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NL-1000 HB Amsterdam (NL)**(54) **Connector assembly for connecting a shielded cable to a printed circuit board.**

(57) A connector assembly for connecting a shielded cable (1) to a printed circuit board (2) comprises a first connector element (3) with a first housing (4) of insulating material, a plurality of rows of male signal contacts (6) and at least one row of male ground contacts (8). A second connector element (9) has a housing (10) formed of metal to be connected with the cable shielding and having an insertion side, an insert (12) of insulation mounted in the housing, rows of female signal contacts (16) received in the insert and corresponding with the rows of male signal contacts (6) and at least one row of female ground contacts (20). The first housing (4) is provided along at least one longitudinal wall (5) with outwardly open slots (7) in which said male ground contacts are received. The metal housing (10) has a receiving space in which the first housing (4) can be fully received in such a manner that the walls of the metal housing (10) are adjoining the printed circuit board (2) in the assembled position. Along at least one longitudinal side of the receiving space (17) the female ground contacts are provided as contact springs for contacting the male ground contacts (8) in the assembled position.

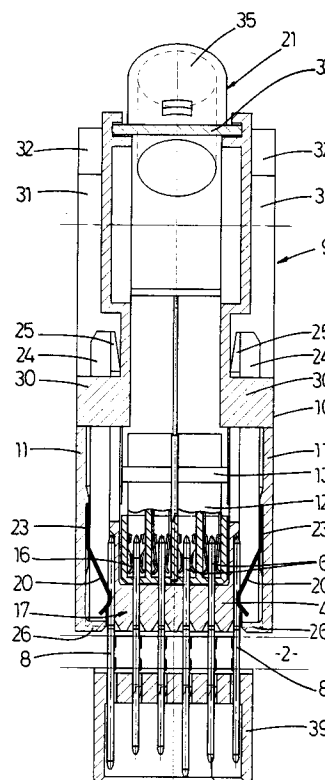


Fig.2

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The invention relates to a connector assembly for connecting a shielded cable to a printed circuit board according to the preamble of claim 1.

Such a connector assembly is disclosed for example in EP-A-0374307. In this known connector assembly the insert of the second connector element projects beyond the metal housing and is received in the housing of the first connector element in the assembled position of the connector assembly. This first connector element keeps the second connector element at a distance from the printed circuit board. Thereby the shielding of the signal conductors is partially interrupted at the location of this first connector element. Due to the ever increasing requirements for the signal transmission in such connector assemblies, this interruption in the shielding is a disadvantage of this known connector assembly.

The invention aims to provide an improved connector assembly of the above-mentioned type.

To this end the connector assembly according to the invention is characterized by the features of claim 1.

In this manner it is obtained that the walls of the metal housing are fully enclosing as a shielding the signal contacts up to the level of the printed circuit board so that there is no interruption at all in this shielding. Moreover the connector assembly according to the invention has the advantage that the signal contacts are enclosed by the walls of the metal housing both in the longitudinal and transverse direction.

According to a preferred embodiment of the connector assembly according to the invention the first housing at at least one longitudinal side is provided with at least one upright, springy locking pin carrying a locking cam at its free end, while the metal housing at the corresponding longitudinal side(s) has an inwardly directed flange with a passing slot for each locking pin and a locking cam cooperating with the locking cam of the (each) locking pin in the assembled position of the contact assembly.

Thereby a mechanical locking in the assembled position of the connector assembly is obtained in the first place, whereas in the second place the second connector element has to be brought in the correct position with respect to the first connector element to register each passing slot with the corresponding locking pin, whereby the different contacts of both connector elements will be registered before they contact each other.

According to a favourable embodiment of the connector assembly according to the invention the metal housing is provided with an inlet element for the cable, said inlet element being mounted rotatably and lockable in the housing. Thereby the cable can be guided into the connector element

under a desired angle with respect to the insertion side of the housing.

The invention further provides a connector element to be used in the described connector assembly, comprising a housing formed of metal and having an insertion side, an insert of insulating material mounted in the housing, rows of female contacts received in the insert and at least one row of female ground contacts, said connector element according to the invention being characterized in that the metal housing is provided at its insertion side with a receiving space for a housing of a complementary connector element, wherein at least at one longitudinal side of the receiving space female ground contacts are provided as contact springs directed obliquely inwardly.

The invention also provides a connector element, comprising a housing of insulating material with a plurality of rows of openings for receiving male signal contacts, wherein said connector element is characterized in that at at least one longitudinal wall slots are provided for receiving male ground contacts.

The invention will be further explained by reference to the drawings in which an embodiment of the connector assembly of the invention is shown.

Fig. 1 shows a perspective view of the connector assembly according to the invention in disengaged position, wherein the second connector element is shown in exploded view.

Fig. 2 is a central cross section of the connector assembly of fig. 1 in assembled position.

Fig. 3 is a side view of the second connector element of the connector assembly of fig. 1.

Fig. 4 shows the inner side of a housing half of the second connector element.

Referring to the drawings there is shown an embodiment of a connector assembly for connecting a cable 1 schematically shown in fig. 3 to a printed circuit board 2. As shown in fig. 1, the connector assembly comprises a first connector element 3 having a first housing 4 of insulating material with upright longitudinal walls 5. Between the longitudinal walls 5 there are four rows of male signal contacts 6 fixed in a suitable manner in plated through-holes of the printed circuit board 2, for example by a press-fit connection. The signal contacts 6 pass through fitting openings in the housing 4 and protrude freely in the space between the longitudinal walls 5.

In both upright longitudinal walls 5 there are provided outwardly open slots 7, in which male ground contacts 8 are received and are accessible from the outside. These ground contacts 8 are made in the same manner as the signal contacts 6 and are fixed for example by a press-fit connection in openings of the printed circuit board 2. In the described embodiment a row of ground contacts 8

is therefore present at both sides of the rows of signal contacts 6.

A second connector element 9 is provided with a housing 10 formed of metal. This housing 10 is assembled of two identical housing halves 11. An insert 12 of insulating material is mounted within the housing 10, wherein a projecting edge 13 of the insert 12 engages in a slot 14 at the inner side of the housing 10. Male signal contacts 16 are received in openings 15 of the insert 12, said male signal contacts 16 being schematically shown in fig. 2. The signal wires of the multi-wire cable 1 indicated in fig. 4 each are connected with a female signal contact 16 in a usual manner.

As appears from fig. 2 in particular, the insert 12 lies within the housing 10, wherein a receiving space 17 is provided at the insertion side of the housing 10, in which receiving space 17 the housing 4 of the first connector element 3 can be fully received. Thereby the longitudinal walls 18 and the transverse walls 19 of the housing 10 adjoin the printed circuit board 2 in the assembled position of the connector assembly according to fig. 2.

At the inner side of the longitudinal walls 18 female ground contacts 20 are provided protruding obliquely inwardly as contact springs and contacting the male ground contacts 8 in the assembled position. The cable 1 is guided into the housing 10 through an inlet element 21 formed of metal, wherein the shielding 22 of the cable 1 is connected with the inlet element 21.

The described connector assembly has the advantage that the shielding extends from the cable 1 upto the level of the printed circuit board 2 without any interruption. Further the signal contacts in the housing 10 are fully enclosed both at the longitudinal sides and the transverse sides by the housing 10 as a shielding. Thereby a high quality of the shielding of the connector assembly is obtained.

In fig. 1 and 4 it is indicated that the female ground contacts 20 are part of a contact strip 23 attached to the inner side of the longitudinal walls 18.

In the embodiment shown the housing 4 has at each longitudinal side two upright springy locking pins 24 carrying locking cams 25 directed towards each other. The longitudinal walls 18 of the housing 10 are provided at the insertion side with inwardly directed flange edges 26 having a passing opening 27 for each locking pin 24. The longitudinal walls 18 are inwardly staggered above the insert 12 through a shoulder part 28 in which a passage opening 29 is also provided for each locking pin 24. A locking cam 30 is formed on the shoulder part 28, which locking cam 30 is common to both locking pins 24 of each longitudinal wall 5. In the assembled position shown in fig. 2 and 3, the locking cams 25 engage behind the locking cam

30, so that the connector element 9 is mechanically locked on the connector element 3. Thereby any undesired detaching of the connector element 9 is not possible anymore. Further the described embodiment with the locking pins 24 shows the advantage that the connector element 9 must be aligned with the passage openings 27 to the locking pins 24 and can only be slid on the locking pins in the correct position. Thereby the signal contacts 16 and ground contacts 20 of the connector element 9 are already registered with the signal contacts 6 and ground contacts 8 of the connector element 3 before a connection between the different contacts is made. Deterioration of the contacts is thereby prevented.

In order to facilitate the unlocking of the locking pins 24 guiding edges 31 are provided on the outer side of the longitudinal walls 18, which guiding edges facilitate to align a tool for pressing the locking pins 24 away from each other. These guiding edges 31 carry cams 32 at their end opposite of the shoulder part 28, at which cams a suitable tool for removing the connector element 9 can engage.

In the embodiment shown in the drawings the inlet element 21 is provided with a cylinder section 33 with a toothing 34 schematically indicated in fig. 1. The cylinder section 33 carries an inlet tube 35 through which the wires of the cable 1 are guided into the housing 10. The shielding 22 of the cable 1 is located on the outer side of the inlet tube 35 and is attached to the same by a ring 36 made of metal.

At the inner side of the longitudinal walls 18 a circle section path 37 is provided for guiding the cylinder section 33. This circle path 37 is also provided with a toothing 38. Thereby the inlet element 21 is rotatable with respect to the housing 10 and can be locked in any desired position by the engaging toothings 34, 38. As schematically shown in fig. 3, the inlet element can be mounted in two different positions in the housing 10, whereby the cable 1 can be mounted under any desired angle with respect to the housing 10.

In fig. 2 it is shown that the contacts 6, 8 extend through the printed circuit board 2 and are received in a connector housing 39 at the side opposite of the housing 4, so that at this side of the printed circuit board 2 a connector element is also provided.

It is noted that in the described embodiment the housing 10, the inlet element 21 and the ring 36 are made of metal. However these parts can also be made of any other suitable electrically conductive material or can be provided with an electrically conductive coating. Within the scope of the invention "metal" also comprises any suitable conductive material.

The invention is not restricted to the above-described embodiment, which can be varied in a number of ways within the scope of the claims.

Claims

1. Connector assembly for connecting a shielded cable to a printed circuit board, comprising
 - a first connector element having a first housing of insulating material, a plurality of rows of male signal contacts and at least one row of male ground contacts, said rows of contacts being inserted in openings in the printed circuit board and being accommodated in the first housing,
 - a second connector element having a housing formed of metal, to be connected with the cable shielding and including an insertion side, an insert of insulating material mounted in the housing, rows of female contacts received in the insert and corresponding with the rows of male signal contacts and at least one row of female ground contacts, said second connector element with its insertion side being connectable with the first connector element, wherein corresponding contacts contact each other, **characterized in that**
 - the first housing is provided at least at one longitudinal wall with outwardly open slots in which said at least one row of male ground contacts is received, and in that
 - the metal housing is provided at its insertion side with a receiving space in which the first housing can be fully received in such a manner that the walls of the metal housing bounding the receiving space are adjoining the printed circuit board in the assembled position, wherein at least at one longitudinal side of the receiving space the female ground contacts are provided as contact springs for contacting the male ground contacts in the assembled position.
2. Connector assembly according to claim 1, **characterized in that** each row of ground contact springs is attached with a common contact strip to the corresponding inner wall of the metal housing.
3. Connector assembly according to anyone of the preceding claims, **characterized in that** the first housing at at least one longitudinal side is provided with at least one upright, springy locking pin carrying a locking cam at its free end, while the metal housing at the corresponding longitudinal side(s) has an inwardly directed flange with a passing slot for each locking pin and a locking cam cooperat-

ing with the locking cam of the (each) locking pin in the assembled position of the contact assembly.

4. Connector assembly according to claim 3, **characterized in that** the longitudinal walls of the metal housing are staggered inwardly through a shoulder part above the insert, wherein a passing opening is provided in the (each) shoulder part for each locking pin and wherein the corresponding locking cam is formed on the shoulder part.
5. Connector assembly according to claim 4, **characterized in that** a guiding means is provided on the (each) inwardly staggered longitudinal wall of the metal housing adapted to cooperate with a tool for detaching the (each) locking pin.
6. Connector assembly according to claim 4 or 5, **characterized in that** at least one engaging cam for a tool for removing the second connector element is provided on the (each) inwardly staggered longitudinal wall.
7. Connector assembly according to anyone of the preceding claims, **characterized in that** the metal housing is provided with an inlet element for the cable, said inlet element being mounted rotatably and lockable in the housing.
8. Connector assembly according to claim 7, **characterized in that** the inlet element is provided with a cylinder section with an inlet tube for the cable and in that the metal housing is provided at its inner side with a circle section path for rotatably guiding the cylinder section.
9. Connector assembly according to claim 8, **characterized in that** the cylinder section and the circle section path are provided with complementary toothings.
10. Connector assembly according to anyone of the preceding claims, **characterized in that** the metal housing is assembled of two identical housing halves.
11. Connector element to be used in a connector assembly according to anyone of the preceding claims, comprising a housing formed of metal and having an insertion side, an insert of insulating material mounted in the housing, rows of female contacts received in the insert and at least one row of female ground contacts, **characterized in that** the metal housing

is provided at its insertion side with a receiving space for a housing of a complementary connector element, wherein at least at one longitudinal side of the receiving space female ground contacts are provided as contact springs directed obliquely inwardly. 5

12. Connector element to be used in a connector assembly according to anyone of the preceding claims 1-10, comprising a housing of insulating material with a plurality of rows of openings for receiving male signal contacts, **characterized in that** at at least one longitudinal wall slots are provided for receiving male ground contacts. 10 15

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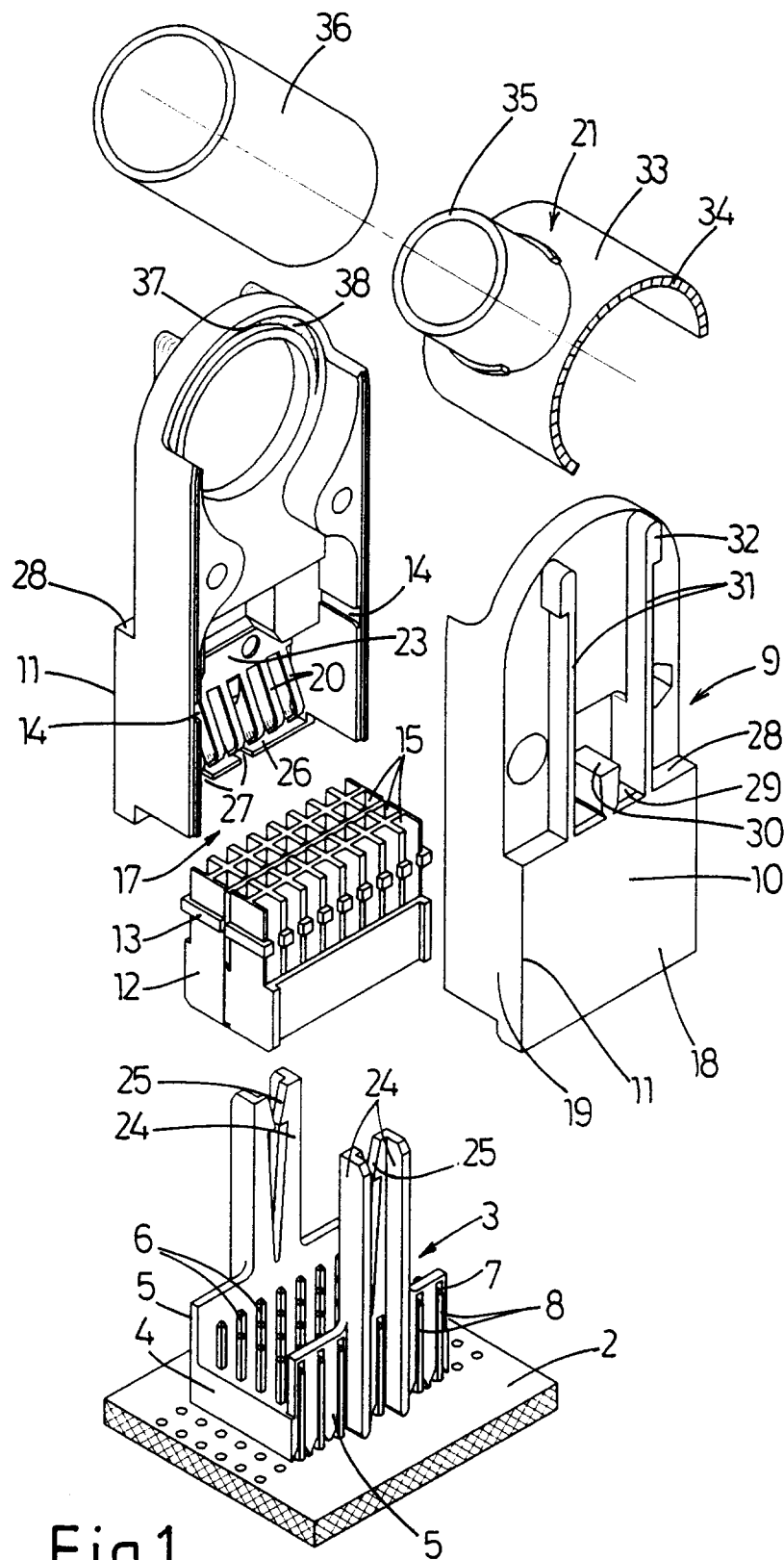


Fig.1

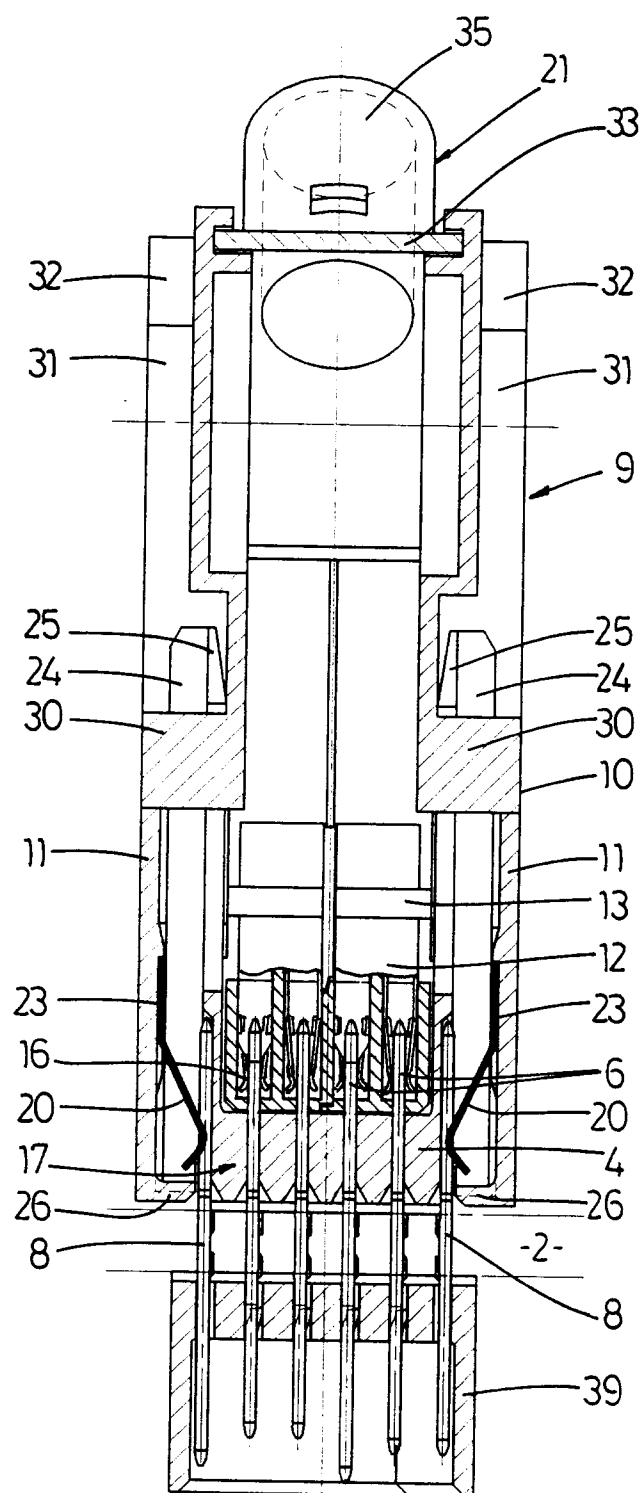


Fig.2

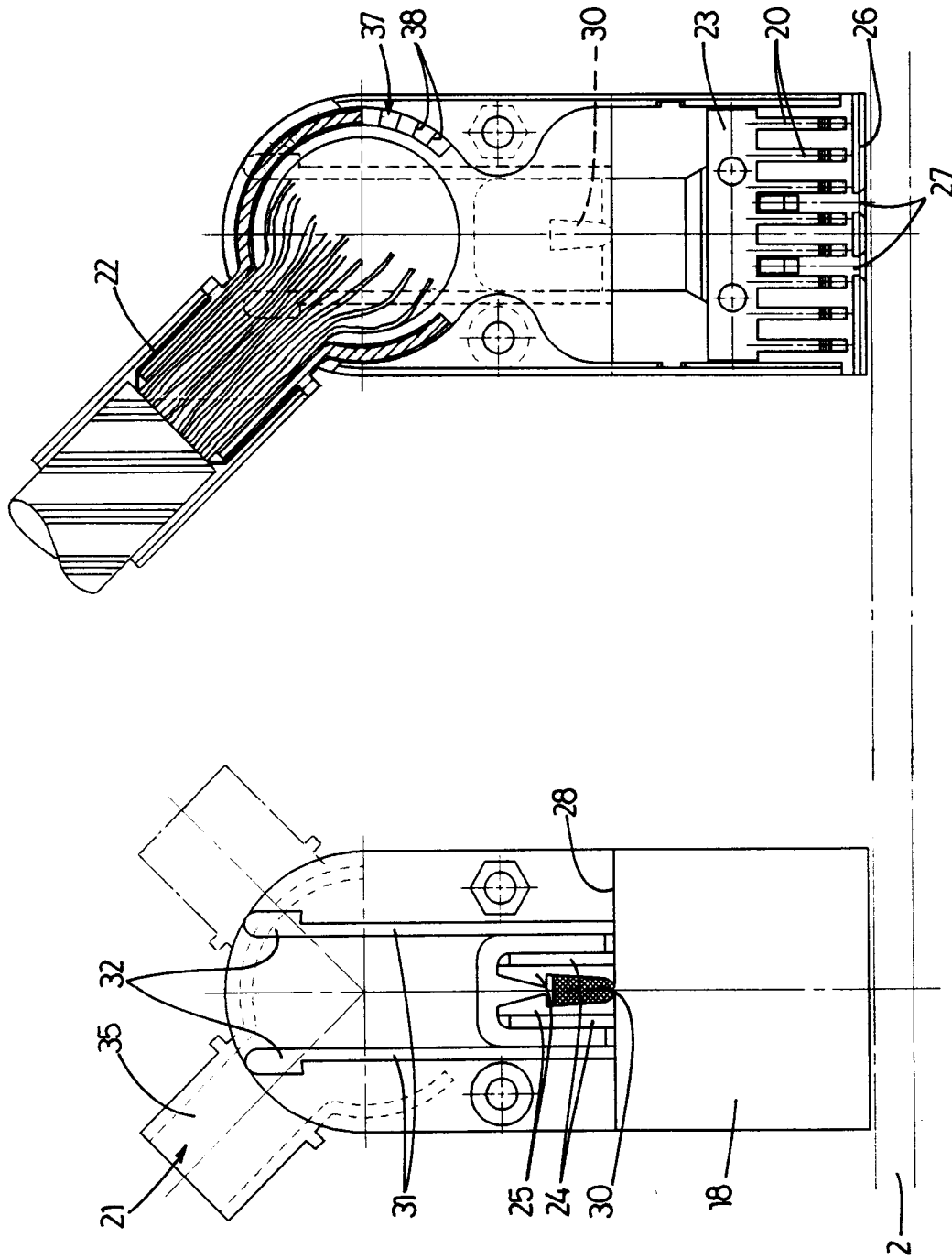


Fig.4

Fig.3



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EUROPEAN SEARCH REPORT

Application Number

EP 92 20 3735

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.5)
A	DE-C-3 904 461 (ERNI ELEKTROAPPARATE GMBH) * column 2, line 24 - line 60; figure * ---	1	H01R23/68 H01R13/658
D,A	EP-A-0 374 307 (BURNDY ELECTRA N.V.) * abstract * * column 6, line 15 - line 35; figure 6 * ---	1,2	
A	DE-A-3 936 466 (ERNI ELEKTROAPPARATE GMBH) * column 1, line 21 - column 2, line 28; figure 1 * ---	1	
A	EP-A-0 412 331 (SIEMENS AG) * abstract; figures 1,3 * ---	1,2	
A	DE-A-3 834 182 (ERNI ELEKTOAPPARATE GMBH) * abstract; figure * -----	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			H01R
Place of search THE HAGUE		Date of completion of the search 12 MARCH 1993	Examiner KOHLER J.W.
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