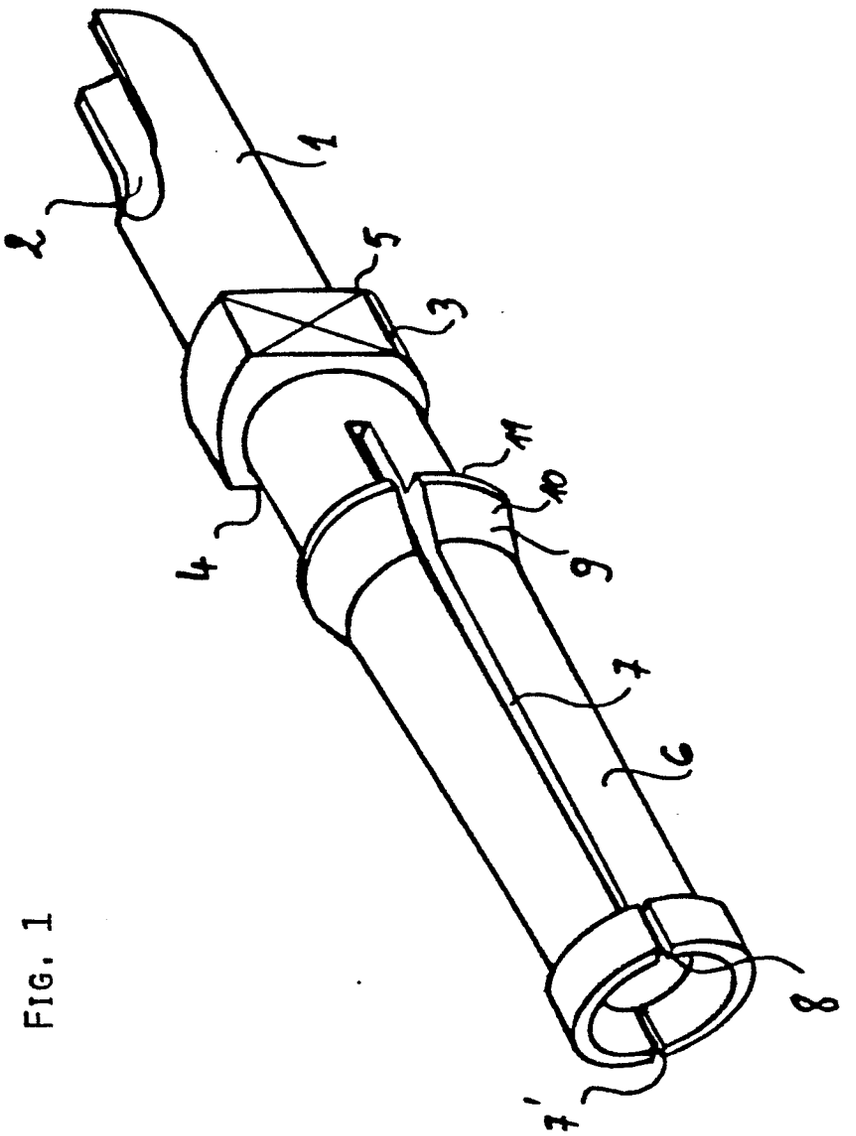


FIG. 1

0168319

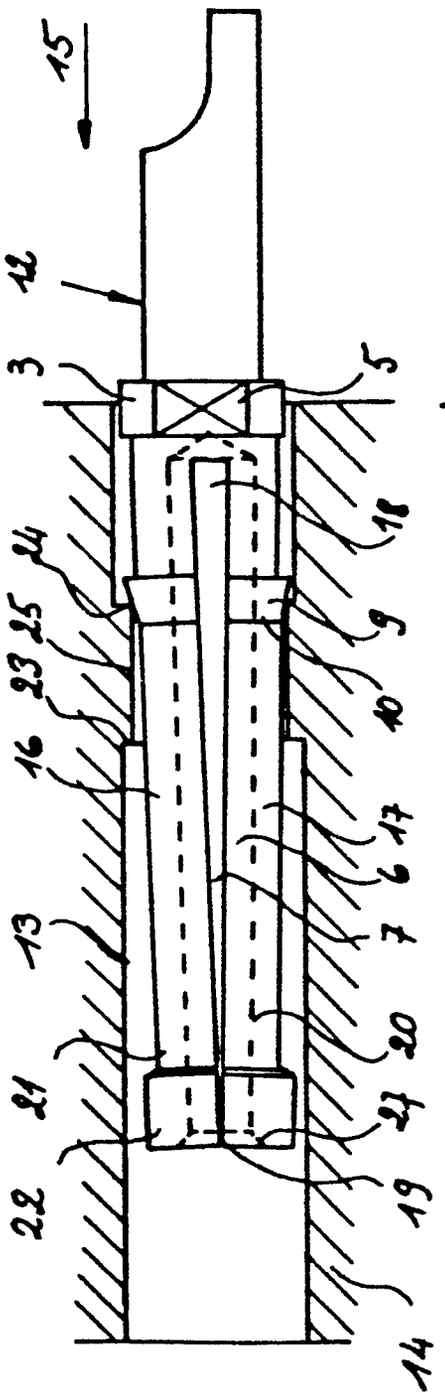


FIG. 2a

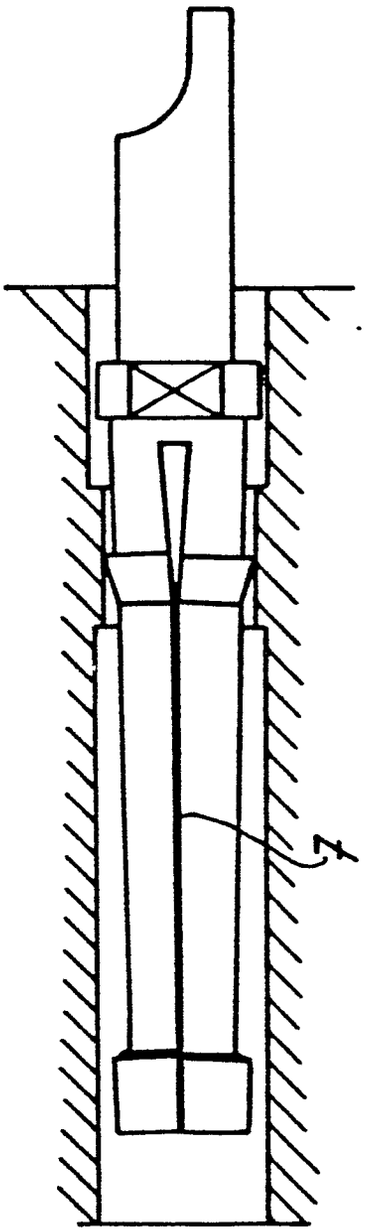


FIG. 2b

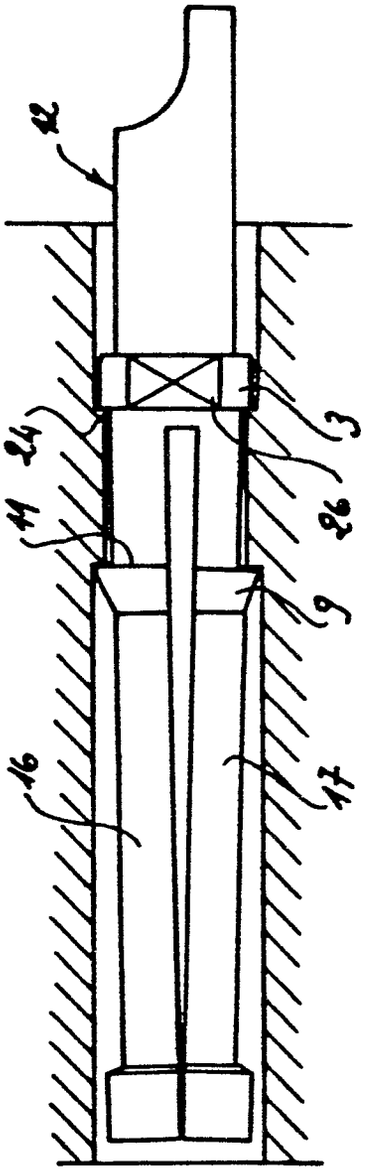


FIG. 2c