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(54) A plug and socket connection

(57) A plug and socket connection comprising two connecting elements (1, 2), namely a plug (1) and a socket (2), into which the plug (1) can be inserted so as to make an electrical connection. The first connecting element (2, 1) is provided with spring means (12), which engage the second connecting element (1, 2) when the plug (1) is inserted in the socket (2), so that the plug (1) will be pulled out of the socket (2) when a predetermined pulling force is exceeded. Preferably, the first connecting element is the socket (2) and the second connecting element is the plug (1). Preferably, the spring means comprise a leaf spring (12).

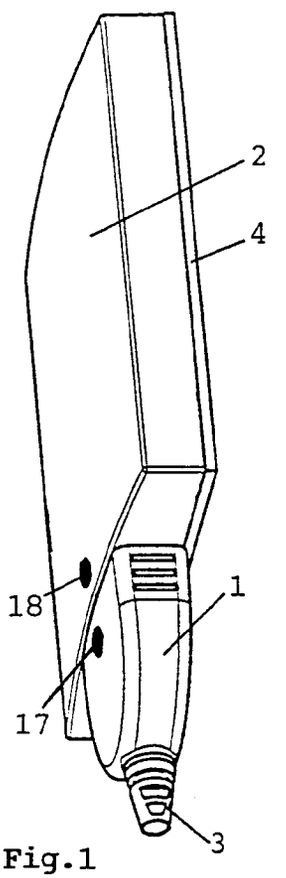

Fig.1

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Description

[0001] The invention relates to a plug and socket connection comprising two connecting elements, namely a plug and a socket, into which the plug can be inserted so as to make an electrical connection.

[0002] Such a plug and socket connection may be provided with a socket outlet, which houses the socket, which socket outlet can be surface-mounted on a wall or be flush-mounted in a wall. The plug can be inserted into the socket of the socket outlet so as to make an electrical connection, for example for connecting a current supply to an appliance to be fed thereby. Plug and socket connections of this kind are also used for connecting a loudspeaker to an amplifier, for example, or for transmitting other electrical signals.

[0003] The electrical connection can be made in that electrically conducting elements are pressed together or in that electrically conducting projections are inserted into corresponding recesses, or in other manners which are known per se.

[0004] The expression "inserting a plug into a socket" which is used herein is to be understood to mean any form of making an electrical connection wherein a plug is moved in the direction of a socket, which may or may not be a fixed socket, in order to bring electrically conducting elements of the two in contact with each other. Also the plug may be provided with recesses into which conducting projections of the socket extend.

[0005] For reasons of safety, it may be important to keep the mechanical load on an electric wire below a predetermined value, to which end it is known to provide such a wire with a break connection, which breaks up into two parts when the pulling force exerted on the wire exceeds a predetermined value. The two parts of the break connection are thereby held together by means of a magnetic force until the magnetic force is no longer able to withstand said pulling force. Such a break connection may be used in order to prevent the electrically conducting wire from being damaged by an excessive pulling force. The protection may also be aimed at other objects or even body parts that run a risk of being damaged as a result of an excessive pulling force being exerted on the conducting wire. In this connection, a person wearing headphones may be considered, whereby the conducting wire to the headphones is wound round said person's neck.

[0006] The objective of the invention is to provide a plug and socket connection which is pulled out when the pulling force exceeds a predetermined value, which is of simple construction and which operates in a reliable and reproducible manner.

[0007] In order to accomplish that objective, the first connecting element is provided with spring means, which engage the second connecting element when the plug is inserted in the socket, so that the plug will be pulled out of the socket when a predetermined pulling force is exceeded. Preferably, the first connecting element is the socket and the second connecting element is the plug, which is engaged by the spring means of the socket. By using mechanical spring means, practically any breakaway force can be selected in a simple manner by adjusting the pre-tension of the spring means accordingly.

[0008] When the plug is inserted in the socket, the spring means preferably engage the second connecting element in such a manner that the connecting elements are held at predetermined positions with respect to each other. In another preferred embodiment, the spring means press the plug and the socket together, so that they abut against each other. In both cases, the plug and the socket are held in an optimum position with respect to each other at all times, until the plug and socket connection is broken as a result of an excessive pulling force being exerted on the plug.

[0009] Preferably, the spring means are provided with at least one spring element, which can move under spring force in a direction which extends substantially perpendicularly to the direction of insertion, which spring element can abut against a surface of the second connecting element which extends obliquely with respect to the direction of insertion. The second connecting element may thereby be provided with an upraised edge transversely to the direction of insertion, behind which edge the spring means can engage. The spring means preferably comprise a leaf spring, which leaf spring may comprise at least two spring elements, which are capable of engaging the second connecting element in different places, for example on either side of the plug.

[0010] When a leaf spring of the socket engages the plug in different places, preferably on either side of the plug, the plug shape can be selected so that a substantially constant pulling force is required at all times to pull the plug out, also if the pulling force is exerted in a direction other than the direction of insertion. If a spring element offers less resistance when the pulling force is exerted in an oblique direction, the other spring element will automatically offer greater resistance, so that the resistance against pulling the spring means loose will remain substantially the same.

[0011] In one preferred embodiment, the plug has a substantially rectangular cross-section, seen in a direction perpendicularly to the direction of insertion, at least that part of the plug which is positioned near the socket or in the socket when inserted, and the spring means engage the second connecting element at the location of the centre of at least one of the sides, preferably at the location of the centres of two sides positioned opposite each other, more preferably on three of the four sides. A plug having a rectangular cross-section is often preferable to a plug having a circular cross-section, because it is easier to insert a plug having a rectangular cross-section in the correct position into the socket. The rectangular cross-section makes it possible to have the spring means engage the straight parts of the edge of the plug. In particular when a leaf spring is used, an ef-

fective engagement can be effected.

[0012] If the socket is housed in a socket outlet, or if it can be mounted on a wall in another manner, the socket can be designed so that the direction of insertion is substantially parallel to the wall on which the socket is mounted.

[0013] One advantage of this is the fact that the plug will be positioned closer to the wall when inserted, and that the cord to which the plug is attached can be laid along the wall from the socket. With a plug and a socket of this kind, the pulling force with which the plug is pulled out of the socket will frequently be exerted at a relatively large angle to the wall, so that the plug is pulled out of the socket in a direction obliquely away from the wall.

[0014] With such a wall-mounted socket, one spring element of the spring means is preferably present on the side of the plug that faces towards the wall, so that the plug is engaged on that side. When the plug is pulled out in an oblique direction, this is the side of the plug that will be released from the socket first.

[0015] Preferably, the socket is provided with a leaf spring mounted therein, which leaf spring comprises three spring elements, one of which engages the plug at the location of the side of the plug that faces towards the wall, and two of which engage the plug at the location of the two sides that extend substantially perpendicularly to the wall. A leaf spring of this kind comprising three spring elements is relatively simple. The spring means need not engage the plug on the side that faces away from the wall, because this side will not be loaded with a pulling force exerted on the plug from the socket when the plug is pulled out in an oblique direction.

[0016] The invention furthermore relates both to the plug and to the socket individually, with said plug and said socket being constructed as described above.

[0017] The invention furthermore relates to a method for securing a releasable electric plug and socket connection against being pulled apart unintentionally, wherein the plug and socket connection is provided with spring means as described before, which prevent said pulling apart as long as the pulling force remains below a predetermined value.

[0018] The invention furthermore relates to a method for preventing damage and/or injury caused by an electrically conducting wire, wherein the conducting wire is provided with a releasable connection as described before.

[0019] The invention will be explained in more detail below by means of an embodiment of the plug and socket connection, whereby reference will be made to the drawing.

Figure 1 is a perspective view of a plug which is inserted in a socket;
Figures 2 - 6 are views of a plug;
Figure 7 is a perspective view of a plug;
Figure 8 is a perspective view of a socket outlet;
Figure 9 is an enlarged view of a part of Figure 8; and
Figure 10 is a perspective view of a leaf spring.

[0020] The Figures are merely schematic representations, wherein like parts are numbered alike.

[0021] Figure 1 is a perspective view of a plug 1, which is inserted in the socket of a socket outlet 2. Plug 1comprises a flexible conducting part 3, through which a cord can extend, in which cord electrically conducting wires are present, which must be conductively connected to electrical conductors which are present in the socket of socket outlet 2.

[0022] Socket outlet 2 is secured to baseplate 4 by means not shown, which baseplate is secured to a wall by means of screws. Socket outlet 2 can be attached to baseplate 4 by means of a snap connection, so that socket outlet 2 can be removed from baseplate 4 when a sufficiently large force is exerted.

[0023] With the socket outlet 2 as shown in Figure 1, the direction of insertion of plug 1 is parallel to the wall. The plug and socket connection is constructed so that the various parts only project from the wall to a limited degree, whereby the cord which is attached to plug 1 can be laid along the wall from the plug and socket connection.

[0024] Plug 1 is provided with a mark 17 on one side, for example a red dot, which must be positioned near the corresponding mark 18 on socket outlet 2 if the plug is correctly inserted in the socket. The side of plug 1 on which mark 17 is provided is the side which is represented as the underside of the plug hereafter.

[0025] Figure 2 is a side view of plug 1, showing a projecting part 5 of the plug on the front (left-hand) side, which part 5 can extend into the socket of socket outlet 2. Contact elements are present in said projecting part 5 of plug 1, which contact elements make contact with corresponding contact elements in the socket of socket outlet 2 when the plug 1 is inserted. The contact elements themselves are not shown in the figures. They are well-known parts of a plug and socket connection, which generally comprise electrical conductors, which can be brought into contact with each other.

[0026] Plug 1 has a substantially rectangular cross-section, seen in the direction of insertion, as has the projecting part 5 of the plug. Projecting part 5 is provided with an edge 6 on its front side, which edge extends along three sides of said projecting part 5.

[0027] Figure 3 (plan view of plug 1) shows edge 6 on the short side in side view, and it shows edge 6 on one of the long sides in plan view.

[0028] Figure 2 (side view of plug 1) shows edge 6 on the upper side of projecting part 5 in side view, and it also shows that the underside of projecting part 5 is not provided with an edge. Figure 4 is a bottom view of plug 1.

[0029] Also the front view (Figure 5) of plug 1 shows edge 6 present on three of the four sides. As already said before, Figure 5 does not show the contact ele-

ments which are present in the plug, but only the space in which said contact elements can be accommodated.

[0030] Figure 6 is a rear view of plug 1, wherein hole 7 can be distinguished, through which the cord to which the plug is attached can extend. Plug 1 and conducting part 3 may be made in one piece of plastic material, in a manner which is known per se.

[0031] Figure 7 is a perspective view of plug 1.

[0032] Figure 8 shows socket outlet 2 with its open side directed upwards, which open side is mounted on baseplate 4 in Figure 1. According to Figure 8, socket outlet 2 comprises four side walls 8 and one front wall 9. Illustrated within circle 10 is a socket, which is mounted in one of the side walls 8.

[0033] Figure 9 is a more detailed view of that which is shown within circle 10 in Figure 8. A substantially rectangular opening 11 is provided in side wall 8, through which the projecting part 5 of plug 1 can extend. Present near said recess 11 are contact elements, which are capable of making contact with corresponding contact elements in plug 1. The contact elements are not shown in the figures.

[0034] Figure 9 shows a leaf spring 12, which is mounted on two supporting elements 13 of socket outlet 2 by means of screws (not shown).

[0035] Figure 10 is a more detailed view of leaf spring 12. Leaf spring 12 is made of a resilient metal, and it is provided with three spring elements 14, 15. Figure 10 shows that said spring elements 14, 15 are formed so that they are capable of engaging behind the edge 6 of the projecting part 5 of plug 1. Spring element 15 can thereby engage behind edge 6 along the upper side of projecting part 5, and spring means 14 can engage behind edge 6 on the short side of projecting part 5.

[0036] Leaf spring 12 is furthermore provided with two fasteners 16, by means of which the leaf spring can be screwed onto supporting elements 13.

[0037] Figure 9 shows the manner in which leaf spring 12 is positioned in the socket. Two spring elements 14 are thereby present on either side of opening 11, whilst a spring element 15 is present on the long side of opening 11, on a side of opening 11 that faces towards the wall.

[0038] The illustrated embodiment is to be considered a mere example, also other embodiments are possible.

Claims

1. A plug and socket connection comprising two connecting elements, namely a plug (1) and a socket (2), into which the plug (1) can be inserted so as to make an electrical connection, wherein the first connecting element (2, 1) is provided with spring means (12, 14, 15), which engage the second connecting element (1, 2) when the plug (1) is inserted in the socket (2), so that the plug (1) will be pulled out of the socket (2) when a predetermined pulling force is exceeded.

2. A plug and socket connection according to claim 1, characterized in that the first connecting element is the socket (2) and the second connecting element is the plug (1).

3. A plug and socket connection according to any one of the preceding claims, characterized in that, when the plug (1) is inserted in the socket (2), the spring means (12, 14, 15) engage the second connecting element in such a manner that the connecting elements are held at predetermined positions with respect to each other.

4. A plug and socket connection according to any one of the preceding claims, characterized in that, when the plug (1) is inserted in the socket (2), the spring means (12, 14, 15) press the connecting elements together.

5. A plug and socket connection according to any one of the preceding claims, characterized in that the spring means (12, 14, 15) are provided with at least one spring element (14, 15), which can move under spring force in a direction which extends substantially perpendicularly to the direction of insertion, which spring element (14, 15) can abut against a surface of the second connecting element which extends obliquely with respect to the direction of insertion.

6. A plug and socket connection according to any one of the preceding claims, characterized in that the second connecting element (1, 2) is provided with an upraised edge (6) transversely to the direction of insertion, behind which edge the spring means (12, 14, 15) can engage.

7. A plug and socket connection according to any one of the preceding claims, characterized in that the spring means (12, 14, 15) comprise a leaf spring.

8. A plug and socket connection according to claim 7, characterized in that the leaf spring (12, 14, 15) comprises at least two spring elements (14, 15), which are capable of engaging the second connecting element (1, 2) in different places, for example on either side of the plug (1).

9. A plug and socket connection according to any one of the preceding claims, characterized in that the plug (1) has a substantially rectangular cross-section, seen in a direction perpendicularly to the direction of insertion, and that the spring means (12) engage the second connecting element (1, 2) on three of the four sides, preferably at the location of the centres of said sides.

10. A plug and socket connection according to any one of the preceding claims, characterized in that the socket (2) comprises fastening means for being secured to a wall.

11. A plug and socket connection according to claim 10, characterized in that the direction of insertion of the plug (1) is substantially parallel to the wall on which the socket (2) is mounted.

12. A plug and socket connection according to claim 11, characterized in that the spring means (12, 14, 15) engage the second connecting element (1, 2) on the side of the plug (1) that faces towards the wall.

13. A plug and socket connection according to claim 12, characterized in that the socket (2) is provided with a leaf spring (12) mounted therein, which leaf spring comprises three spring elements (14, 15), one of which engages the plug (1) at the location of the side of the plug (1) that faces towards the wall, and two of which engage the plug (1) at the location of the two sides that extend substantially perpendicularly to the wall.

14. A socket outlet provided with a socket corresponding with the first connecting element (2) according to any one of the preceding claims.

15. A plug corresponding with the second connecting element (1) according to any one of the claims 1 - 13.

16. A method for securing a releasable electric plug and socket connection against being pulled apart unintentionally, characterized in that the plug and socket connection is provided with spring means (12) according to any one of the claims 1 - 13.

17. A method for preventing damage and/or injury caused by an electrically conducting wire, characterized in that the conducting wire is provided with a releasable connection according to any one of the preceding claims 1 - 13.

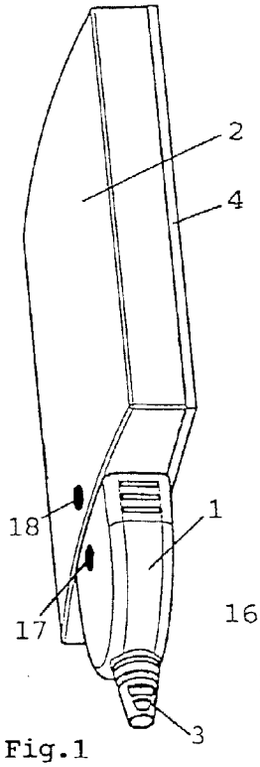

Fig.1

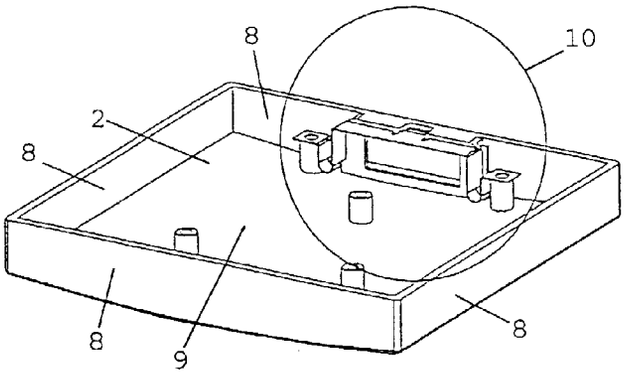

Fig.8

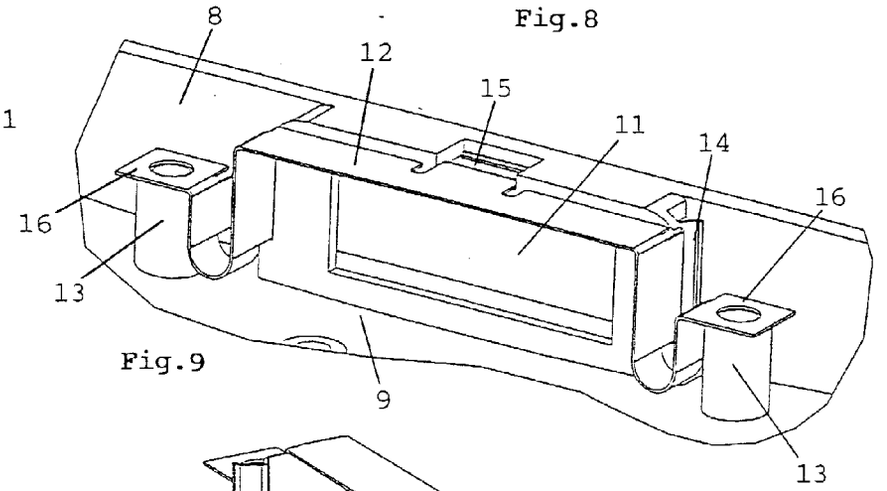

Fig.9

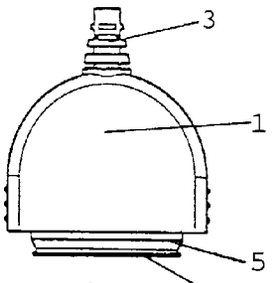

Fig.3

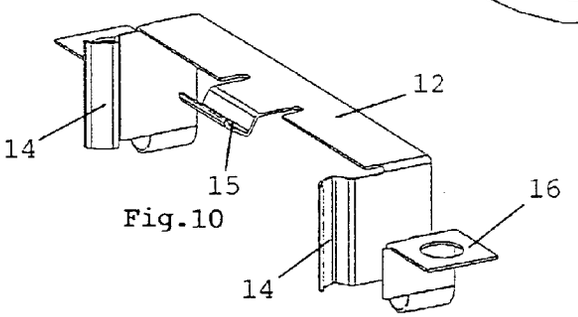

Fig.10

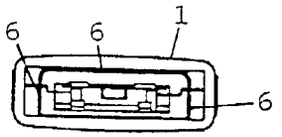

Fig.5

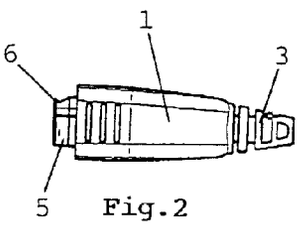

Fig.2

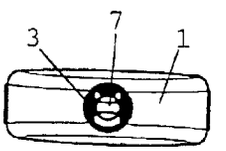

Fig.6

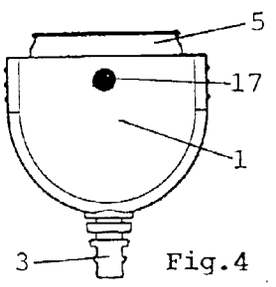

Fig.4

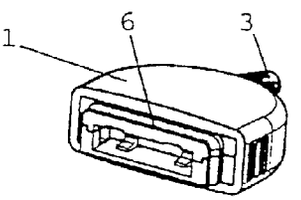

Fig.7

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EUROPEAN SEARCH REPORT

Application Number
EP 98 20 4188

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	US 5 695 355 A (HASENFRATZ ROBERT ET AL) 9 December 1997 * column 1, line 15 - line 19; figures 1-10 *	1-11, 14-17	H01R13/627 H01R13/633
X	EP 0 697 754 A (MOLEX INC) 21 February 1996 * column 6, line 53 - column 7, line 15; figures 1-5 *	1-11, 14-17	
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X	EP 0 594 937 A (CONTACT GMBH) 4 May 1994 * column 10, line 44 - line 57; figures 1-12 *	1-8, 14-17	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 March 1999	Tappeiner, R

CATEGORY OF CITED DOCUMENTS

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