

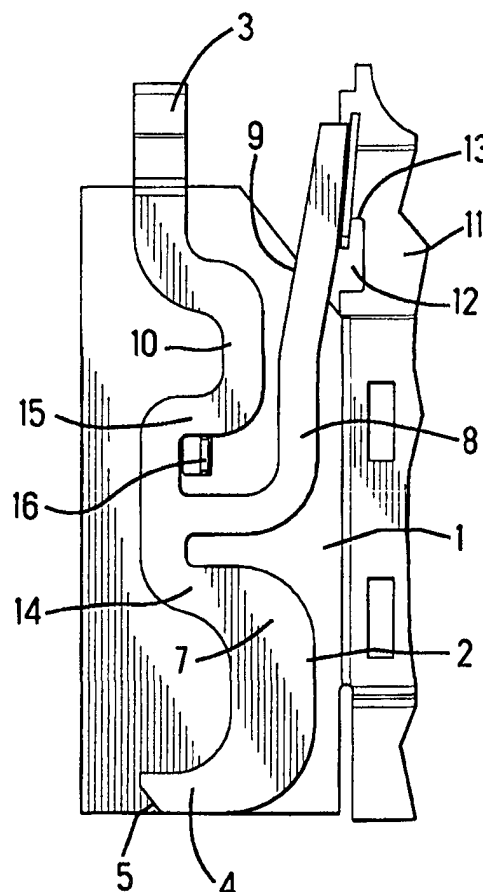


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(21) International Application Number: PCT/IB97/01475 (22) International Filing Date: 21 November 1997 (21.11.97) (30) Priority Data: 96119211.9 29 November 1996 (29.11.96) EP (34) <i>Countries for which the regional or international application was filed:</i> AT et al. (71) Applicant (for all designated States except US): THE WHITAKER CORPORATION [US/US]; Suite 450, 4550 New Linden Hill Road, Wilmington, DE 19808 (US). (72) Inventors; and (75) Inventors/Applicants (for US only): BROEKSTEEG, Johannes, Marcelus [NL/NL]; Buitenhof 11, NL-5346 WJ Oss (NL). ZEEMAN, Johannes, Marinus, Paulus [NL/NL]; Ratelaarstraat 4, NL-4621 CW Bergen op Zoom (NL). (74) Agents: HEINZ-SCHAEFER, Marion et al.; AMP International Enterprises Ltd., AMPèrstrasse 3, CH-9323 Steinach (CH).		(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i>

(54) Title: RESILIENT LATCH FOR AN ELECTRICAL CONNECTOR**(57) Abstract**

A resilient latch element (2) is connected by a fixed first end (3) to a wall part (1) of a component of an electrical plug-in connector. The resilient latch element (2) has a first U-shaped spring (7) and a second U-shaped spring (10). A free end (4) of the resilient latch element (2) is interlocked with respect to a complementary locking element of a mating connector by the actuation of a lever arm (8). Unintentional unlocking, such as pulling a part, of the plug-in connector requires a much greater expenditure of force than intentional unlocking, because the U-shaped springs (7, 10) are designed to be of different strengths and because the second U-shaped spring (10), is prevented from distorting by striking against a tab (16).



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RESILIENT LATCH FOR AN ELECTRICAL CONNECTOR

The invention relates to interlocking an electrical plug-in connector with a complementary receptacle
5 connector.

Electrical plug-in connectors are often designed such that the complementary parts can be interlocked with respect to each other. In this case, it is desirable that the complementary parts can easily be interlocked
10 with respect to each other and, when required, can easily be separated again, but are protected against unintentional separation.

It is the object of the invention to provide an arrangement for interlocking which makes intentional
15 interlocking and separation easier and makes unintentional separation more difficult.

This object is achieved by providing a latch structure for the interlocking of a component with a complementary part, in particular an electrical plug-in
20 connector with a complementary plug-in connector, having the features of Patent Claim 1.

Furthermore, this object is achieved by providing latch structure for the interlocking of a component with a complementary part, in particular an electrical plug-in
25 connector with a complementary plug-in connector, having the following features: the component has on at least one outer side a wall part; a resilient element that is connected by a first end to the wall part of the component, and has a second end, which is freely movable
30 in two directions generally in one plane; the resilient element has between the rigid first end and the freely movable second end a U-shaped spring; at the freely movable second end, a flank is arranged interact with a complementary locking element on the complementary part

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for interlocking; the resilient element has a lever arm, which interacts with a pivot alongside the lever arm in such a way that, in the state in which it is interlocked with the complementary locking element, the resilient
5 element can be separated.

An advantage of the invention is that a much greater force has to be exerted for the unintentional separation of the component than for intentional separation. This is achieved by the fact that the resilient element has a
10 first U-shaped spring and a second U-shaped spring, which are connected to each other and a lever arm therebetween.

It is also an advantage that the latch structure is simple to produce. This is achieved by the fact that the resilient element is produced by punching and bending
15 from the same sheet metal part as the wall part. The resilient element is arranged parallel to and at a distance from the wall part by bending. This leads to the further advantage of the invention, that the latch takes up little space.

20 An exemplary embodiment of the invention is explained with reference to the drawings, in which:

Figure 1 shows a view of a wall part of an electrical plug-in connector with a latch according to the present invention;

25 Figure 2 shows a perspective view of a component of an electrical plug-in connector with the wall part from Figure 1 in the pre-bending state;

Figure 3 shows a perspective view of the component from Figure 2 in the partially bent state;

30 Figure 4 shows a perspective view of the component from Figure 3 in the fully bent state;

Figure 5 shows a end view, in the plugging direction, of the component from Figure 4; and

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Figure 6 shows a section through a plug-in connector with the latch according to the invention.

Represented in Figure 1 is a detail of a wall part 1. The wall part 1 forms the outer wall of a component, but may also represent the outer side of a printed circuit board, or a shield about a connector housing. A resilient latch element 2 is connected by a rigid first end 3 to the wall part 1. If the resilient element 2 and the wall part 1 are produced from the same material, the rigid first end 3 is formed during production, for example in an injection-moulding process if the material is plastic. If the wall part 1 and the resilient latch element 2 are produced from metal, the rigid first end 3 is formed by punching and bending a single sheet metal part. The rigid first end 3 may, however, also be connected to the wall part 1 by screwing or welding. The resilient latch element 2 has a second end 4, which is freely movable in two directions in one plane. The plane runs substantially parallel to the wall part 1. This is intended to achieve the effect that the freely movable second end 4 can perform movements parallel to the wall part 1, but not in the direction perpendicular with respect to the wall part 1.

A flank 5 is arranged on the freely movable second end 4. The flank 5 of the freely movable second end 4 interacts with a complementary locking element 6 on a mating connector, which is described in more detail in Figure 6. The flank 5 is designed in such a way that, when interlocking with respect to the complementary locking element 6, the freely movable second end 4 locks in easily. The resilient latch element 2 has between the rigid first end 3 and the freely movable end 4, in a first subregion, a first U-shaped spring 7 and, in a third subregion, a second U-shaped spring 10. The

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multiple U-shaped formation of the resilient latch element 2 results in a defined spring force of the resilient latch element 2. When the resilient latch element 2 is brought together with the complementary locking element 6 (Figure 6) for interlocking, first of all the flank 5 interacts with the complementary locking element 6 in such a way that the springs 7, 10 punched out in a U-shaped manner are slightly tensioned. In the interlocked state, the resilient element 2 is relaxed and interlocks by the second end 4 engaging the complementary locking element 6.

Between the first U-shaped spring 7 and the second U-shaped spring 10, the resilient latch element 2 has a lever arm 8. The lever arm 8 is used for the intentional unlocking of the latching structure. When the resilient latch element 2 is in the locked state with respect to the complementary locking element 6, the freely movable second end 4 can be moved by the exertion of a force on the lever arm 8. For transferring the force, a pivot 9 is arranged alongside the lever arm 8. The pivot 9 may be produced by punching away a clearance 12 and subsequently bending over a further wall part 11, but may also be arranged on a housing part (not shown) alongside the lever arm 8.

In the present configuration, the pivot 9 is formed by the arrangement of an end face 13 of the clearance 12 of the wall part 11. In the view of Figure 5, and in the cross-section of Figure 6, it can be seen how the end face 13 of the clearance 12 of the wall part 11 is arranged as a pivot 9 alongside the lever arm 8. This configuration has the advantage that no further housing parts are required and consequently the arrangement for interlocking can be produced from a single sheet metal part.

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Since the freely movable second end 4 is movable in a plane parallel to the wall part 1, the force for unlocking on the lever arm 8 must also be exerted in a plane parallel to the wall part 1. The force for
5 unlocking acts by lever action on the freely movable end 4 in an direction perpendicular with respect to the plugging direction. If the freely movable second end 4 is moved sufficiently away from the complementary locking element 6, the mating connectors can be separated.

10 The resilient latching element 2 has the second spring 10 punched out in a U-shaped manner with a leg 14 of the first spring 7 connected to a leg 15 of the second spring 10. The first spring 7 and the second spring 10 are arranged one behind the other between the fixed first
15 end 3 and the freely movable second end 4. The lever arm 8 is likewise connected to the leg 14 of the first spring 7 and the leg 15 of the second spring 10. Arranged alongside the leg 15 of the second spring 10 is a stop 16. The stop 16 is produced from the wall part 1 by
20 punching and bending. During the normal interlocking and separation, the leg 15 of the second spring 10 slides past this stop 16. During unintentional separation, for example by pulling the connectors apart, of the latch, the lever arm 8 is not actuated. The complementary
25 locking element 6 prevents movement of the freely movable second end 4 of the resilient latch element 2 in the plugging direction. The leg 15 of the second spring 10 is prevented from movement in the plugging direction by the stop 16 that would tend to stress the fixed end 3.

30 In order to release the locking element 6 during unintentional separation, a much greater force must be exerted than is the case during intentional separation. This is achieved since the lever arm 8 is not actuated, that the leg 15 of the second spring 10 is prevented from

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movement in the plugging direction by the stop 16 and by the fact that the first spring 7 is designed to be much stronger than the second spring 10. With corresponding shaping of the two springs 7, 10, the separating force
5 for intentional separation may be less than half the separating force for unintentional separation as the arm 8 will tend to act about the second spring 10.

Represented in Figure 2 is a component of an electrical plug-in connector after punching out, but
10 before bending. Here it can be seen how the wall part or shell 1 has two latches 2 according to the invention, which are produced from a single sheet metal part. The resilient latch elements 2 are connected at the fixed ends 3 to the wall part 1. It can be seen how the stop
15 16 is punched out from the wall part 1. Also clear that the clearance 12, which, after full bending of the sheet metal part, forms the pivot 9 for the lever arm 8 at end face 13.

Represented in Figure 3 is the component from Figure
20 2 in the partially bent state. Here it can be seen how the leg 15 of the second spring 10 is arranged alongside the stop 16. It can also be seen how the lever arm 8 has a pressure-exerting area or tab 17, which serves as an area for applying the force during intentional
25 separation.

Represented in Figure 4 is a perspective view of a component of an electrical plug-in connector after full bending. This could advantageously be a shielding shell. The wall part 1 is shaped by bending to form a metal
30 housing of an electrical connector. It can be seen here how on two opposite sides of the housing there are the freely movable ends 4. It can also be seen how the rigid first end 3 is connected to the wall part 1. There can likewise be seen two pressure-exerting areas 17, arranged

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on two opposite sides of the housing, for the actuation of the lever arm 8.

Represented in Figure 5 the component from Figure 4, viewed in the plugging direction. It can be seen here how the resilient elements 2 are arranged parallel to the wall part 1. It can likewise be seen how the stop 16 is bent away from the wall part 1 and serves as a stop for the resilient element 2. It can be seen in Figure 5, and better in Figure 6, how the pivot 9 interacts with the lever arm 8 in the clearance 12 in the bent further wall part 11. In Figure 5 there can likewise be seen a support 20, which is produced by punching out and bending from the wall part 1 and serves for supporting the resilient latch element 2 during the movements parallel to the wall part 1.

Represented in Figure 6 is a section through a plug-in connector with the arrangement for interlocking according to the invention. Here it can be seen how the freely movable end 4 of the resilient element 2 is interlocked with respect to the complementary locking element 6 of the mating connector. In the section of Figure 6 there are diagrammatically shown two press studs 18, which are connected to the pressure-exerting area 17 to the lever arm 8. Likewise diagrammatically shown is a cable bushing 19, through which a multi-core cable is led to a connector housing in the interior of the plug-in connector.

The arrangement for interlocking may be used in a multi-pin electrical plug-in connector, such as in computer connectors for example. In this case, it is advantageous that the means for interlocking and the wall part are produced from a sheet metal part. The sheet metal part also serves at the same time for screening the electrical plug-in connector.

CLAIMS

1. An electrical connector comprising a wall (1) and a resilient latch element (2) fixed at one end (3) to the wall (1) and having a second end (4) that is movable to releasably engage a complementary locking element (6) on a complementary connector, and an actuation tab (17) for effecting release of the complementary locking element (6), characterized in that the actuation tab (17) is connected to the latch (2) between the end (3) fixed to the wall (1) and the movable second end (4) and where a resilient spring (10) is formed between where the actuation tab (17) is connected and the fixed end (3), whereby depression of the actuation tab (17) deforms the resilient latch (2) at the resilient spring (10) such that the second end (4) is displaced.

2. The electrical connector of claim 1, wherein the actuating tab (17) is formed on a lever arm (8) that is attached to the latch arm (2) and a pivot (13) is provided that cooperates with the latch arm (2) to establish a pivot point (9) about which the free end (4) is actuated.

3. The electrical connector of claim 2, wherein the resilient spring (10) is U-shaped and a tab (16) is provided to prevent deformation of the spring during an intentional demating.

4. The electrical connector of claim 3, wherein a second spring (7) that is stiffer than the first resilient spring member (10) is formed between where the lever is attached to the latch arm (2) and the freely movable end (4).

5. The electrical connector of claim 4, wherein a leg (14) of the first U-shaped spring (7) and a further leg (15) of the second U-shaped spring (10) are arranged one behind the other, connected to the lever arm (8) and to each other generally in one plane.

6. The electrical connector of claim 5, wherein the resilient latch (2) is arranged parallel to and at a distance from the wall (1) of the electrical connector.

7. The electrical connector of claim 6, wherein the resilient latch (2) and the wall (1) of the electrical connector are formed in one part.

8. The electrical connector of claim 7, wherein the resilient latch (2) is produced by punching and bending from the same sheet metal part as the wall (1) of the electrical connector.

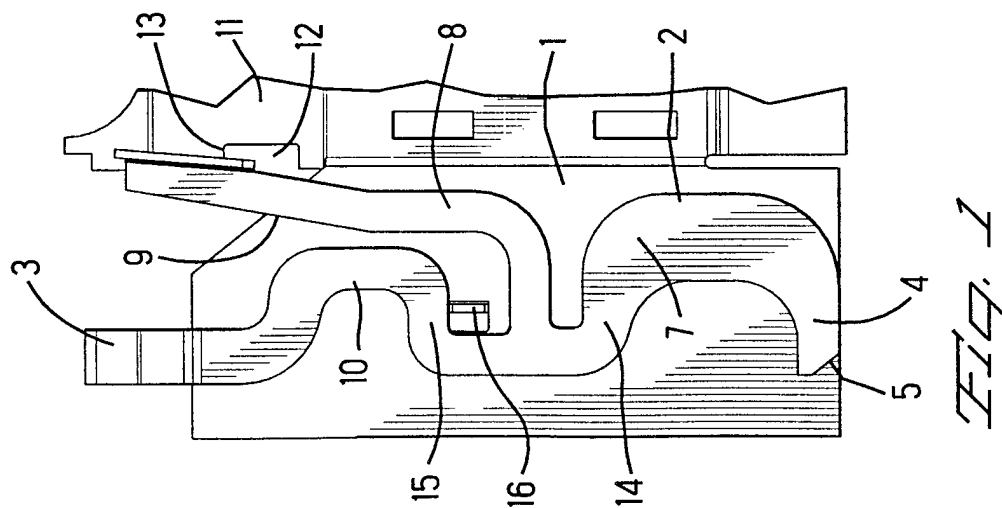
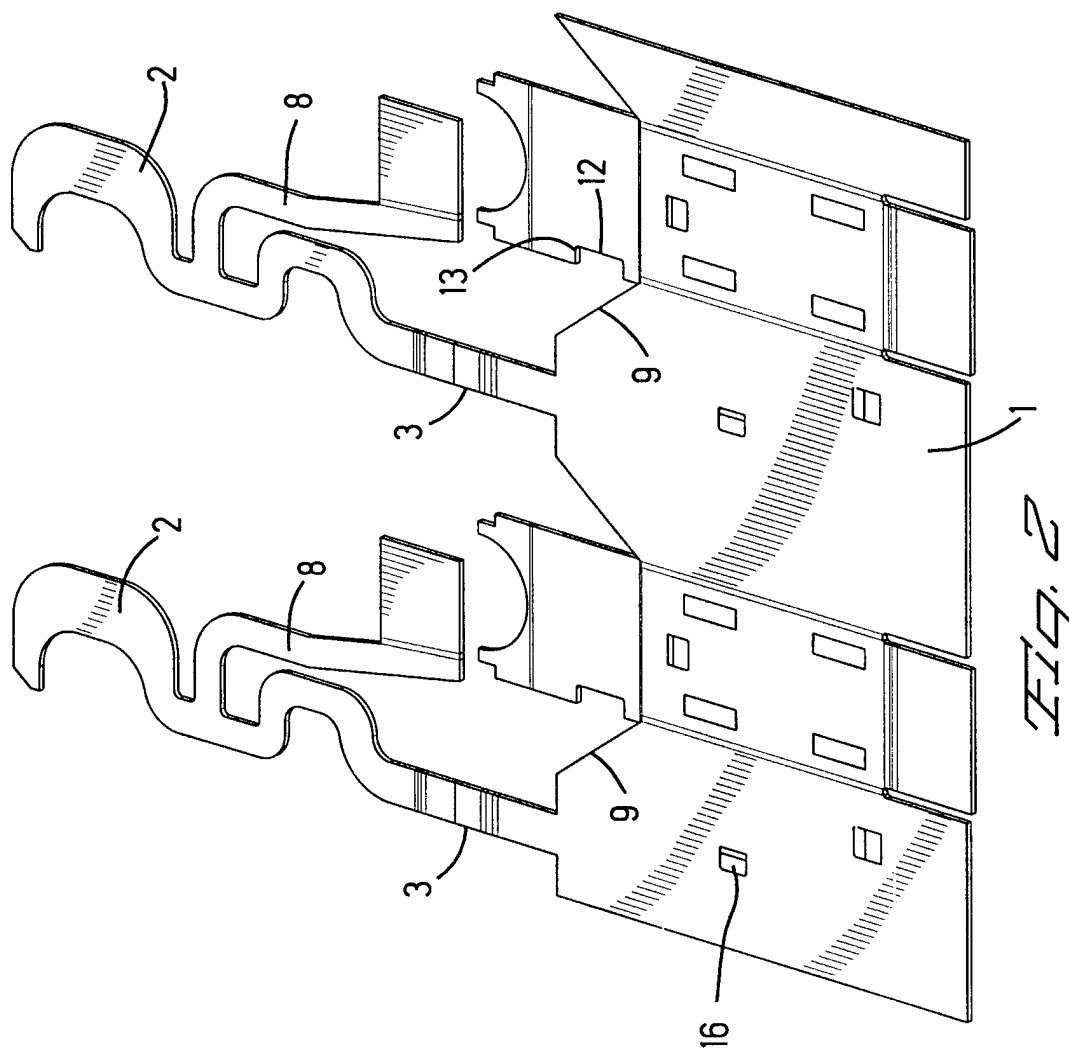
9. The electrical connector of claim 8, wherein the first U-shaped spring (7) and the second U-shaped spring (10) have different spring constants.

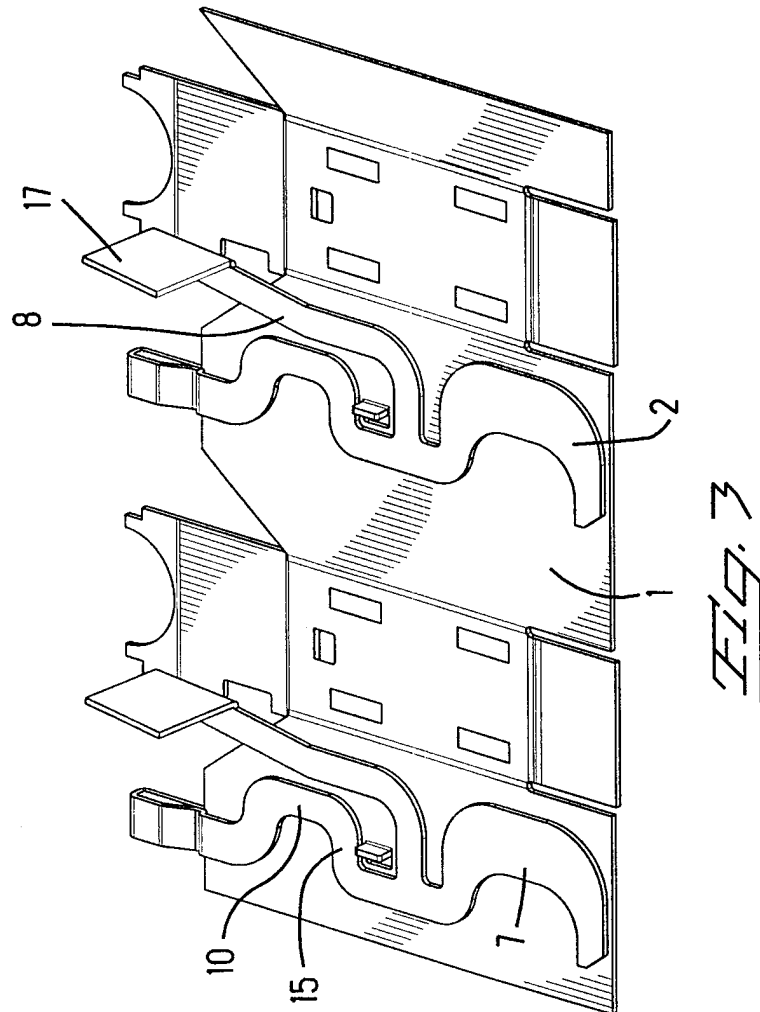
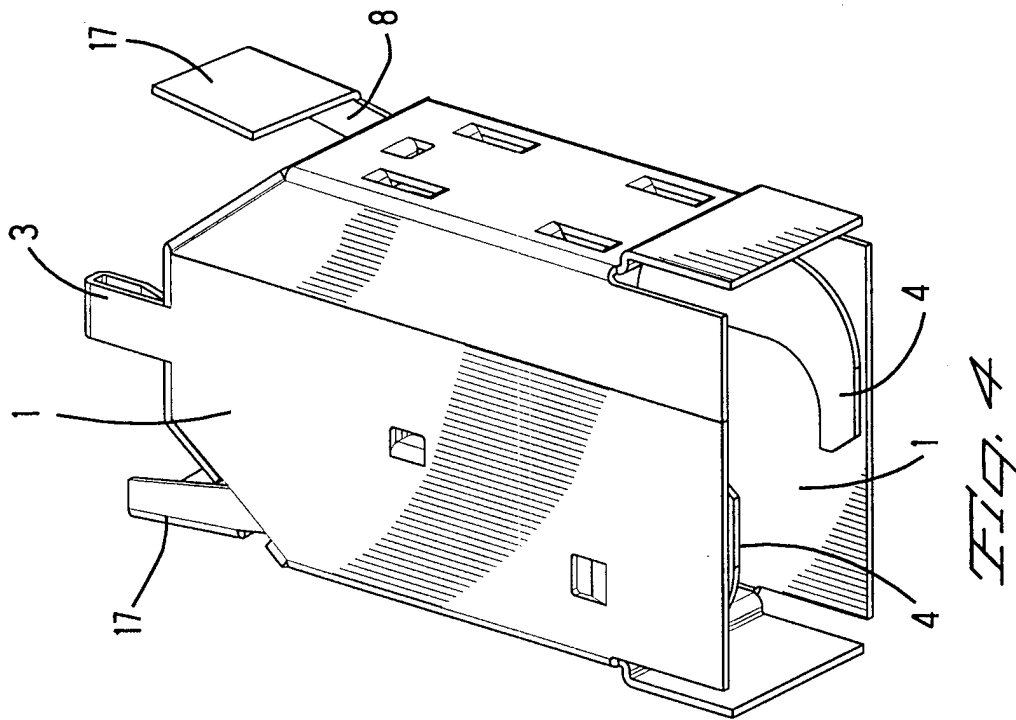
10. The electrical connector of claim 9, wherein the wall (1) has a tab (16), which is produced by punching and bending from the same sheet metal part as the wall (1), and is arranged in such a way that the leg (15) of the second U-shaped spring (10) is prevented from movement in the plugging direction during unintentional demating.

11. The electrical connector of claim 10, wherein the wall (1) has, at a clearance (12), an end face (13)

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which, after the full bending of the sheet metal part, acts as the pivot point (9) for the lever arm (8).





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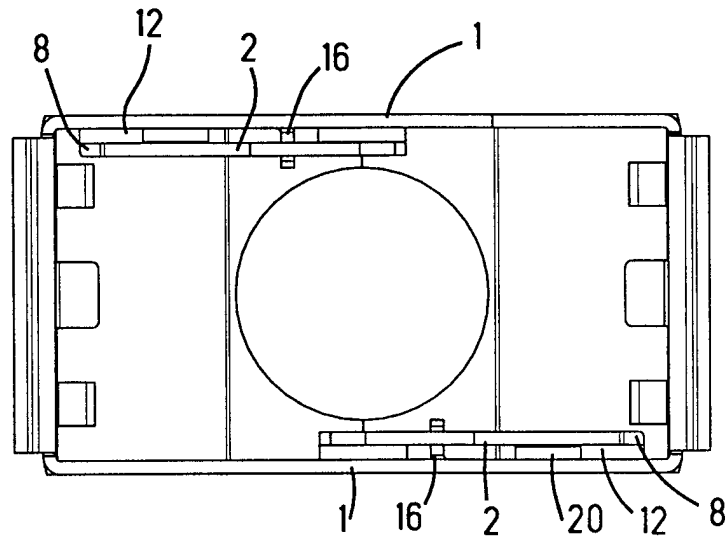


Fig. 5

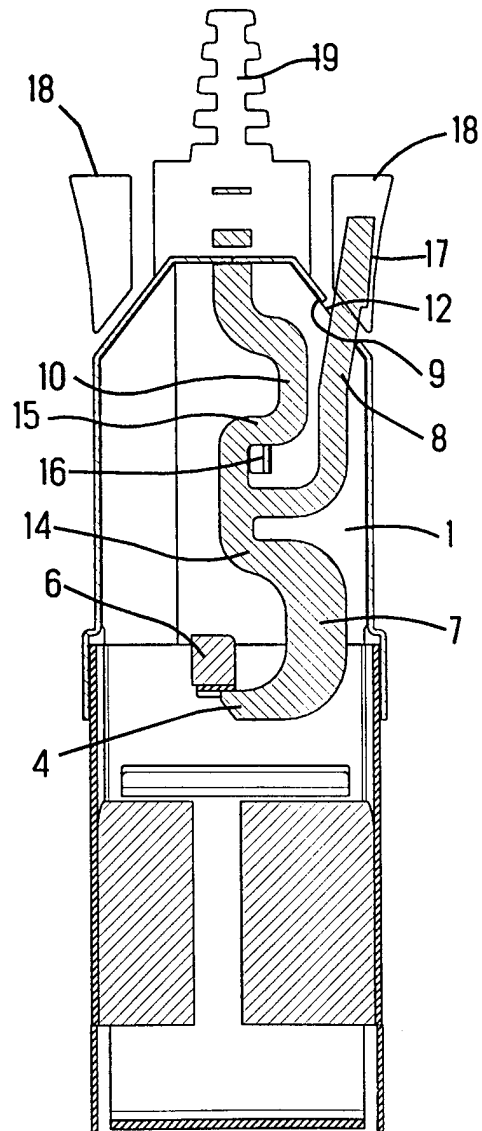


Fig. 6

INTERNATIONAL SEARCH REPORT

International Application No

PCT/IB 97/01475

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H01R13/627

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 H01R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 486 117 A (CHANG WEI-SUN) 23 January 1996	1
A	see column 3, line 24 - column 6, line 13 ---	2-7
X	FR 2 669 897 A (LABINAL) 5 June 1992	1
A	see page 5, line 7 - page 7, line 27 ---	2-7
X	EP 0 356 157 A (MOLEX INC ; XEROX CORP (US)) 28 February 1990 see column 7, line 4 - line 48; figures 3,4 ---	1
A	US 4 702 542 A (NOYES ROBERT W) 27 October 1987 see column 3, line 18 - column 4, line 27; figure 1 ---	1-5
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 119 952 A (SIEMENS AG) 26 September 1984 see the whole document ---	1-5
A	WO 87 07088 A (KINLOCH ELECTRONICS LTD) 19 November 1987 -----	

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/IB 97/01475

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