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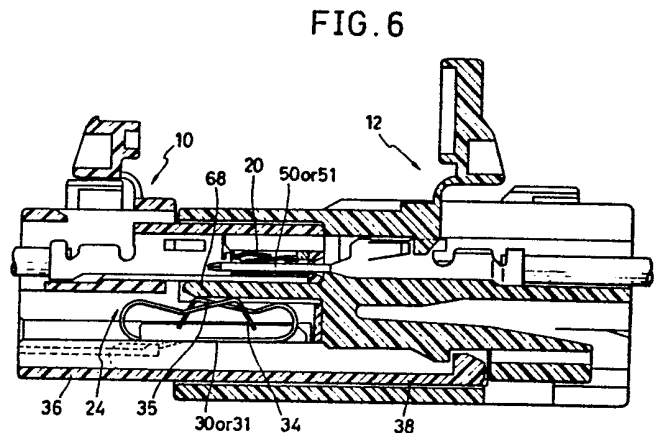
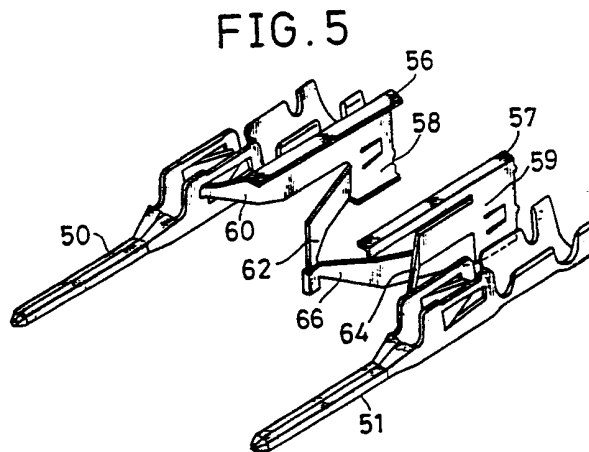
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(54) Switched electrical connector

(57) An electrical connector includes: a socket contact housing (10) in which at least a pair of socket contact elements (20) are mounted and are interconnected by a short-circuit contact element (24); and a pin contact housing (12) in which at least a pair of pin contact elements (50, 51) are mounted and are connected by a pair of switch contact elements (56 - 64). The connections between each of the socket contact elements (20) and the short circuit contact elements (24) and between the pin contact elements (50, 51) are broken when the socket contact housing is inserted into the pin contact housing, by protruberence (68) on the pin contact housing and protruberence (70, not shown) on the socket contact housing, respectively.



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1990.

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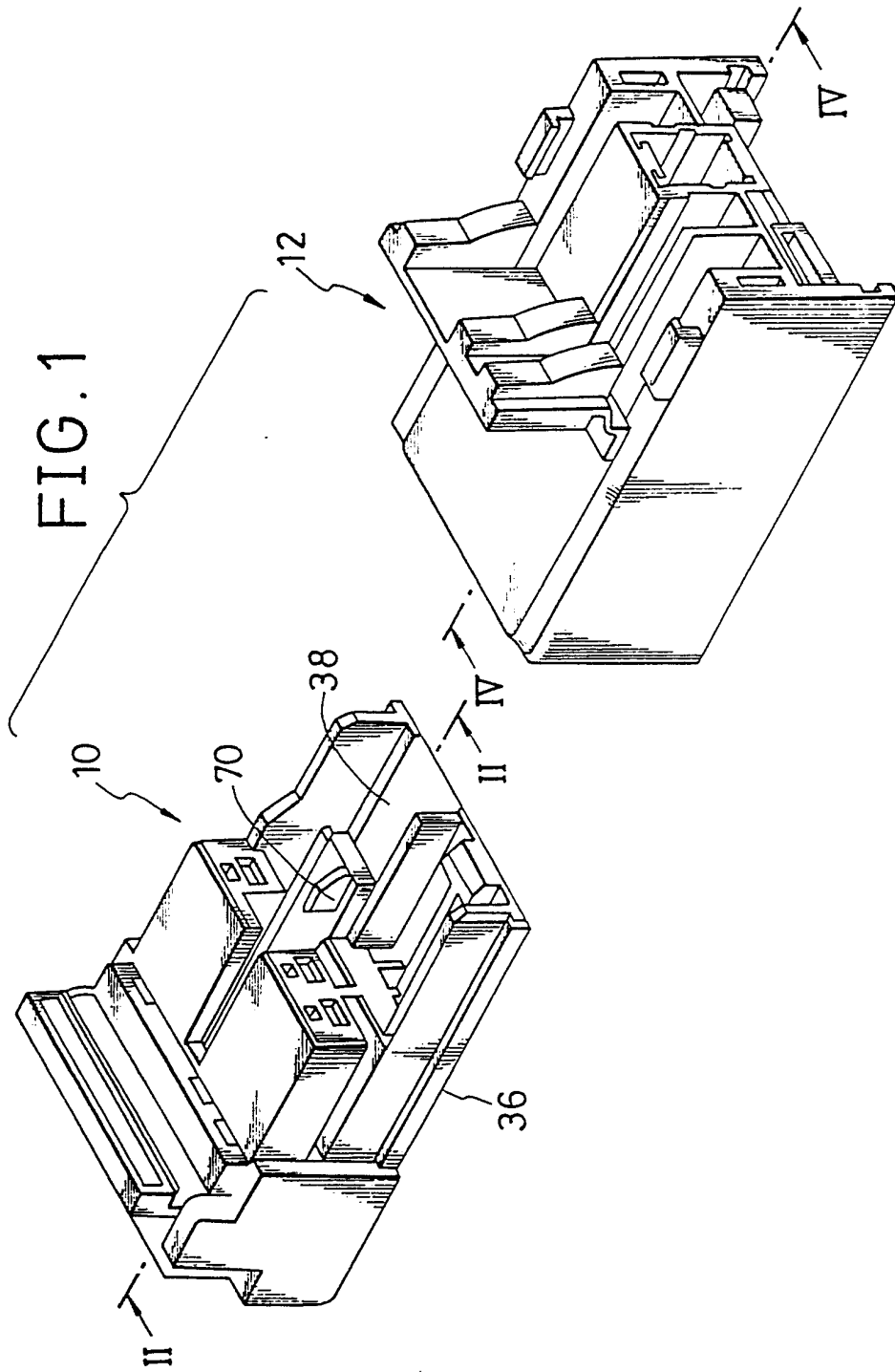


FIG. 2

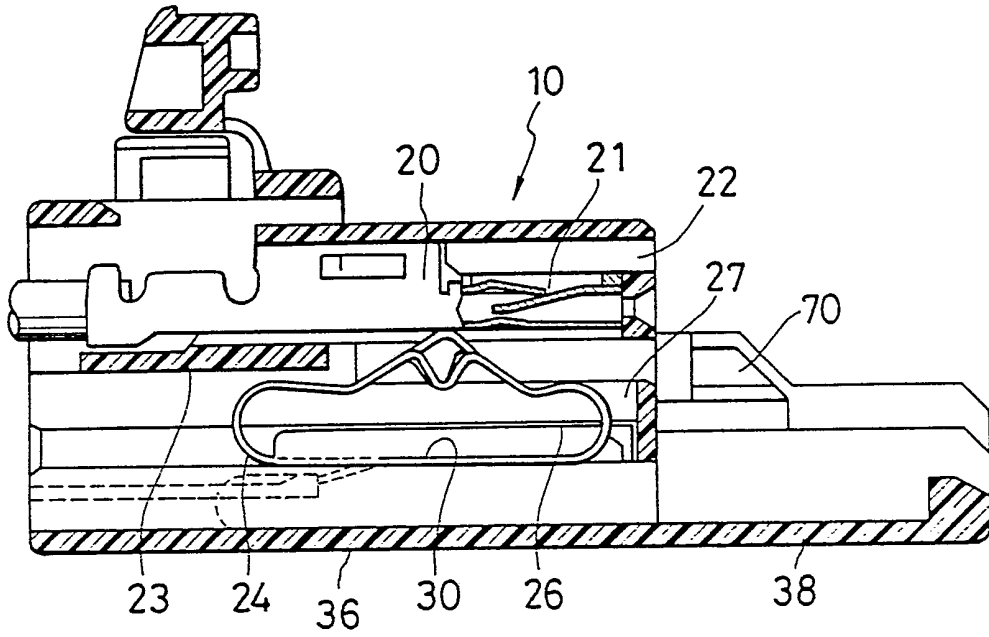


FIG. 3

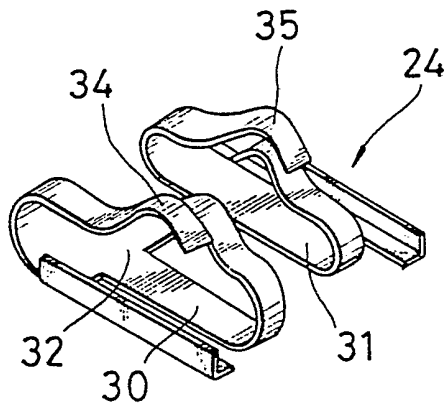


FIG. 4

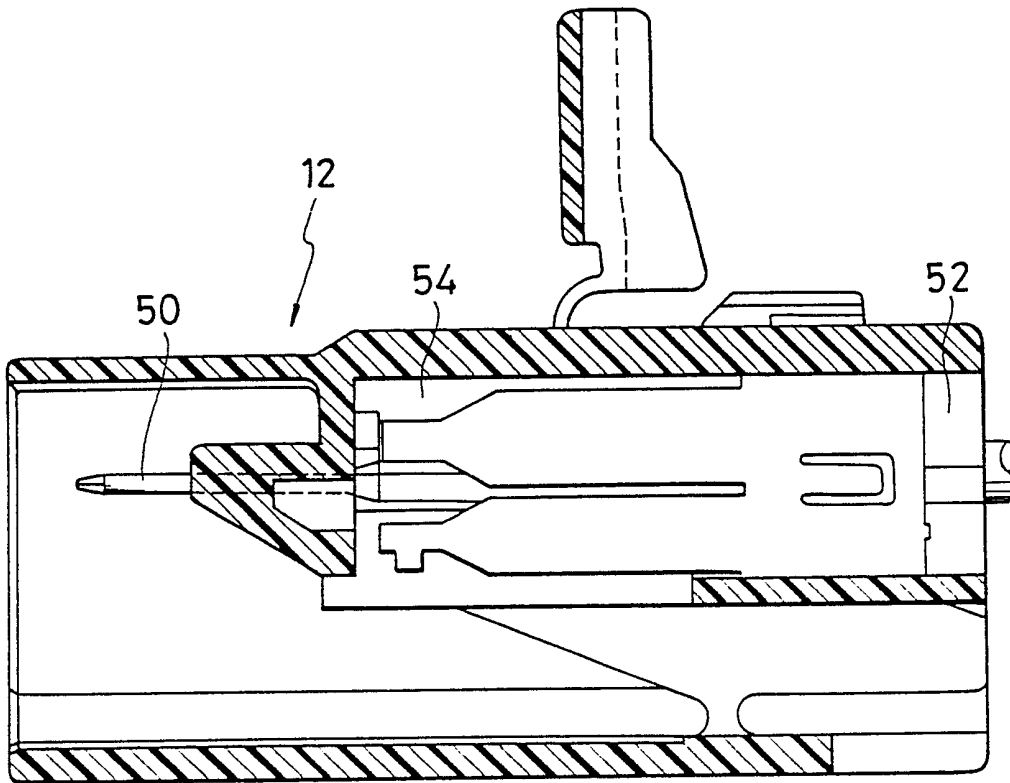


FIG. 5

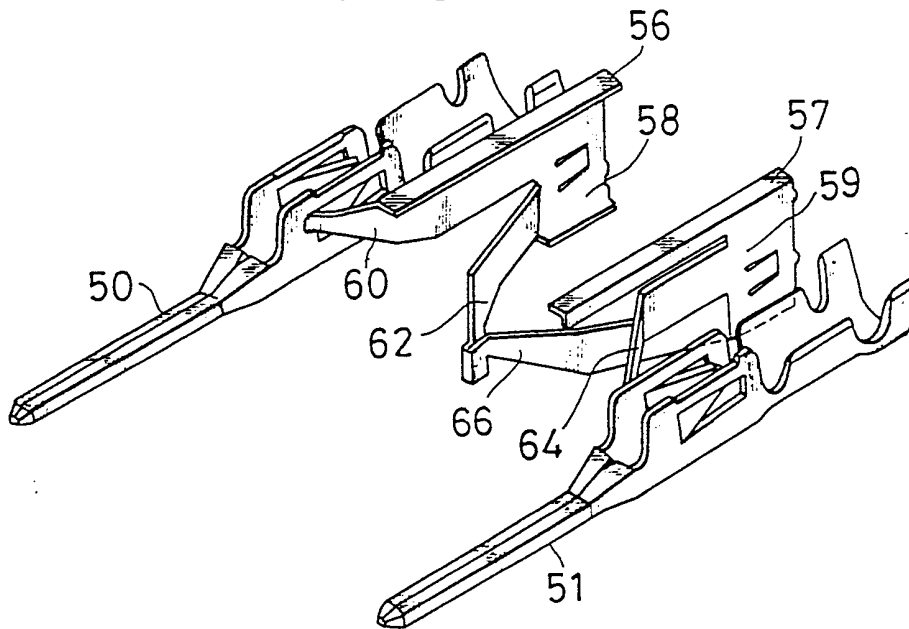


FIG. 6

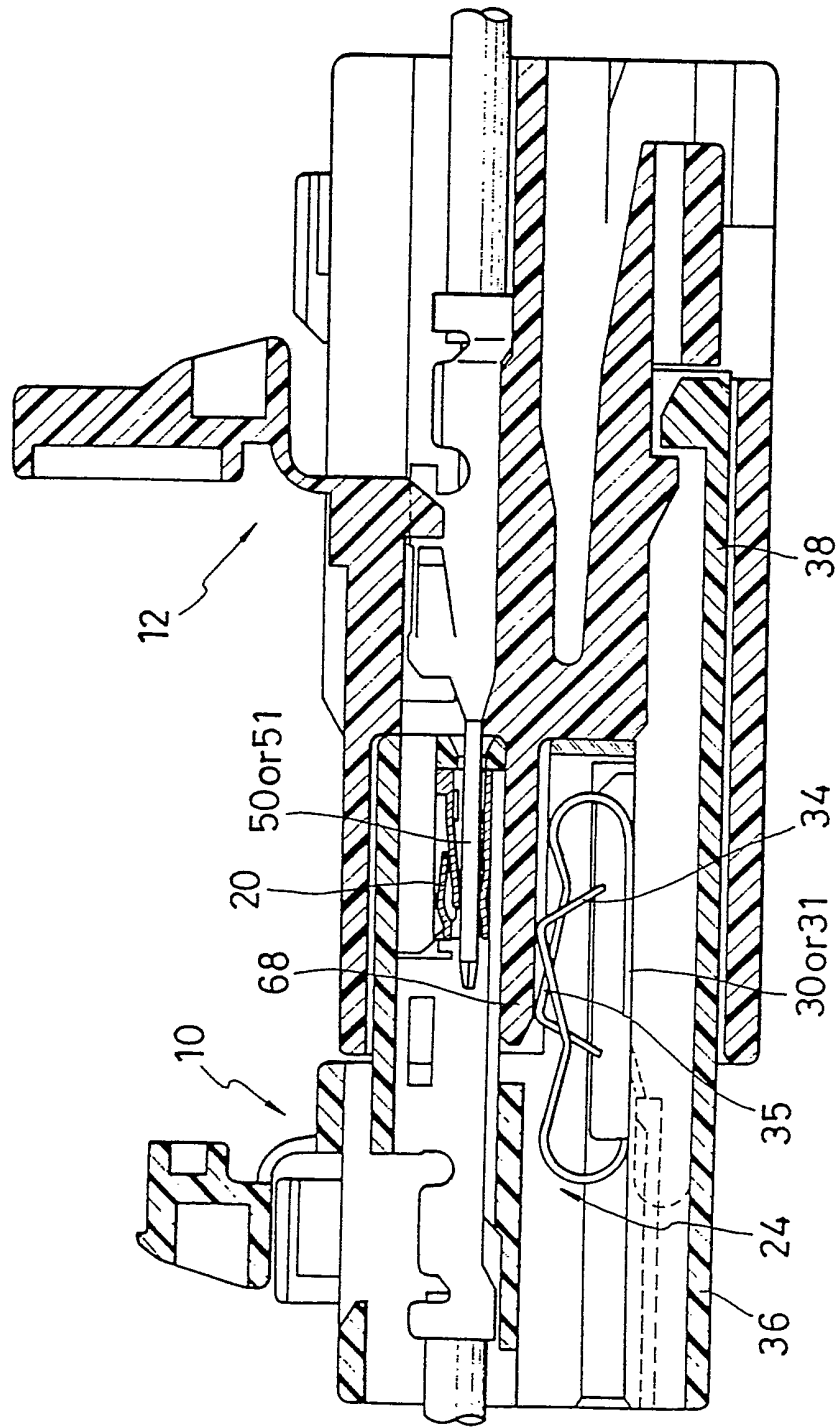
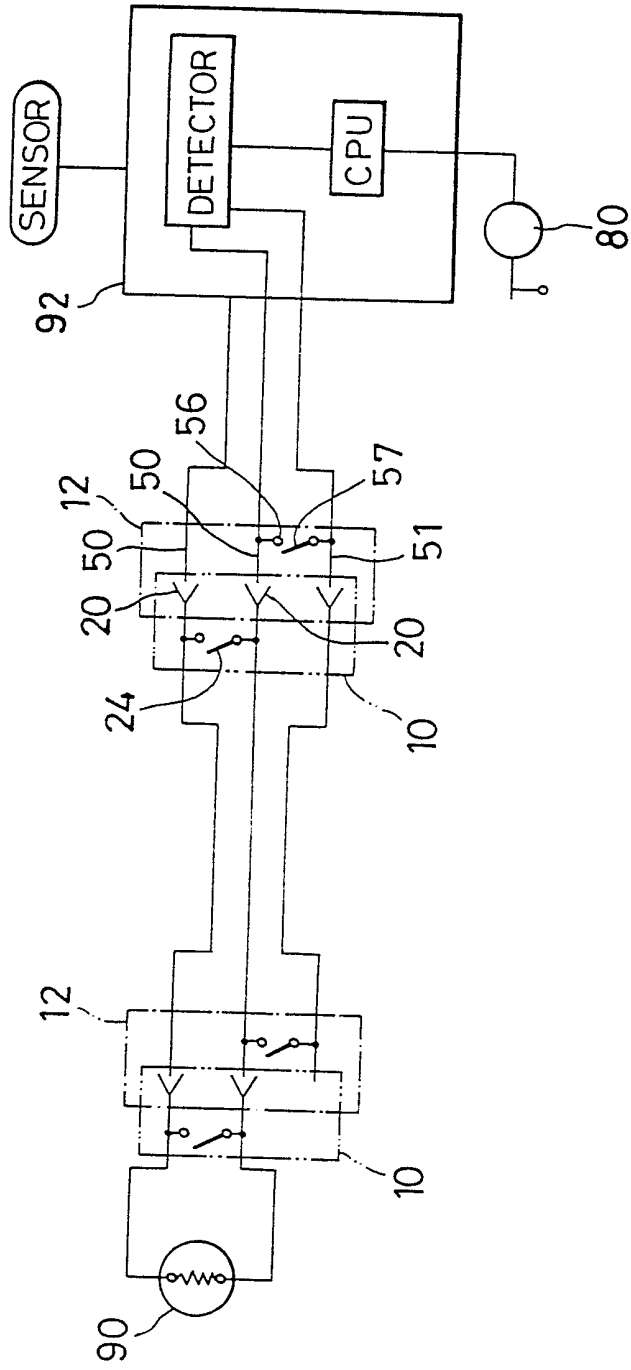


FIG. 7



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## ELECTRICAL CONNECTOR

### BACKGROUND OF THE INVENTION

#### 1. Field of the Invention

This invention relates to an electrical connector, and more particularly to such an electrical connector including a pin contact housing and a socket contact housing that is able to protect the electrical devices or elements connected therewith and to inspect that the pin contact housing is sufficiently inserted into the socket contact housing.

#### 2. Prior Art

Japanese Non-examined Utility Model Publication No. 1-77287 discloses an electrical connector including a pin contact housing and a socket contact housing, in which only one of the housings a pair of contact elements are connected by a short-circuit contact element with each other, and when the pin contact housing is inserted into the socket contact housing the connection of the contact element with the short-circuit contact element in one of the housings can be separated by insulating members provided to the other housing.

In such a conventional electrical connector, the adjacent contact elements in one of the housings are short-circuited for

protecting electrical devices or elements connected with either one of the socket contact housing or the pin contact housing. This connector may be only used for for protecting the electrical devices or elements, but it is impossible to use for inspecting or confirming whether the pin connector housing is inserted into the socket contact housing sufficiently or insufficiently.

#### SUMMARY OF THE INVENTION

The electrical connector of the present invention includes a socket connector housing in which at least a pair of socket contact elements are connected by a short-circuit contact element with each other and a pin contact housing in which at least a pair of pin contact elements are connected by a pair of switch contact elements for protecting the electrical devices or elements connected therewith.

According to the present invention, when the socket contact housing is inserted into the pin contact housing the connections between the socket contact elements and the short-circuit contact element and between the pin contact elements and the switch contact elements are respectively separated from each other.

Consequently, a general object of the present invention is to provide an improved electrical connector.

Another object of the invention is to provide an electrical connector that is able to protect the electrical devices or elements connected therewith and also inspect the connection of the pin contact housing with the socket contact housing.

A still further object of the invention is to provide an electrical connector which is possible to avoid erroneous



operation of the electrical devices or elements connected therewith by inspecting the connection of the socket contact housing with the pin contact housing.

#### BRIEF DESCRIPTION OF THE DRAWINGS

For the complete understanding of the present invention reference should be made to accompanying drawings in which:

Figure 1 is a schematic perspective view of a socket contact housing and a pin contact housing which are not assembled or coupled to each other;

Figure 2 is a sectional view of the socket contact housing taken along the line II - II in Figure 1;

Figure 3 is a perspective view of a short-circuit contact element;

Figure 4 is a sectional view of the pin contact housing taken along the line IV - IV in Figure 1;

Figure 5 is a schematic perspective view of a pair of pin contact elements which are short-circuited by a pair of switch contact elements each other;

Figure 6 is a sectional view of the socket contact housing and the pin contact housing in coupled or assembled each other; and

Figure 7 is a schematic circuit diagram of an air-bag system in which the electrical connector according to the present invention is included.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now, the best mode for carrying out the present invention will be explained with reference to the drawings. As shown in

Figure 1, an electrical connector according to the present invention includes an insulating socket contact housing 10 and an insulating pin contact housing 12. At least a pair of socket contact elements are mounted in the respective socket contact reception bores 22 formed at the upper side in the socket contact housing 10 and a short-circuit contact element 24 is held in a lower reception bore 26 which is separated by a bottom wall 23 from the upper socket contact reception bore 22. A pair of contact portion 34 and 35 of the short-circuit contact element 24 are extended through an opening 27 in the bottom wall 23 and contact with the respective adjacent socket contact elements 20.

To this end, the short-circuit contact element 24 is punched and formed from a resilient sheet metal, as shown in Figure 3. That is, the short-circuit contact element 24 consists of a pair of base plates 30 and 31 which are longitudinally extended in parallel to each other, an arm 32 for connecting the base plates 30 and 31, and the resilient contact portions 34 and 35 of the short-circuit contact element 24. The upper end of each of the base plates 30 and 31 is bent into a U-shaped configuration.

In the socket contact housing 10, the adjacent socket contact elements 20 are connected by the short-circuit contact element 24 with each other.

A bottom wall 36 of the socket contact housing 10 is longitudinally extended to form a guide plate 38 for inserting the pin contact housing 12 into the socket contact housing 10.

A pair of pin contact elements 50 and 51 are held in the respective pin contact reception bores 54, and a pair of switch

contact elements 56 and 57 are placed between the adjacent pin contact elements 50 and 51 in parallel with each other.

As shown in Figure 5, the switch contact elements 56 and 57 are substantially the same in configuration and can be punched and formed from a resilient sheet metal. The switch contact element 56 is formed from a plate portion 58, a first upper contact arm 60 and a first lower contact arm 62 which are respectively diverged from the plate portion 58. The switch contact element 57 is formed from a plate portion 59, a second upper contact arm 64 and a second lower contact arm 66 which are respectively diverged from the plate portion 59 so as to form a Y-shaped configuration.

When the switch contact elements 56 and 57 are inserted into between the adjacent pin contact elements 50 and 51 in the pin contact housing 12, the first upper contact arm 60 of the switch contact element 56 contacts with a side portion of the pin contact element 50, the second upper contact arm 62 of the switch contact element 57 contacts with a side portion of the pin contact element 51, and also the tip of the first lower arm 62 of the switch contact element 56 contacts with the tip of the second lower contact arm 66 of the switch contact element 57. As clear from the foregoing, the adjacent pin contact elements 50 and 51 in the pin contact housing 12 are electrically short-circuited by the switch contact elements 56 and 57.

Accordingly, in inserting the socket contact housing 10 into the pin contact housing 12 so as to connect both housings electrically, the connection of the socket contact elements 20 with the corresponding resilient contact portions 34 and 35 of

the short-circuit contact element 24 in the socket contact housing 10 and the connection of the first lower arm 62 and the second lower arm 64 in the pin contact housing must be released before each of the socket contact elements 20 is connected with each of the corresponding pin contact elements 50 and 51.

To this end, according to the present invention, as shown in Figure 6, a middle base plate 68 in the pin contact housing 12 is outwardly extended from the tip of the pin contact element 50 mounted in the housing 12 so as to insert it into between each of the socket contact elements 20 and the corresponding resilient contact portions 34 and 35 of the short-circuit contact element 24 so as to release the connection between them when the socket contact housing 10 is inserted into the pin contact housing 12.

Further, in order to release the connection between the first lower contact arm 62 of the short-circuit contact element 56 contacted with the pin contact element 50 and the second lower contact arm 64 of the switch contact element 57 connected with the pin contact element 51, the socket contact housing 10 is provided with a short projecting flap member or tab 70 which may be inserted into between the first lower contact arm 62 and the second lower contact arm 64. As clear in Figure 2, the tab 70 is provided at the front portion of the socket contact reception bore 22 in the socket contact housing 10. Accordingly, in inserting the socket contact housing 10 into the pin contact housing 50, the short-circuit connection of the adjacent socket contact elements 20 contacted by means of the corresponding resilient contact portions 34 and 35 is separated or released by

the middle base plate 68 of the pin contact housing 12 and also the short-circuited connection of the adjacent pin contact elements 50 and 51 with the respective switch contact elements 56 and 57 is released or separated by the flap member 70 of the pin contact housing 10.

As described above, before connecting the socket contact housing 10 with the pin contact housing 12, since the adjacent socket contact elements 20 in the socket contact housing 10 are short-circuited by the short-circuit contact element 24, a dangerous difference of potential may not be established between the socket contacts elements 20, and therefore there is not any fear of arising erroneous operation in the electrical circuits or elements connected therewith.

In the same way, since the adjacent pin contact elements 50 and 51 in the pin contact housing 12 are connected by the switch contact elements 56 and 57 with each other, there is no difference of potential between them.

As an example of using the connector according to the present invention, reference will be made in air bag system which is one of devices for protecting a car driver from his damage in auto wreck as well known in the art.

In the air bag system, a gasified material is contained in an air bag (not shown) to which an ignition device or inflator 90 is provided. The inflator can be connected to a control circuit 92 including a shock detector and central processors (CPU). The control circuit may be so constructed that a pilot lamp 80 may be turned on when the leads to be connected with the switch contact elements 50 and 51 are formed in closed-circuit, as shown in

Figure 7.

If the pin contact housing 12 is incompletely or insufficiently inserted into the socket housing 10, the inflator 90 may not be controlled by the control circuit 92 and in the side of the control circuit, the connection between the switch contact elements 56 and 57 of the pin contact housing 12 can not be released by the wedge-shaped protuberance 70, and the pilot lamp 80 can give the notice to the driver.

While the particular embodiments of the present invention have been shown and described, it is apparent that changes and modifications may be made therein without departing from the invention in its broader aspects. The aim of the appended claims, therefore, is to cover all such changes and modifications as fall within the spirit and scope of the invention.

What is claimed is:

1. An electrical connector comprising a socket contact housing in which at least a pair of socket contact elements are mounted, the adjacent socket contact elements being connected by a short-circuit contact element with each other,

a pin contact housing in which at least a pair of pin contact elements are mounted, the adjacent pin contact elements being connected by a pair of switch contact elements with each other,

the socket contact housing being provided with means to release the connection between the pin contact elements when the socket contact housing is inserted into the pin contact housing, and

the pin contact housing being provided with means to release the connection between the socket contact elements and the short-circuit contact element when the socket contact housing is inserted into the pin contact housing.

2. The electric connector as claimed in claim 1, wherein the short circuit contact element is made of a resilient sheet metal with a pair of resilient contact portions to be contacted with the respective socket contact elements.

3. The electric connector as claimed in claim 1, wherein the switch contact element is made of a resilient sheet metal and has contact arms diverged from a main body of the switch contact element.

4. An electrical connector comprising:

at least a pair of contact elements mounted in an insulating socket contact housing;

a short-circuit contact element arranged to contact with each of the socket contact elements in the socket contact housing;

at least a pair of pin contact elements mounted in an insulating pin contact housing,

a pair of switch contact elements to be mounted in the between the adjacent pin contact elements in pin contact housing each of which has a first arm contacting with one of the pin contact elements and a second arm connecting with each other,

a wedge-shaped protuberance provided to the socket contact housing to separate the connection between each of the switch contact elements and the short-circuit contact element upon the socket contact housing is inserted into the pin contact housing, and

means provided to the socket contact housing for separating the connection between the switch contact elements in the pin contact housing when the socket contact housing is inserted into the pin contact housing.

5.

An electrical connector substantially as herein described with reference to and as shown in the accompanying drawing(s)