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(12) # EUROPEAN PATENT APPLICATION

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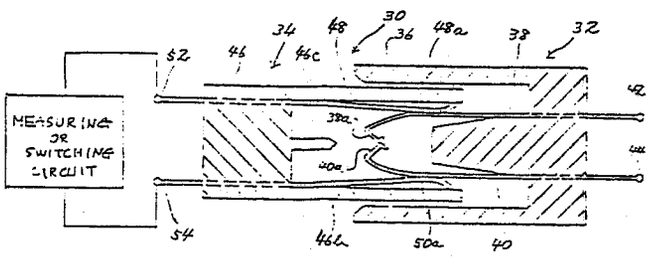
(54) **Connector connectable with no instantaneous shut-off.**

(57) The connector is of the type allowing signals generated in a communication apparatus or the like to be measured or switched without instantaneous shut-off. The connector is made up of a socket (32) having two first contacts (38, 40) which resiliently make contact with each other, and a plug (34) having two second contacts which engage the first contacts respectively as the plug is pushed into the socket. The plug also has a projection (46c), or breaking member, which is made of an insulating material. When the plug is fully inserted into the socket, the projection forces the first contacts (38, 40) apart and interrupts the resilient contact therebetweeen.

FIG. 4A



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Description

CONNECTOR CONNECTABLE WITH NO INSTANTANEOUS SHUT-OFF

BACKGROUND OF THE INVENTION

The present invention relates to a connector for measurement which is applicable to a communication apparatus and others and, more particularly, to the structure of a connector which allows the measurement and switching of a signal generated in an apparatus to be performed without causing instantaneous shut-off.

A prior art connector of the type described is made up of a socket and a plug which is adapted for measurement. Female contact pieces which are built in the socket to serve as contact springs cooperate to complete a closed circuit. Male contact pieces provided on the plug may be inserted into between the female contact pieces to pick up a signal from the closed circuit within the socket or to switch the signal, without entailing instantaneous shut-off. To attach and detach the plug from the socket without causing shut-off, the contact springs installed in the socket are provided with two contact points which are located one after another with respect to an intended direction of plug insertion. Specifically, the female contact pieces are individually provided with two contacts arranged one after another, i. e., a first contact with which the plug makes contact first as the plug is inserted deeper into the socket, and a second contact with which it makes contact when the plug is fully inserted into the socket. This kind of connector is disadvantageous in that the structure is complicated, and that the depthwise dimension of the socket is great. Moreover, since the delicate procedure from the start of contact of the male contact pieces with the first contacts of the female contact pieces to the opening of the second contacts relies simply on the shape and dimensions of the female contact pieces, special management is needed not only for the dimensions of the individual parts but also for the maintenance of quality after assembly of the individual parts.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to eliminate the drawbacks particular to the prior art connector of the type described as stated above.

It is another object of the present invention to provide a connector of the type described which is simple in construction and needs a minimum of depthwise dimension.

It is another object of the present invention to provide a connector of the type described which positively functions against instantaneous shut-off after assembly and, thereby, eliminates the need for special management after assembly.

It is another object of the present invention to provide a generally improved connector of the type described.

A connector connectable without instantaneous shut-off of the present invention comprises at least a pair of resilient female contact pieces facing each other and each having an engaging portion and a contact portion, the contact portions facing and resiliently making contact with each other, at least a pair of male contact pieces facing each other and each having a contact portion which is engageable with a respective one of the contact portions of the female contact pieces from the outside of the contact portion, and a projection disposed between the male contact pieces and made of a resilient material for, when the male contact pieces are individually engaged with the female contact pieces from the outside, cancels the resilient contact of the facing contact portions of the female contact pieces.

The above and other objects, features and advantages of the present invention will become apparent from the following detailed description taken with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a section of a prior art connector of the type causing no instantaneous shut-off;

Figs. 2A and 2B are sections showing a sequence of steps for mating a plug of the connector of Fig. 1 with a socket;

Fig. 3 is a section showing a connector of the type described in accordance with the present invention;

Figs. 4A and 4B are sections showing a sequence of steps for mating a plug of the connector of Fig. 3 with a socket; and

Fig. 5 is a fragmentary enlarged section showing an alternative structure for breaking a closed circuit which is installed in the socket in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

To better understand the present invention, a brief reference will be made to a prior art connector of the described, shown in Fig. 1. The prior art connector, generally 10, consists of a socket 12 and a measuring plug 14.

The socket 12 is made up of a housing 15 made of an insulating material, and female contact pieces 16 which are disposed in the housing 15 to face each other. Each female contact piece 16 is provided with a first contact 16a and a second contact 16b. Usually, the female contact pieces 16 are resiliently held in contact at their second contacts 16b to complete a closed circuit via terminals 18 and 20, which are connected to a circuit installed in an apparatus. On the other hand, the measuring plug 14 comprises a body 22 made of an insulating material, male contact pieces 24 provided on both sides of a mating portion of the plug 14, and terminals 26 and 28 which are connected to a measuring circuit or a switching circuit.

The shut-off preventing function of the connector 10 will be described with reference to Figs. 2A and 2B. As shown in Fig. 2A, as the plug 14 sequentially inserted into the socket 12, the male contact pieces 24 are engaged with the contacts 16a of the female

contact pieces 16, but the contacts 16b are still closed. In this condition, two different conduction paths are developed at the same time, i. e., one extending from the terminal 18 to the terminal 20 via the contacts 16b, and the other extending from the terminal 18 to the terminal 26 via the contacts 16b and 16a or from the terminal 20 to the terminal 28 via the contacts 16b and 16a. As the plug 14 is inserted deeper into the socket 12 from the position shown in Fig. 2A, it sequentially urges the female contact pieces 16 away from each other. As shown in Fig. 2B, when the insertion of the plug 14 into the socket 12 is completed, the contacts 16b of the female contact pieces 16 become open. At this instant, a signal coming in through the terminals 18 and 20 appear on the terminals 26 and 28, respectively, and are connected to the measuring or the switching circuit. When the plug 14 is removed from the socket 12, the initial condition is regained without shut-off by the opposite procedure to the above-described one.

The prior art connector 10 of the kind described is disadvantageous in that the structure is complicated, and that the depthwise dimension of the socket 12 is great, because two consecutive contacts 16a and 16b are provided on the female contact pieces 16. Moreover, since the delicate procedure from the start of contact of the male contact pieces 24 with the first contacts 16a to the opening of the second contacts 16b relies simply on the shape and dimensions of the female contact pieces 16, special management is needed not only for the dimensions of the individual parts but also for the maintenance of quality after the assembly of the individual parts.

Referring to Figs. 3, 4A and 4B, a connector connectable without instantaneous shut-off embodying the present invention is shown and generally designated by the reference numeral 30. As shown, the connector 30 comprises a socket 32 and a measuring plug 34. The socket 32 is made up of a housing 36 which is made of an insulating material, and a pair of or a plurality of pairs of female contact pieces 38 and 40. The female contact pieces 38 and 40 are provided with, respectively, contacts 38a and 40a which complete a closed circuit. The contacts 38a and 40a have an adequate degree of contact pressure due to the elasticity of the facing contact pieces 38 and 40. Terminals 42 and 44 which are connected to, respectively, the female contact pieces 38 an 40 are adapted for connection with a circuit which is built in an apparatus. On the other hand, the plug 34 is made up of a body 46 made of an insulating material, and male contact pieces 48 and 50. The male contact pieces 48 an 50 are made of a resilient material and deformable toward, respectively, frame portions 46a and 46b of the plug body 46. A projection 46c which is also made of an insulating material extends from the plug body 46 and and at the intermediate between the male contact pieces 48 and 50. As described in detail later, the projection 46c serves to break the closed circuit of the female contact pieces 38 and 40 immediately before the female and male contact pieces fully mate with each other. Terminals 52 and 54 connected the male contact pieces 48 and 50, respectively, are connected to a measuring or a switching circuit.

As shown in Fig. 4A, as the plug 34 is inserted into the socket 32, contacts 48a and 50a of the male contact pieces 48 and 50, respectively, are brought into resilient contact with the female contact pieces 38 and 40 of the socket 32 from the outside of the latter. In this condition, two different conduction paths are set up at the same time, i. e., one extending from the terminal 42 on the socket 32 side to the the terminal 44 on the socket side 32 via the contacts 38a and 40a, and the other extending from the terminal 42 to the terminal 52 on the plug 34 side via the contacts 48a or from the terminal 44 to the terminal 54 on the plug 34 side via the contact 50a.

The plug 34 is inserted deeper into the plug 34 from the position of Fig. 4A until it reachs the position shown in Fig. 4B. Then, the projection, or breaking member, 46c of the plug 34 penetrates to between the contacts of the female contact pieces 38 and 40, whereby the closed circuit, or conduction path, completed by the terminal 42, contacts 38a and 40a, and terminal 44 is opened. This allows a signal received from the terminals 42 and 44 to be picked up without shut-off at the terminals 52 and 54, respectively. When the plug 34 is removed from the socket 32, the connector 30 is restored to the original condition without shut-off by the opposite procedure to the above-described one.

Referring to Fig. 5, an alternative structure for causing the projection 46c to break the closed circuit, which is completed by the female contact pieces 38 and 40, is shown. In this particular embodiment, those portions of the female contact pieces 38 and 40 which extend from the contacts 38a to 40a to the tips of the pieces 38 and 40 are slightly opened toward the tips. Such a configuration causes the projection 46c to surely break the closed circuit when it is brought to the vicinity of the contacts 38a and 40a.

In summary, it will be seen that the present invention provides a connector which is surely connectable without instantaneous shut-off despite its simple construction and short depthwise dimension. This advantage is derived from a single-step contact configuration which completes a closed circuit on a socket side. In addition, a sure anti-interruption function is provided to eliminate the need for special managment for the maintenance of quality heretofore required. This advantage is achievable with resilient male contact pieces provided on a plug and engageable with female contacts of the socket from the outside, and a breaking member adapted to break the closed circuit.

Various modifications will become possible for those skilled in the art after receiving the teachings of the present disclosure without departing from the scope thereof.

Claims

1. A connector connectable without instanta-

neous shut-off, comprising:
at least a pair of resilient female contact pieces facing each other and each having an engaging portion and a contact portion, said contact portions facing and resiliently making contact with each other;
at least a pair of male contact pieces facing each other and each having a contact portion which is engageable with a respective one of the contact portions of the female contact pieces from the outside of said contact portion; and
a projection disposed between said male contact pieces and made of a resilient material for, when the male contact pieces are individually engaged with the female contact pieces from the outside, cancels the resilient contact of the facing contact portions of said female contact pieces.

2. A connector as claimed in claim 1, wherein the socket comprises the female contact pieces, and the plug comprises the male contact pieces and projection.

3. A connector as claimed in claim 2, wherein the socket further comprises a housing having a space for accommodating the female contact pieces and supporting said female contact pieces.

4. A connector as claimed in claim 3, wherein the socket further comprises terminals which are connected one to each of the female contact pieces and provided on the outside of the housing.

5. A connector as claimed in claim 2, wherein the plug further comprises a housing having a space for accommodating the male contact pieces and supporting said male contact pieces.

6. A connector as claimed in claim 5, wherein the plug further comprises terminals which are connected one to each of the male contact pieces and provided on the outside of the housing.

FIG. 1 PRIOR ART

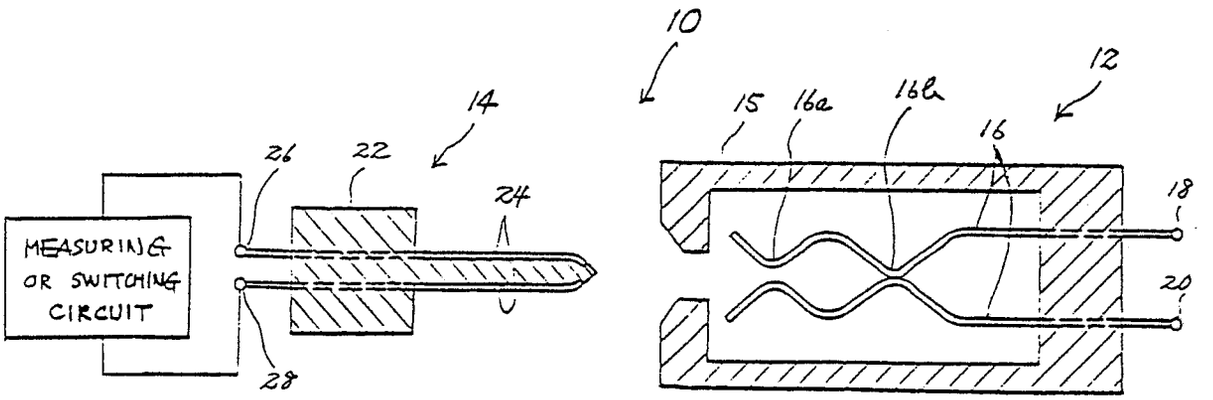

FIG. 2A PRIOR ART

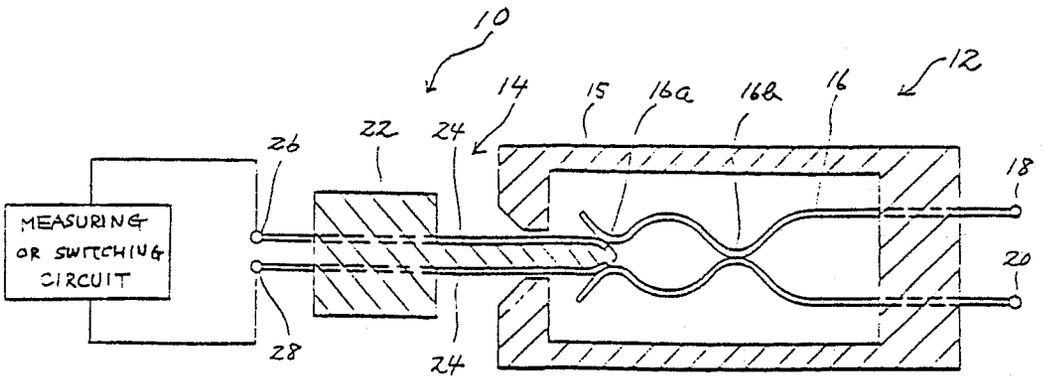

FIG. 2B PRIOR ART

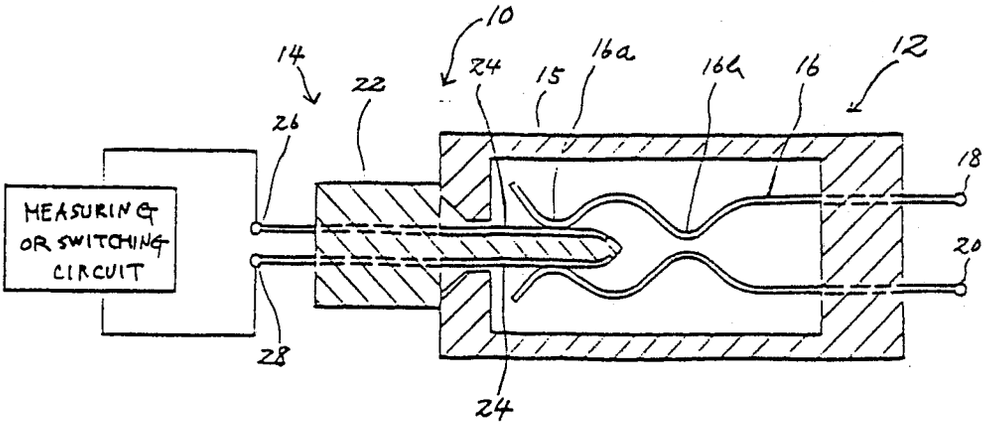

FIG. 3

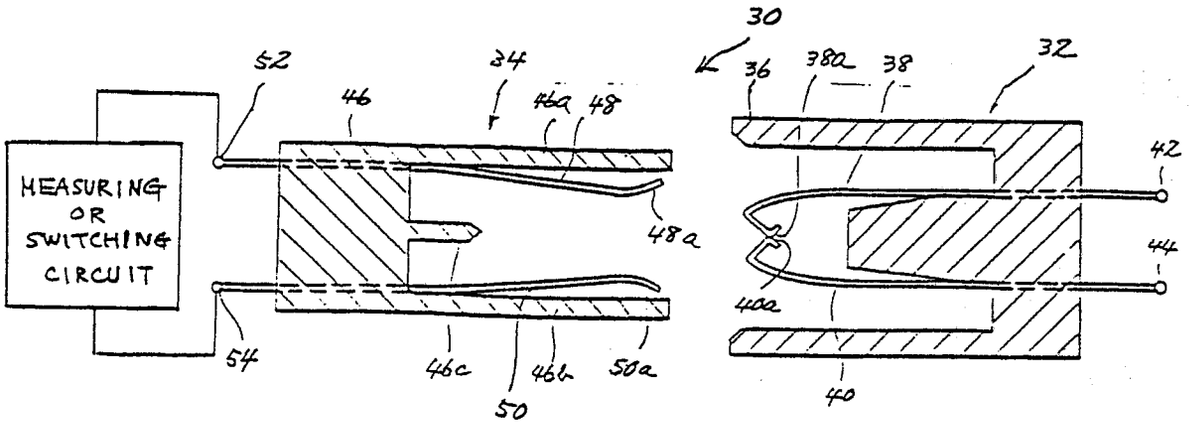

FIG. 4A

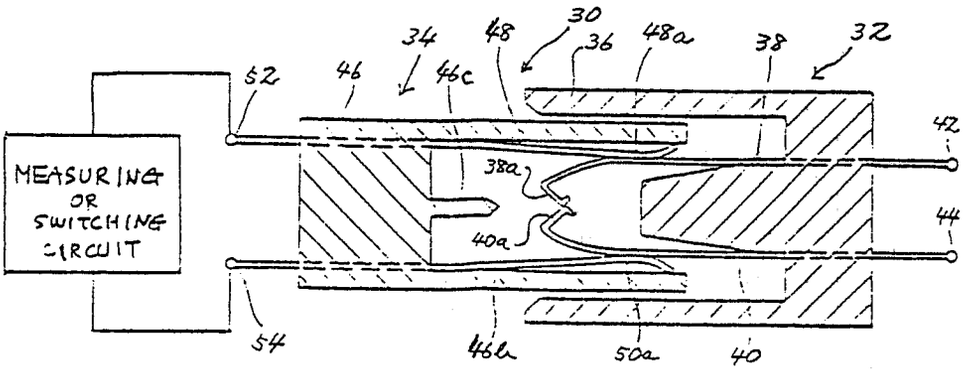

FIG. 4B

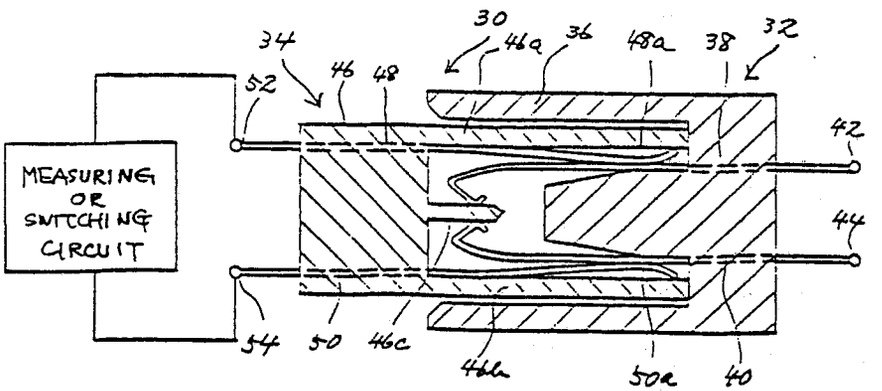

FIG. 5