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(54) **Electric connector**

Elektrischer Steckverbinder

Connecteur électrique

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(56) References cited:
**DE-U- 8 026 598 DE-U- 9 014 673
FR-A- 2 029 572**

EP 0 571 962 B1

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Description

The present invention relates to an electric connector, particularly, but not exclusively, for connecting an electronic control system to the electric system of a vehicle.

Electric connectors are known featuring a seal housed in a seat on the connector and designed to cooperate frontally with a mating surface formed in complementary connecting means with which the connector is designed to mate.

For example, IT-U-223255 relates to a connector for connecting an electronic control system to the electric system of a vehicle, and comprising an elongated parallelepiped terminal block with a number of cavities housing respective electric terminals; an outer casing housing the terminal block; click-on retaining means for fitting the connector to the terminal board of the control system; and an annular seal for airtight fitment of the connector to the terminal board, and for preventing damp from infiltrating into the connector and so impairing operation of the electrical contacts.

The seal presents a substantially solid rectangular section, and is housed inside a seat extending about the periphery of the terminal block and between the block and the housing.

When the connector is fitted to the terminal board, the seal is compressed between the end surface of the seat and a mating surface on the terminal board, and is so deformed transversely as to cooperate with the lateral surfaces of the seat.

A major drawback of connectors of the aforementioned type is the high insertion load involved, that is, the effort required for connecting them to the terminal board, and which is mainly due to the force required for compressing the seal. In addition to making manual insertion of the connector difficult, a high insertion load may also result in undesired deformation of the terminals, thus impairing reliability of the contact.

DE-U- 80 26 598 discloses an electric connector in accordance with the preamble of claim 1.

Such a connector includes a peripheral seal having a hollow, substantially U-shaped cross-section with a curved and ribbed bottom surface designed to be deformed by a complementary connector.

A scope of the present invention is to provide an electric connector designed to overcome the aforesaid drawback.

This scope is achieved by an electric connector according to claim 1.

A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Fig. 1 shows a side view of a preferred embodiment of an electric connector in accordance with the present invention;

Fig. 2 shows a section along line II-II in Fig. 1;

Fig. 3 shows a detail of Fig. 2;

Fig. 4 shows a section along line IV-IV in Fig. 3; and
Fig. 5 shows a graph of the insertion load of the Fig. 1 connector as a function of travel and as compared with that of a conventional connector.

Number 1 in Figs 1 and 2 indicates an electric connector, particularly for connecting an electronic control system to the electric system of a vehicle, and as described in Italian Patent Application n. TO91U000096 entitled "Electric connector", filed on 24 April, 1991, and the content of which is included herein purely by way of reference as required.

Connector 1 comprises a substantially elongated parallelepiped terminal block 2, and an outer casing 3 housing block 2. Block 2 and casing 3 are made of plastic material, and combine to define an insulating body for connector 1.

As shown in Fig. 2, block 2 comprises two parallel lateral walls 4 facing each other, and a central wall 4a between and parallel to walls 4. Between each lateral wall 4 and wall 4a, block 2 presents a row of through cavities 5 extending in a direction parallel to the shorter dimension of walls 4 and 4a, and each housing an electric terminal 6 (only one shown in Fig. 2) fitted to the end of an electric cable 7.

Block 2 also comprises conventional click-on connecting means 8 for connecting terminals 6 inside respective cavities 5; and a pair of terminal retaining elements 9 formed integral with lateral walls 4 of block 2. Not being the object of the present invention, connecting means 8 and retaining elements 9 described in the aforementioned patent application are only described herein as required for a clear understanding of the present invention.

More specifically, retaining elements 9 define a pair of tabs 10 projecting laterally from terminal block 2.

Tabs 10 are coplanar with respective plate elements 11 and 12 (Fig. 1) projecting integrally from the respective opposite front and rear ends of block 2. At one end, plate element 11 presents an upper projection 13; and, from the free end of plate element 12, there extends a transverse wall 14. The function of projection 13 and wall 14 is described in detail later on.

With reference to Figs. 1 and 2, casing 3 is elongated in shape with a substantially U-shaped cross section, and is defined by a pair of flat parallel lateral walls 16 facing each other, by a top wall 17, and by an end wall 18. At the end opposite end wall 18, casing 3 presents an end opening 19 for enabling longitudinal insertion of block 2 inside casing 3, and which, after insertion, is closed by wall 14. On the side opposite top wall 17, casing 3 is open for enabling connection of connector 1 to the terminal board 20 of the control system, which terminal board presents a number of electric terminals 6' mating in use with terminals 6.

The inner surface of each lateral wall 16 presents a longitudinal guide groove 21 (Fig. 2). Grooves 21 com-

municate with opening 19 and house in sliding manner respective lateral edges of tabs 10 and plate elements 11 and 12.

Block 2 is fitted axially inside casing 3 by means of a grip screw 22 engaging a through hole in end wall 18 of casing 3 and screwed inside projection 13.

Transverse wall 14 of terminal block 2 and top wall 17 define, integrally, respective half shells 42, 43 designed to mate with each other and in turn defining a hollow sleeve 44 through which cables 7 extend outwards of connector 1.

As shown in Fig.2, connector 1 also comprises an annular seal 23 housed inside a peripheral seat 24 defined by block 2 and casing 3. More specifically, seat 24 presents an end surface 25 defined by tabs 10 and plate elements 11 and 12, and an inner and outer lateral surface 26, 27 parallel to and facing each other. Surface 26 is formed in a peripheral portion of terminal block 2; and surface 27 is defined by lateral walls 16, end wall 18 of casing 3, and transverse wall 14.

As shown more clearly in Figs 3 and 4, seal 23 is substantially rectangular, presents a hollow, substantially U-shaped section, and comprises a flat bottom wall 28 with a substantially trapezoidal section and defining a flat supporting surface 28a; and a first and second lateral wall 30a, 30b facing each other, projecting respectively along the inner and outer periphery of bottom wall 28, and defining, with wall 28, an annular, substantially rectangular-section cavity 29. The outer surfaces of walls 30a, 30b diverge slightly as of bottom wall 28.

Cavity 29 is closed partially by a pair of lips 31 integral with walls 30a, 30b and having a substantially triangular cross section. Lips 31 extend along the free edge of walls 30a, 30b, and project towards each other from the respective inner faces of walls 30a, 30b. Each lip 31 defines a flat outer surface 31a of cavity 29, opposite surface 28a, and diverging in relation to surface 27a as of respective wall 30a, 30b.

Seal 23 also comprises a number of reinforcing walls 33 extending transversely between walls 30a and 30b and across cavity 20.

Seal 23 is fitted inside seat 24 so that lips 31 cooperate with end surface 25 of seat 24, and bottom wall 28 cooperates in use with a mating surface 32 on terminal board 20, which surface 32 is conveniently narrower than wall 28.

As shown in Fig.1, connector 1 comprises connecting means for securing it in use to terminal board 20, and which in turn comprise a hook element 35 projecting outwards from end wall 18 of casing 3, with its concavity facing top wall 17; and a tooth 36 projecting outwards from transverse wall 14. Hook element 35 is designed to engage a respective mating element 37 on terminal board 20, so as to constitute a hinge enabling connector 1 to rotate between a first position (shown by the dotted line) wherein hook element 35 engages mating element 37, and a second position wherein tooth 36 clicks inside a hole 38 formed in a leaf spring 39 fixed to terminal

board 20.

Assembly of block 2 inside casing 3 will be obvious from the foregoing description and therefore requires no further explanation. As for assembly of connector 1 to terminal board 20, on the other hand, connector 1 is first set to said first position wherein hook element 35 engages respective mating element 37; and is then rotated from the first to the second position, so that terminals 6 gradually engage respective electric terminals 6' on terminal board 20, and seal 23 gradually contacts surface 32 of terminal board 20. When compressed, lips 31 rotate towards wall 28 so that the whole of surface 31a contacts end surface 25 of seat 24; and wall 28 is deformed elastically and curved downwards on mating surface 32. By virtue of the above deformations, lateral walls 30a, 30b curve outwards so as to press against surfaces 26, 27 of seat 24, and, once said second position is reached, surfaces 28a and 31a are positioned mutually parallel, and seal 23 is pressed contacting both surfaces 25, 32 and surfaces 26, 27, thus effectively protecting connector 1 against damp.

Moreover, as seal 23 is gradually compressed and deformed, transverse walls 33 reinforce seal 23 to prevent lateral walls 30a, 30b from being so deformed as to fail to contact surfaces 26, 27, thus resulting in impaired sealing performance.

The Fig.5 graph shows the insertion force required by a connector featuring a solid seal (curve A) and the connector according to the present invention (curve B) as a function of rotation from said first to said second position, i.e. as a function of travel. As can be seen, the behaviour of both types of connector is identical over a first portion relative to a small amount of rotation wherein the force required is employed for inserting the electric terminals of the connector inside those of the terminal board, but differs considerably over a second portion wherein the force required is employed for elastically deforming the seal. In particular, the load required for deforming the hollow-section seal according to the present invention is far less than that of the conventional seal.

Claims

1. An electric connector (1) comprising an insulating body (2, 3) with a number of through cavities (5); a number of electric terminals (6) housed in respective said cavities (5) and mating with respective electric terminal (6') on complementary connecting means (20); and a seal (23, 40) housed in a peripheral seat on said body (2, 3) and which is compressed between said body (2, 3) and a mating surface (23) on said complementary connecting means (29); said seal (23) being designed to expand transversally when compressed, so as to cooperate in sealing manner with respective lateral walls (26, 27) of said seat (24); said seal (23) presenting a hollow, substantially U-shaped section and comprising an

annular bottom wall (28) defining a first outer surface (28a) and a pair of lateral walls (30a, 30b) facing each other and projecting from the inner and outer periphery of said bottom wall, said lateral walls (30a, 30b) defining with said bottom wall (28) a cavity (29), characterized in that said bottom wall (28) is flat and in that said seal (23) comprises a pair of lips (31) integral with said lateral walls (30a, 30b) and extending towards each other from the free edge of said lateral walls (30a, 30b) and defining respective second outer surfaces (31a) opposite said first outer surface (28a).

2. A connector as claimed in claim 1, characterized in that, when not deformed, said second outer surfaces (31a) are inclined in relation to said first outer surface (28a); each said second outer surface (31a) diverging in relation to said first outer surface (28a) as of said respective lateral wall (30a, 30b).

3. A connector as claimed in claim 1 or 2, characterized in that said seal (23) comprises a number of walls (33) extending transversely inside said cavity (29) and between said lateral walls (30a, 30b).

4. A connector as claimed in any of the foregoing claims, characterized in that said insulating body comprises a terminal block (2) having said cavities (5), and an outer casing (3) housing said terminal block (2); said peripheral seat (24) being defined between said terminal block (2) and said outer casing (3).

5. A connector as claimed in any of the foregoing claims, characterized in that said second outer surfaces (31a) cooperate with an end surface (25) of said seat (24); said first outer surface (28a) being designed to cooperate with said mating surface (32) on said complementary connecting means (20).

6. A connector as claimed in any of the foregoing claims, characterized by comprising hinge means (35) for securing said connector (1) to said complementary connecting means (20) and enabling said connector (1) to rotate with respect to said complementary connecting means (20).

Patentansprüche

1. Elektrischer Stecker (1) mit einem Isolierkörper (2, 3), der mehrere durchgehende Ausbuchtungen (5) aufweist, mehrere elektrische Anschlüsse (6), die sich in den jeweiligen genannten Ausbuchtungen (5) befinden und mit den jeweiligen elektrischen Anschlüssen (6') auf Zusatzverbindungseinrichtungen (20) verbunden werden, und einer Dichtung (23, 40), die sich auf einem randgelegenen Sitz des ge-

nannten Körpers (2, 3) befindet und zwischen dem Körper (2, 3) und der Verbindungsfläche (23) auf diesen Zusatzverbindungseinrichtungen (29) zusammengedrückt wird, wobei die genannte Dichtung (23) ausgelegt wurde, damit sie sich quer ausdehnt, wenn sie zusammengedrückt wird, so daß sie in einer verdichteten Weise mit den jeweiligen Seitenwänden (26, 27) des genannten Sitzes (24) zusammenarbeitet, wobei die Dichtung (23) einen hohlen im wesentlichen U-förmigen Querschnitt und eine ringförmige untere Wand (28) aufweist, die eine erste äußere Fläche (28a) und ein Paar gegenüberliegende Seitenwände (30a, 30b) umfaßt, die aus dem inneren und äußeren Umfang der unteren Wand herausragen, wobei diese Seitenwände (30a, 30b) mit der unteren Wand (28) einen Hohlraum (29) beschreiben, dadurch **gekennzeichnet**, daß

die untere Wand (28) flach ist und daß die Dichtung (23) ein Paar Lippen (31) aufweist, die in den Seitenwänden (30a, 30b) integriert sind und von der freien Kante der Seitenwände (30a, 30b) sich aufeinander zu erstrecken und jeweils eine zweite äußere Fläche (31a) beschreiben, die der ersten äußeren Fläche (28a) gegenüberliegt.

2. Stecker nach Anspruch 1, dadurch gekennzeichnet, daß

wenn dieser nicht verformt ist, dann sind die zweiten äußeren Flächen (31a) gegenüber der ersten äußeren Fläche (28a) geneigt, wobei jede der zweiten äußeren Flächen (31a), verglichen zur ersten äußeren Fläche (28a) und zu jeweiligen Seitenwänden (30a, 30b), auseinandergehen.

3. Stecker nach Anschluß 1 oder 2, dadurch gekennzeichnet, daß

die Dichtung (23) mehrere Wände (33) aufweist, die innerhalb des Hohlraums (29) und zwischen den Seitenwänden (30a, 30b) quer verlaufen.

4. Stecker nach einem der vorherigen Ansprüche, dadurch gekennzeichnet, daß

der Isolierkörper Reihenklemmen (2) mit Hohlräumen (5) und einem äußeren Gehäuse (3) umfaßt, das diese Reihenklemmen (2) aufnimmt, wobei die Randdichtung (24) durch die Reihenklemmen (2) und dem äußeren Gehäuse (3) eingeeengt wird.

5. Stecker nach einem der vorhergehenden Ansprü-

che,
dadurch gekennzeichnet, daß

die zweiten äußeren Flächen (31a) mit einer Endfläche (25) der Dichtung (24) zusammenarbeiten, wobei die erste äußere Fläche (28a) ausgelegt ist, um mit der Verbindungsfläche (32) auf der Zusatzverbindungseinrichtung (20) zusammenzuarbeiten.

6. Stecker nach einem der vorhergehenden Ansprüche, gekennzeichnet durch

ein Gelenk (35), das den Stecker (1) an den Zusatzverbindungseinrichtungen (20) sichert und gestattet den Stecker (1) über die Zusatzverbindungseinrichtungen (20) zu drehen.

Revendications

1. Connecteur électrique (1) comprenant un corps isolant (2, 3) avec un certain nombre de cavités traversantes (5); un certain nombre de bornes électriques (6) logées dans lesdites cavités respectives (5) et s'accouplant avec une borne électrique correspondante (6') située sur le moyen de connexion complémentaire (20), et un joint d'étanchéité (23, 40) logé dans un support périphérique situé sur ledit corps (2, 3) et comprimé entre ledit corps (2, 3) et une surface d'accouplement (23) située sur ledit moyen de connexion complémentaire (29), ledit joint d'étanchéité (23) étant conçu pour s'agrandir transversalement lorsqu'il est comprimé, de façon à coopérer de manière étanche avec les parois latérales respectives (26, 27) dudit support (24), ledit joint d'étanchéité (23) présentant une section creuse, sensiblement en U et comportant une paroi inférieure annulaire (28) définissant une première surface extérieure (28a) et une paire de parois latérales (30a, 30b) en regard l'une de l'autre et dépassant du pourtour intérieur et du pourtour extérieur de ladite paroi inférieure, lesdites parois latérales (30a, 30b) définissant avec ladite paroi inférieure (28) une cavité (29), caractérisé en ce que ladite paroi inférieure (28) est plane et en ce que ledit joint d'étanchéité (23) comporte une paire de lèvres (31) faisant corps avec lesdites parois latérales (30a, 30b) et s'étendant l'une vers l'autre depuis le bord libre desdites parois latérales (30a, 30b) et définissant en regard de ladite première surface extérieure (28a) des secondes surfaces extérieures respectives (31a).

2. Connecteur selon la revendication 1, caractérisé en ce que, lorsqu'elles ne sont pas déformées, lesdites secondes surfaces extérieures (31a) sont inclinées

par rapport à ladite première surface extérieure (28a), chacune desdites secondes surfaces extérieures (31a) divergeant par rapport à ladite première surface extérieure (28a), par exemple de ladite paroi latérale respective (30a, 30b).

3. Connecteur selon la revendication 1 ou 2, caractérisé en ce que ledit joint d'étanchéité (23) comporte un certain nombre de parois (33) s'étendant transversalement à l'intérieur de ladite cavité (29) et entre lesdites parois latérales (30a, 30b).
4. Connecteur selon l'une quelconque des revendications précédentes, caractérisé en ce que ledit corps isolant comporte un bloc de connexion (2) ayant lesdites cavités (5), et un boîtier extérieur (3) logeant ledit bloc de connexion (2), ledit logement périphérique (24) étant défini entre ledit bloc de connexion (2) et ledit boîtier extérieur (3).
5. Connecteur selon l'une quelconque des revendications précédentes, caractérisé en ce que lesdites surfaces extérieures (31a) coopèrent avec une surface (25) d'extrémité dudit logement (24), ladite première surface extérieure (28a) étant conçue pour coopérer avec ladite surface d'accouplement (32) située sur ledit moyen de connexion complémentaire (20).
6. Connecteur selon l'une quelconque des revendications précédentes, caractérisé en ce qu'il comporte un moyen d'articulation (35) servant à fixer ledit connecteur (1) audit moyen de connexion complémentaire (20) et permettant audit connecteur (1) de tourner par rapport audit moyen de connexion complémentaire (20).

FIG. 1

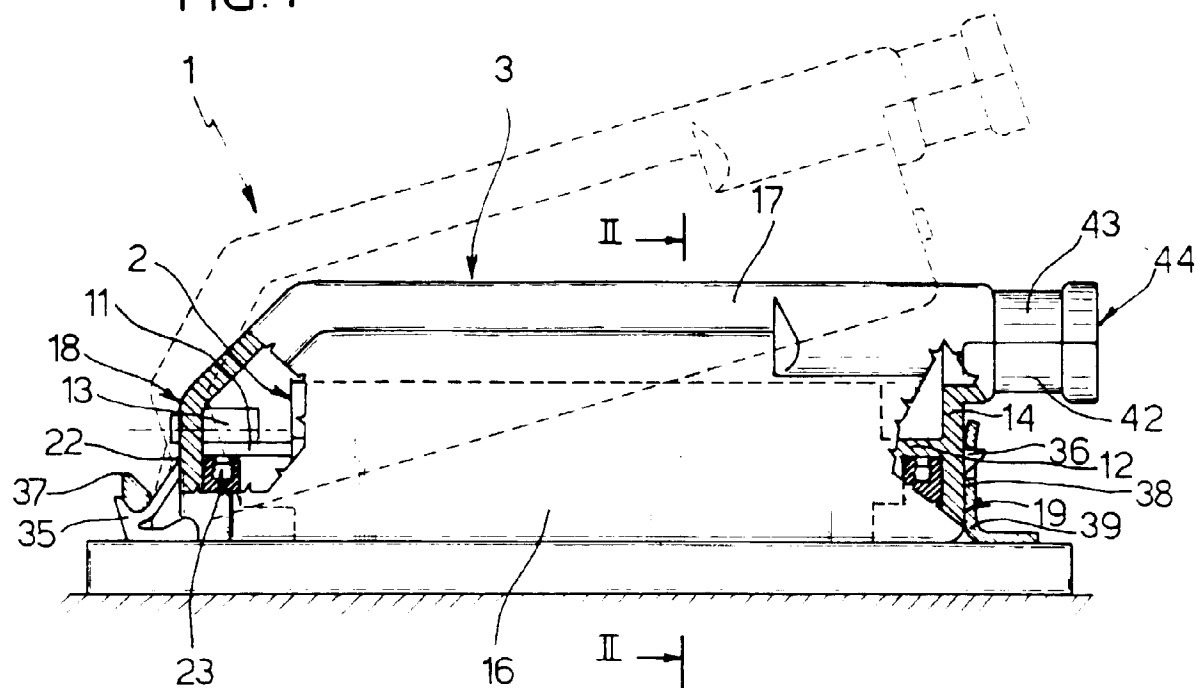


FIG. 2

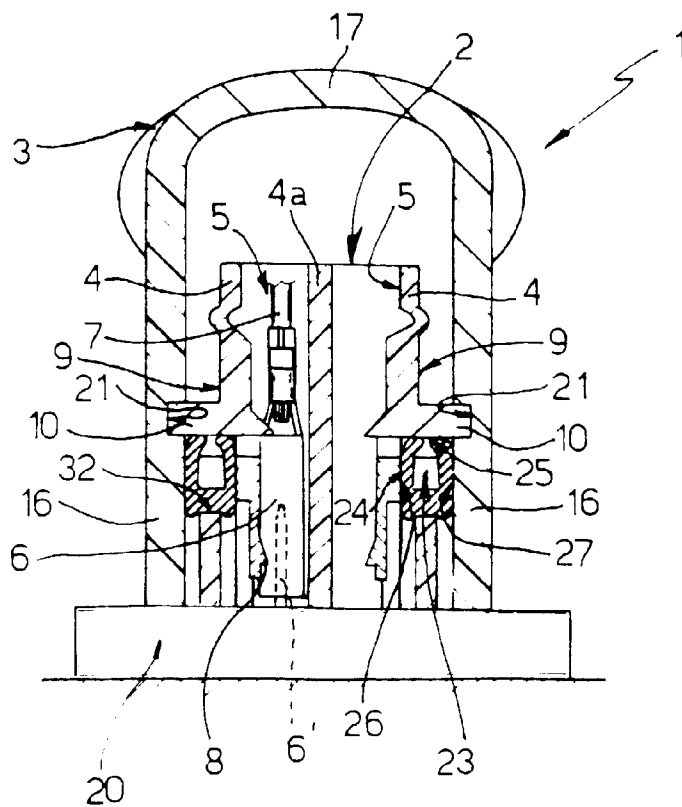


FIG. 4

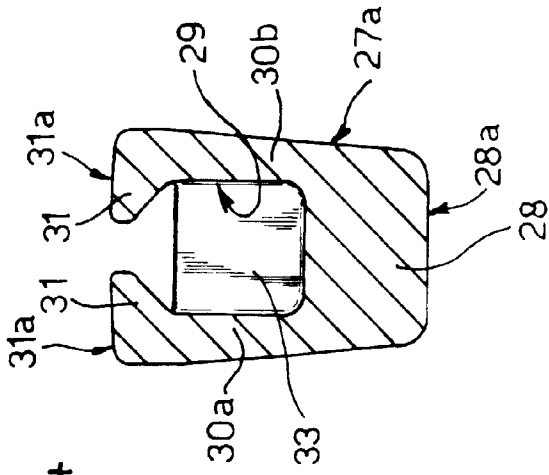


FIG. 3

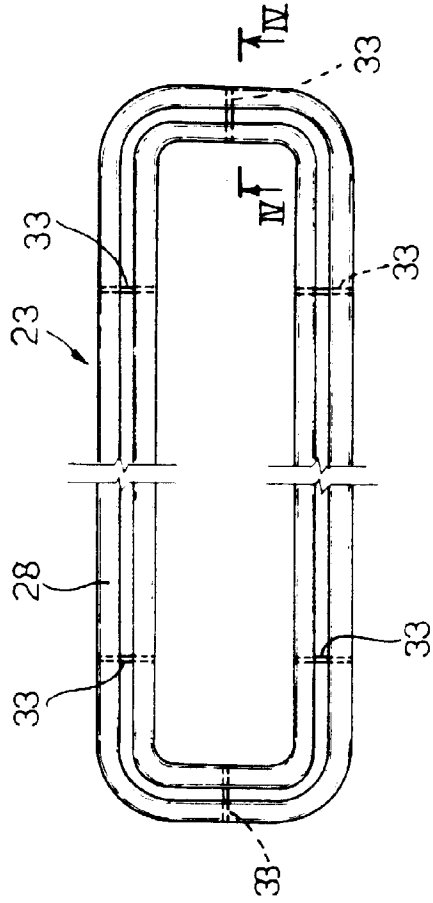


FIG. 5

