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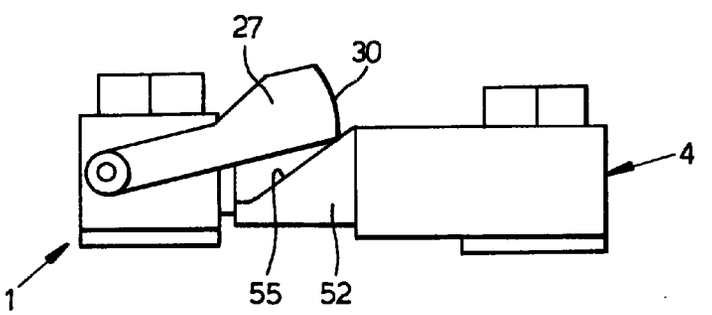
(54) Electrical connector assemblies having shutter and align means

(57) An electrical connector assembly has two connectors 1 and 4 with mating contacts 15 and 45. One connector 1 has a hinged shutter 27 protecting the contacts. The other connector 4 has two parallel alignment arms 51 and 52, which enter slots 32 in the shutter 27 to lift it away from the contacts 15 as the connectors are brought together. The first connector 1 has two pockets 24 to receive the alignment arms 51 and 52, the pocket and arms having cooperating rails 23 and grooves 53, which are flared at their ends to facilitate alignment.

Fig.12.



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Description

This invention relates to electrical connector assemblies of the kind comprising first and second connectors, each connector having a housing and a plurality of contact elements, the connectors being arranged to mate with one another so that the respective contacts engage one another.

Electrical connectors for use in high power applications present particular problems. The large size of the contacts in the mating connectors of the assembly means that they are particularly vulnerable to inadvertent contact. Also, one connector of the assembly is often mounted at the back of an equipment housing, making access difficult. More particularly, it can be difficult to align the two connectors of the assembly.

It is an object of the present invention to provide an improved electrical connector assembly.

According to one aspect of the present invention there is provided an electrical connector assembly of the above-specified kind, characterised in that one of the connectors has first and second alignment members projecting from its housing, that the other of the connectors has cooperating surface formations arranged to cooperate with the alignment members and thereby align the two connectors with one another, that the other connector has a shutter movable between a first position in which the shutter prevents access to the contacts and a second position in which the contacts are exposed for access, and that the shutter is arranged to be displaced away from the first position to the second position by the alignment members when the two connectors are brought together.

Preferably, the surface formations on the other connector are elongate, the alignment members having elongate surface formations arranged to cooperate with the surface formations on the other connector, and the surface formations on one of the connectors tapering in two orthogonal planes at their forward end such as to facilitate alignment in the two planes. The alignment members may each have a surface formation along one surface arranged to cooperate with respective surface formations on the other connector, the alignment members having an inclined ramp formed on an opposite surface and arranged to engage the shutter. The alignment members are preferably provided by two arms projecting forwardly parallel to one another at opposite ends of the one connector. The alignment members and the surface formations on the other connector may have a cooperating rail and groove. The grooves may be formed along an inside surface of respective arms, the forward end of each arm being flared outwardly, and the forward end of each groove being flared to a greater width. The other connector preferably has two pockets extending alongside the contacts, the pockets being arranged to receive respective ones of the alignment members. The contacts in the one connector may be male pin elements, the contacts in the other connector being female socket elements. The shutter preferably has two side arms pivotally mounted at opposite ends of the housing of the other connector. The shutter may have two slots spaced along its length and adapted to receive the alignment members.

An electrical connector assembly according to the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a plan view of one connector of the assembly;

Figure 2 is an end elevation view of the connector of Figure 1 along the arrow II;

Figure 3 is a sectional end elevation along the line III-III of Figure 1, omitting the shutter;

Figure 4 is a side elevation view of the connector along the arrow IV of Figure 1;

Figure 5 is a transverse sectional view along the line V-V of Figure 4, omitting the shutter;

Figure 6 is a plan view of the other connector of the assembly;

Figure 7 is a side elevation view of the rear of the connector of Figure 6 along the arrow VII;

Figure 8 is a side elevation view of the front of the connector of Figure 6 along the arrow VIII;

Figure 9 is a transverse sectional view along the line IX-IX of Figure 8;

Figure 10 is a side elevation view along the arrow X of Figure 6;

Figure 11 is a transverse sectional elevation view along the line XI-XI of Figure 9; and

Figure 12 is an end elevation view showing the two connectors at a preliminary stage of mating.

The assembly comprises two connectors arranged to mate with one another. With reference first to Figures 1 to 5, the first connector 1 is of rectangular shape with a housing 10 of a plastics or other electrically-insulative material. The housing 10 has a row of five bores 11 extending parallel to one another along the housing from the rear face 12 to the front face 13. The bores 11 open on the front face through reduced diameter apertures 14 and each contains a female socket contact member 15, only one of which is shown. The socket member 15 is of an electrically-conductive material,

such as brass, and has a contact recess 16 at its forward end adapted to receive a male, contact pin of the other connector. The contact recess 16 typically contains some form of spring element arranged to make a resilient sliding contact with the contact pin as it is inserted. The rear end of the socket member 15 has a recess 17 for receiving the end of a wire 18. The wire 18 is retained in the rear recess 17 by means of two screws 19 extending through tapped holes in the wall of the socket member 15 and protected by short sleeves or shrouds 20 projecting from the upper surface of the housing 10.

At opposite ends of the main part of the connector housing 10 there are two end walls 21 and 22 along each of which projects a horizontal rail 23 located about midway up the height of the housing. The rails 23 are enclosed along the rear half of their length by two pockets 24 of rectangular shape and square section. The pockets 24 extend alongside the contacts 15 from the rear side of the connector to about half way across its width and each opens at its forward end 25. Two short studs 26 project horizontally from opposite ends of the housing 10, the studs being aligned with each other and located about halfway up the height of the housing and close to its rear side. The studs 26 support a shutter 27 moulded from a plastics material. The shutter 27 has two side arms 28, each having a bearing aperture 29 at their rear ends which receive respective ones of the studs 26. The side arms 28 extend horizontally and forwardly, parallel to one another, to a location just forwardly of the front face 13 of the housing 10, where the arms are joined by a vertical shutter plate 30 and a horizontal support plate 31. The shutter plate 30 is slightly convex, when viewed along the arrow IV, and has two vertical slots 32 located towards opposite ends of the plate. The slots 32 open on the lower edge of the shutter plate 30 and are aligned with the rails 23. In the position shown, the support plate 31 rests on the upper, forward edge of the housing 10 and the shutter plate 30 covers the apertures 14 of the sockets 16.

With reference now to Figures 6 to 11, the assembly is completed by a second connector 4. The second connector 4 has a generally rectangular housing 40 of an electrically-insulative material, such as a plastics, with five bores 41 extending parallel to one another along the housing from the rear face 42 to a rectangular recess 43 formed across the front surface of the housing. The size and shape of the recess 43 is such that it can receive the front end of the first connector 1 as a push fit. The bores 41 open into the recess 43 through reduced diameter apertures 44, each bore housing the rear end of a male electrical contact member 45, only one of which is shown. The forward end of the contact member 45 is in the form of a cylindrical pin 46 with a rounded end, which projects through the aperture 44 and extends to within a short distance of the forward end of the recess 43. The shape and size of the pin 46 is such that it can be inserted within, and make electrical contact with, a contact recess 16 in a corresponding socket member 15. The rear end 47 of the contact members 45 have a recess 48 within which the exposed end of a wire 49 is inserted, the wire being retained in position by means of a screw (not shown) extending through a tapped hole in the wall of the rear end of the contact member. The screws are protected in shrouds 50 projecting vertically upwards from the upper surface of the housing 40.

The second connector 4 also has two alignment arms 51 and 52 moulded as a part of the housing 40. The arms 51 and 52 extend horizontally forwards parallel to one another at opposite ends of the connector and are of generally rectangular section. The inside surface of each arm 51 and 52 has a horizontal groove 53 extending along the length of the arms and continuing into the recess. The depth and width of the grooves, along the major part of their length, match those of the rails 23 on the first connector 1, such that the rails can be slid along the grooves. The inside surface at the forward end of the arms 51 and 52 is flared outwardly at an angle α of 15°, in the horizontal plane, to provide a vertical bevel surface 54. Over the length of the bevel 54, each groove 53 flares outwardly, in a vertical plane, at an angle θ of 30° so that the width of the grooves at their forward end is about three times the width along most of their length. The depth of the grooves 53 is also reduced to zero at the forward end of the arms. The outside surface of the two arms 51 and 52 is reduced in thickness and is profiled to provide a cam surface 55. The cam surface 55 has a straight ramp 56 inclined upwardly from front to rear at an angle of about 37° to the horizontal and a short curved lead-in section 57 providing a transition from the forward end of the ramp to a horizontal forward edge 58. The forward ends of the arms 51 and 52 above the cam surface 55 is thinner than the remainder of the arms so that they locate in the slots 32 in the shutter 27.

To mate the two connectors 1 and 4 together, the forward end of the second connector 4 is brought up to the forward end of the first connector 1. The alignment arms 51 and 52 on the second connector 4 are aligned with the slots 32 in the shutter plate 30, this being facilitated by the bevels 54 on the inside of the arms, which reduce their thickness and help guide the arms into alignment, in the horizontal plane, with the rails 23 in the first connector 1. The leading edge 58 of each cam surface 55 is located just below the lower edge of the shutter plate 30, on the outside of respective slots 32, so that forward movement of the second connector 4 brings the lower edge of the shutter plate into engagement with the cam surfaces 55. This urges the shutter 27 to pivot upwardly, as shown in Figure 12, away from its first, closed position to a second open position where the plate 30 is raised above the apertures 14, to expose the sockets 16. As the second connector 4 is moved further forwards, the forward end of the rails 23 aligns with the forward end of the grooves 53, the flare at the for-

ward end of the grooves increasing their width and helping to align the rails, in a vertical plane, with the main part of the grooves. When the rails 23 are fully aligned with the grooves 53, the pins 46 in the second connector 4 are in alignment with the apertures 14 in the housing 10 of the first connector 1. Further movement together of the two connectors 1 and 4 causes the pins 46 to enter the sockets 16 so that full electrical interconnection between the two connectors is established. As this happens, the arms 51 and 52 slide into the pockets 24.

The shutter 27 serves to protect the sockets 16 from inadvertent contact and falls back to its original, closed position after removal of the second connector 4. A spring could be used to help return the shutter to its closed position, particularly where the connectors are not used in a horizontal orientation. The arms 51 and 52 on the second connector 4 serve a dual purpose of both displacing the shutter 27 to an open position and aligning the two parts of the connector, in two orthogonal planes, for mating of their respective contact elements.

It will be appreciated that the connector assembly could take various different forms, for example, it could have different numbers of contacts.

Claims

1. An electrical connector assembly comprising first and second connectors (1 and 4), each connector having a housing (10, 40) and a plurality of contact elements (15, 45), the connectors being arranged to mate with one another so that the respective contacts engage one another, characterised in that one of the connectors (4) has first and second alignment members (51 and 52) projecting from its housing (40), that the other of the connectors (1) has cooperating surface formations (23) arranged to cooperate with the alignment members and thereby align the two connectors with one another, that the other connector (1) has a shutter (27) movable between a first position in which the shutter prevents access to the contacts (15) and a second position in which the contacts are exposed for access, and that the shutter (27) is arranged to be displaced away from the first position to the second position by the alignment members (51 and 52) when the two connectors (1 and 4) are brought together.

2. A connector assembly according to Claim 1, characterised in that the surface formations (23) on the other connector (1) are elongate, that the alignment members (51, 52) have elongate surface formations (53) arranged to cooperate with the surface formations (23) on the other connector, and that the surface formations (53) on one of the connectors (4) taper in two orthogonal planes at their forward end such as to facilitate alignment in the two planes.

3. A connector assembly according to Claim 1 or 2, characterised in that the alignment members (51, 52) each have a surface formation (53) along one surface arranged to cooperate with respective surface formations (23) on the other connector (1), and that the alignment members have an inclined ramp (56) formed on an opposite surface and arranged to engage the shutter (27).

4. A connector assembly according to any one of the preceding claims, characterised in that the alignment members are provided by two arms (51 and 52) projecting forwardly parallel to one another at opposite ends of the one connector (4).

5. A connector assembly according to any one of the preceding claims, characterised in that the alignment members (51, 52) and the surface formations on the other connector (1) have a cooperating rail (23) and groove (53).

6. A connector assembly according Claim 5 when dependent on Claim 4, characterised in that the grooves (53) are formed along an inside surface of respective arms (51 and 52), that the forward end of each the arm is flared outwardly, and that the forward end of each the groove (53) is flared to a greater width.

7. A connector assembly according to any one of the preceding claims, characterised in that the other connector (1) has two pockets (24) at either end extending alongside the contacts (15), and that the pockets (24) are arranged to receive respective ones of the alignment members (51 and 52).

8. A connector assembly according to any one of the preceding claims, characterised in that the contacts (45) in the one connector (4) are male pin elements, and that the contacts (15) in the other connector (1) are female socket elements.

9. A connector assembly according to any one of the preceding claims, characterised in that the shutter (27) has two side arms (28) pivotally mounted at opposite ends of the housing (10) of the other connector (1).

10. A connector assembly according to any one of the preceding claims, characterised in that the shutter (27) has two slots (32) spaced along its length and adapted to receive the alignment members (51, 52).

Fig.1.

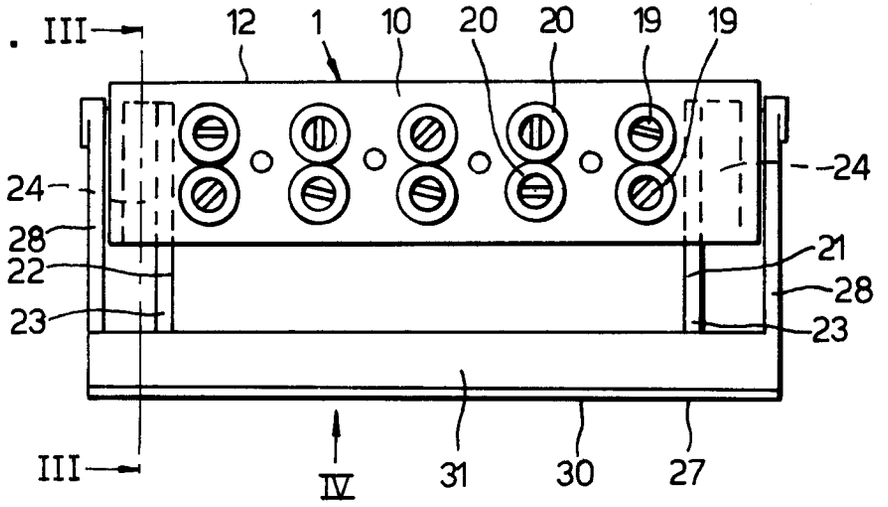


Fig.5.

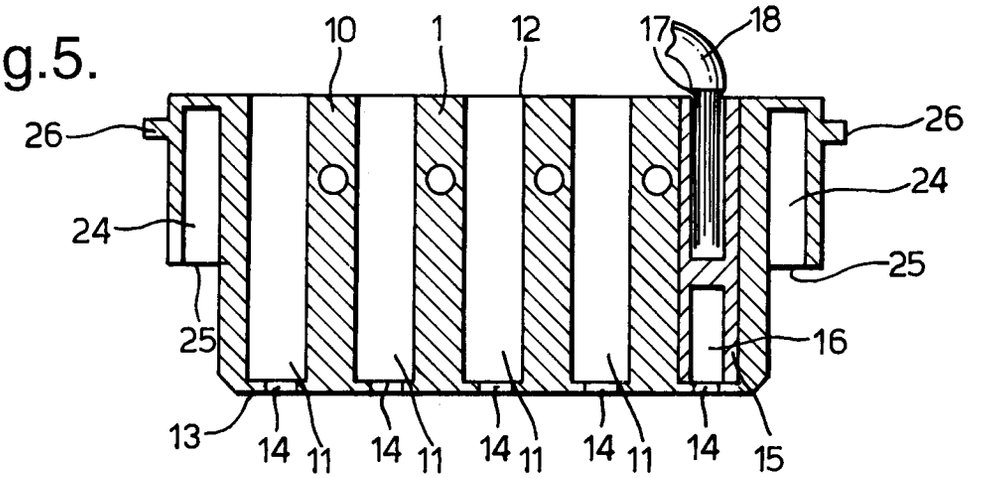


Fig.2.

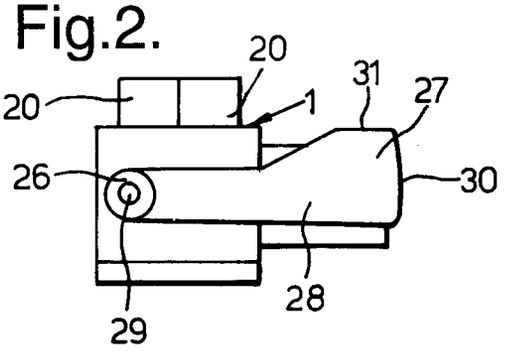


Fig.3.

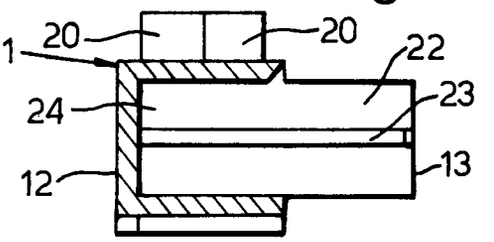


Fig.4.

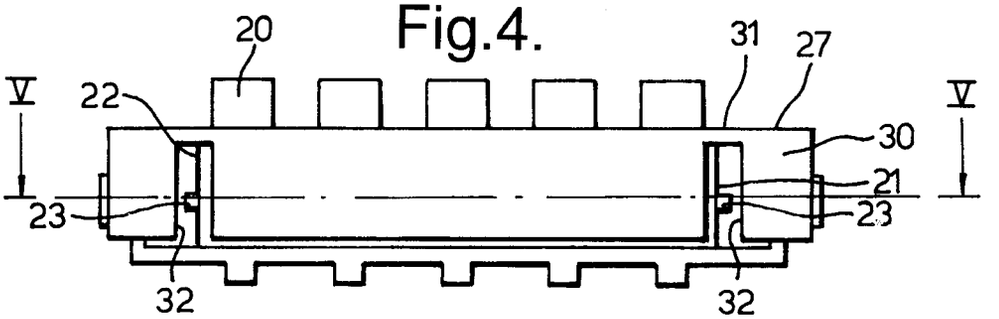


Fig.6.

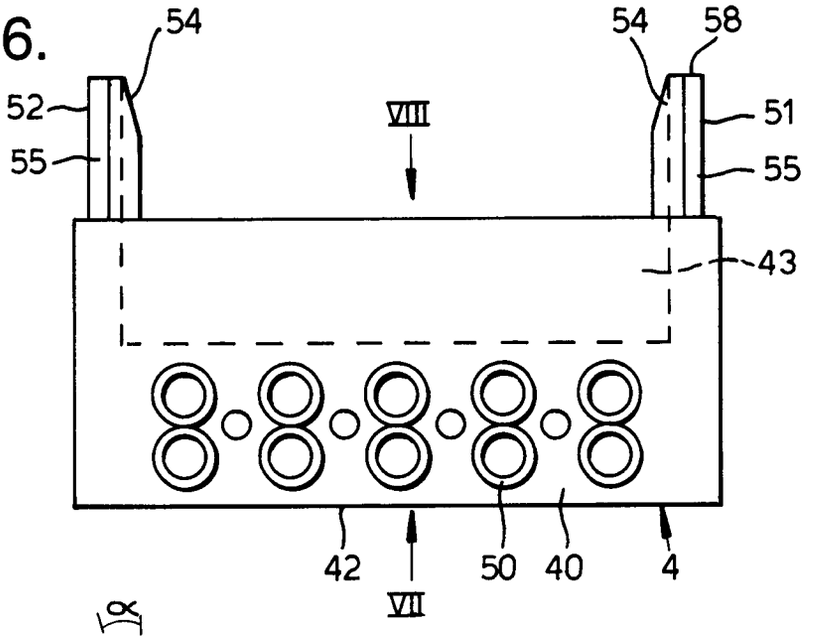


Fig.9.

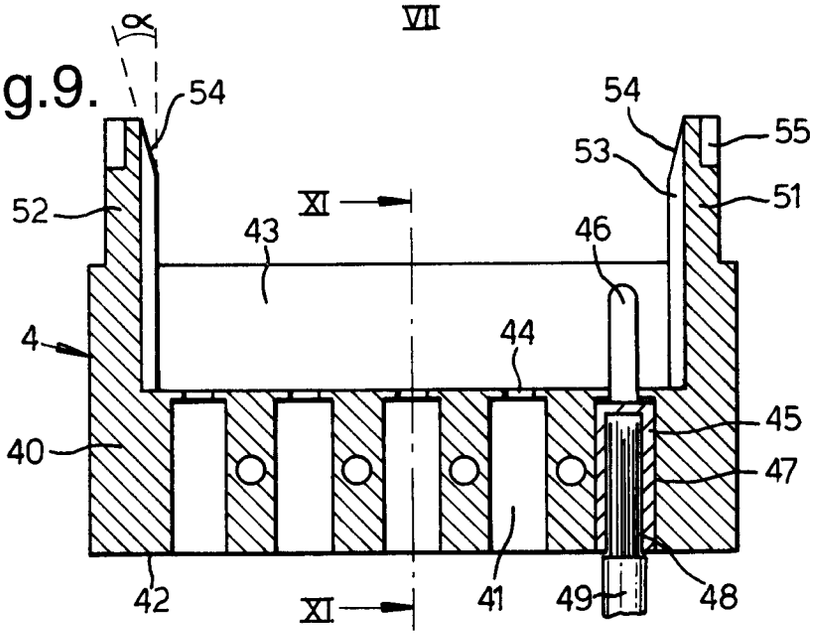


Fig.7.

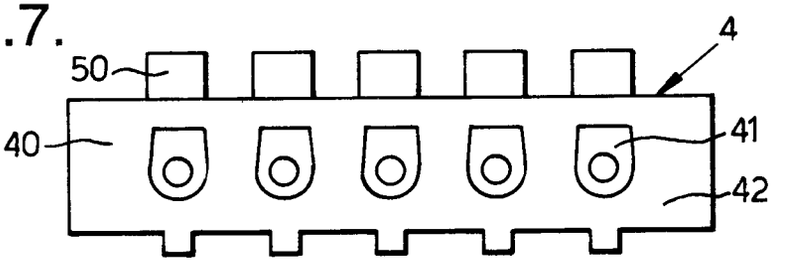


Fig.8.

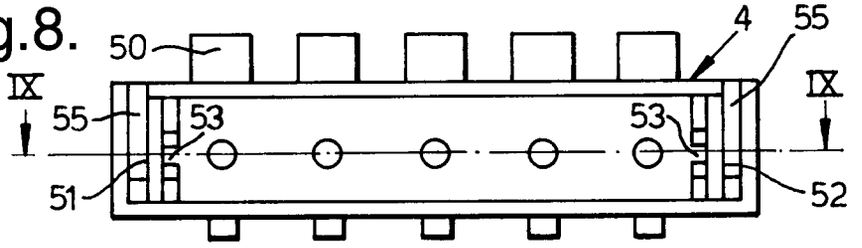


Fig.10.

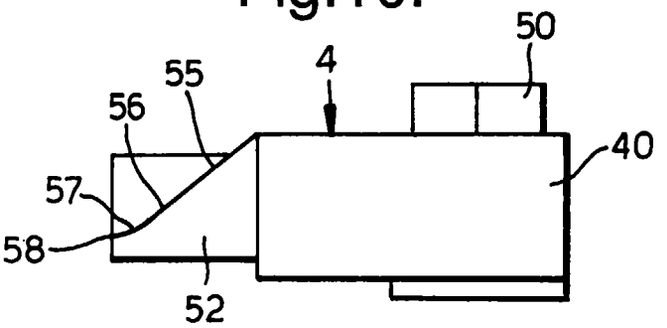


Fig.11.

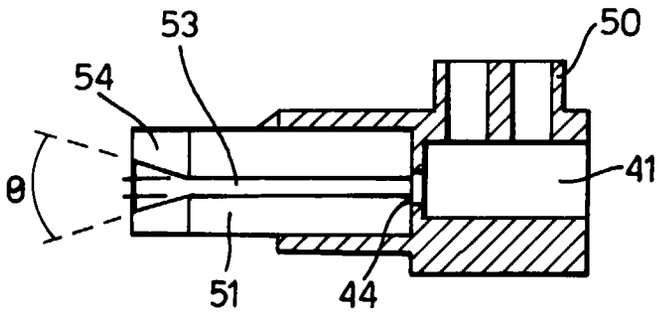
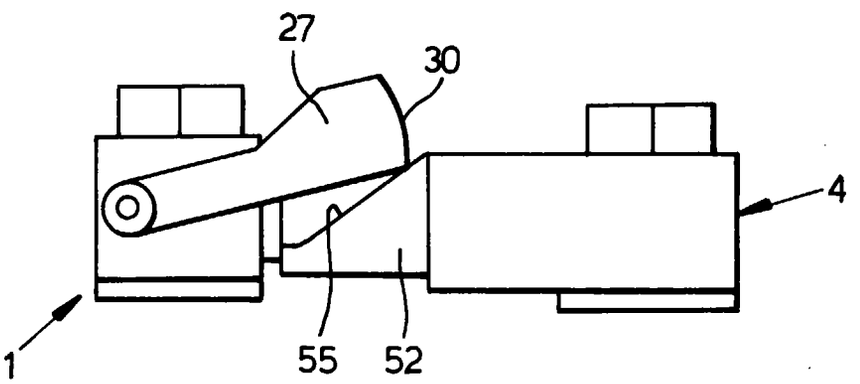


Fig.12.



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EUROPEAN SEARCH REPORT

Application Number
EP 97 30 6966

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	DE 31 51 560 A (P.LOEWENHOFF)	1,4,7,8	H01R13/453
	* page 7, paragraph 2 *		H01R13/631
Y	* page 8, paragraph 3 - page 9, paragraph 1; figure 1 *	2,3,5,9	

Y	WO 96 14101 A (PHYSIO-CONTROL)	2,3,5	
A	* page 8, line 26 - page 9, line 8; figure 3 *	1,4,7,8	

Y	EP 0 067 730 A (DE DIETRICH)	9	
A	* page 3, line 8 - page 4, line 15; figures 1-4 *	1,3,8	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

H01R

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	13 January 1998	Alexatos, G

CATEGORY OF CITED DOCUMENTS

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