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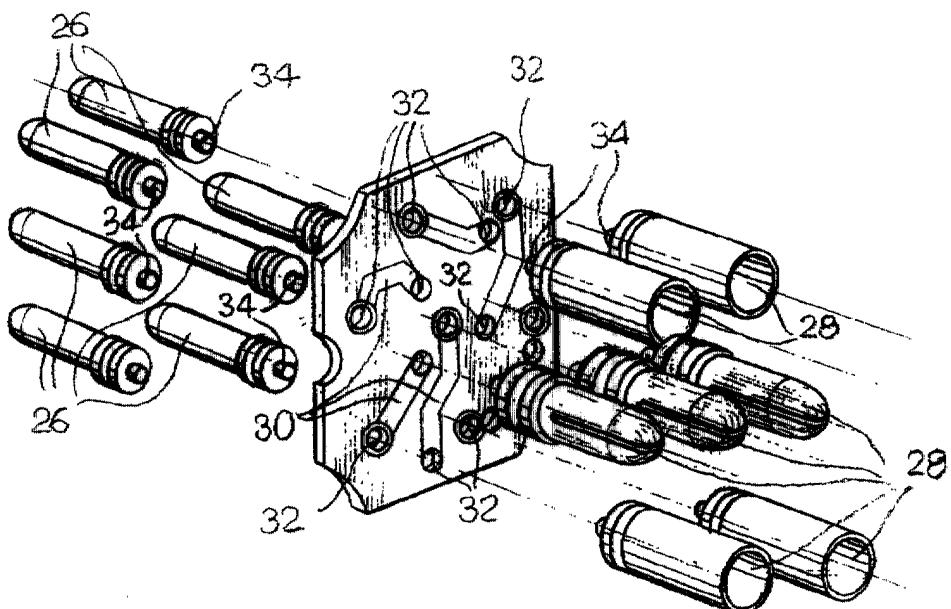
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### (54) Adapter for the electrical connection between a plug and a socket

(57) Adapter for the electrical connection between a plug and a socket presenting a different number of poles, comprising an external casing (12) with bayonet connection (14) for connecting to a socket, a first and a second set of contacts (26, 28) suitable respectively to

engage the contacts of a socket and a plug. The contacts (26, 28) of the first and second set are fastened to a printed circuit (24) equipped with conducting races (32) for the electrical connection between the corresponding contacts of the first and second set (26, 28).

Fig. 7



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## Description

**[0001]** This invention relates to an adapter for the electrical connection between a plug and a socket presenting a different number of poles. This invention was specifically developed to ensure the electrical connection between a plug and a socket complying with the technical specifications set forth in ISO standard 11446 - 1993. Document EP-A-0249181 describes a plug which complies with said ISO standard. This plug comprises an external casing, a contact board and a bayonet connection portion for connecting the plug to a socket. The bayonet connection portion can turn with respect to the contact board between a position in which the plug is inserted in the socket and a position in which the plug is locked in the socket.

**[0002]** Adapters which are destined to be placed between a plug and a socket to allow the electrical connection between a plug and a socket presenting a different number of poles are known. A known adapter manufactured by the applicant is described in Italian Patent no. TO99A000340. This adapter is equipped with a first and a second set of contacts and a plurality of electrical wires connecting a contact of the first set to a corresponding contact of the second set.

**[0003]** The objective of this invention is to provide a similar and more compact adapter with respect to known devices, which is particularly shorter in length.

**[0004]** According to this invention, this objective is attained by means of an adapter which characteristics form the subject of the main claim.

**[0005]** Characteristics and advantages of this invention will be illustrated with reference to a preferred embodiment, as non-limiting examples, in the enclosed drawings, whereas:

- figure 1 is a lateral view of an adapter according to this invention,
- figure 2 is a front view according to arrow II in figure 1,
- figure 3 is an exploded, partial section view of the adapter in figure 1,
- figure 4 is a front view according to arrow IV in figure 3,
- figure 5 is a section view according to the V-V line in figure 4,
- figure 6 is a perspective view of the part indicated by the arrow VI in figure 5 and
- figure 7 is an exploded perspective view of the component illustrated in figure 6.

**[0006]** With reference to this figures, number 10 indicates an adapter for establishing an electrical connection between a plug and a socket (neither of which are illustrated). The adapter 10 comprises an external casing 12 made of injection-moulded plastic material, preferably consisting of a monolith element with a bayonet attachment portion 14 and a support 16 forming a base

for a cover (non illustrated) of the socket when the adapter is inserted in a socket of the type complying with ISO standard 11446-1993. The casing 12 has an internal cavity 18 in which the contact board 20 is inserted and axially locked. The casing 12 is free to turn with respect to the contact board 20 between an insertion position in the socket and a locking position. The way in which the contact board 20 is connected to the casing 12 with the possibility of relative rotation between an insertion position and a locking position is described in detail in Italian patent application no. TO99A000340 by this applicant. As described in detail in said patent application, the contact board 20 presents an annular groove 20 on the external surface, which angular width corresponds to the angular relative rotation stroke of the casing 12 and the contact block 20. The annular groove 22 is engaged by a radial tong 24 projecting from the internal surface of cavity 18 of the casing 12. The radial tong 24 engages the annular groove 22 by an axial groove 25 communicating with the annular groove 22 by means of a step 27 destined to be passed over by radial tong 24.

**[0007]** With reference to figures 5, 6 and 7, a group of contact 12 is arranged on the contact board 20. The group of contacts 22 comprises a printed circuit 24 to which a first set of contacts 26 are connected which contacts are destined to establish an electrical connection with the respective contacts of a socket and a second set of contact 28 destined to establish an electrical connection with the corresponding contacts of a plug. In the example shown in the figures, the adapter is destined to be used to electrically connect a seven pole plug and a thirteen pole socket. The number of poles of the plug and of the socket which can be connected by means of the adapter according to this invention can be varied while remaining within the scope of this invention.

**[0008]** With particular reference to figure 7, the printed circuit 24 is equipped with a plurality of conducting races 30, each of which is electrically connected to a pair of holes 32, which are destined to be fastened to contacts 26, 28. The contacts 26, 28 of the first and the second set project from the opposite part of the printed circuit 24. Each contact 26, 18 is fastened to a respective hole 32 by means of a pin portion 34 projecting from a frontal rear face of each contact 26, 18. The pin positions 34 ensure both the mechanical connection of contacts 26, 28 to the printed circuit 24 and the electrical connection of the contact 26, 28 to the conducting races 30. Each contact 26 of the first set is electrically connected to a corresponding contact 28 of the second set with conducting races 30 on the printed circuit 24. A pre-fit group of contacts is obtained by fastening the contacts 36, 38 on the printed circuit 24, which group can be used to test the electrical connection between homologous contacts. The pre-fit group of contacts 22 is consequently arranged in an injection moulding device where plastic material is moulded on the contact board 22 to obtain the end contact board which is illustrated in figure 5. Dur-

ing the moulding process, the plastic material incorporates the printed circuit 24 and the portions of contact roots (the ones destined to be coupled to a socket). Conversely, the plastic material fully surrounds the contacts 28 of the adapter which are destined to be coupled to a plug. These contacts, as shown in the figures, can be partially male contacts and partially female contacts. The contact board 20 resulting at the end of the moulding operation is ready to be fit inside casing 12, thus completing the assembly cycle of the adapter according to this invention.

**[0009]** As appears from the described above, the use of a printed circuit 24 to ensure the electrical connection between the contact of the first and the second series will allow to obtain a contact board which dimension is very contained in the direction of the contacts. Consequently, the length of the entire adapter 10 is extremely contained with respect to devices of the known type, which is particularly appreciated considering that in most case the concerned adapter is destined to establish an electrical connection between a socket fastened to the rear part of a towing vehicle and a plug attached to a trailer. This is because an adapter of the type described above is used when the plug and the socket have a different number of poles and said adapter is frequently permanently connected to said socket, also when the trailer is not connected to the vehicle. In this case, the fact that the adapter is particularly short is very appreciated, offering advantages from an aesthetic point of view and because the shorter length of the device makes it less subject to breakage by knocks or vibrations.

the contact board (20) can turn with respect to the outer casing (12) between an insertion position in a socket and a locked position with respect to the socket.

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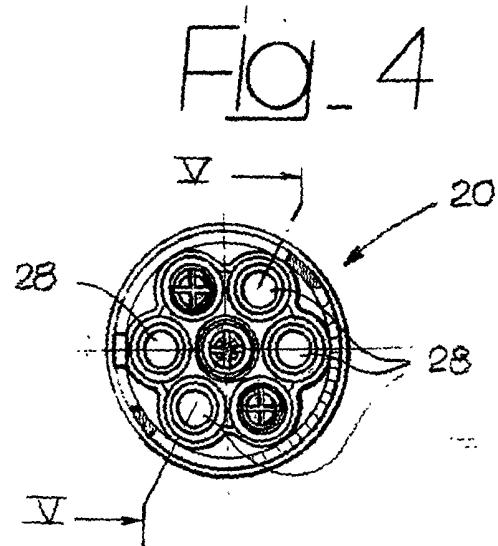
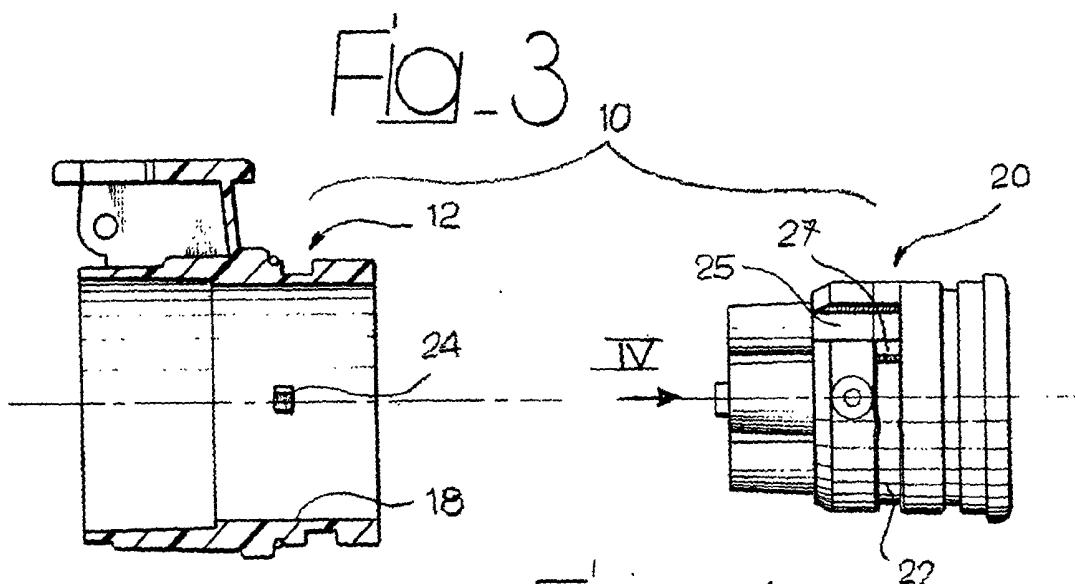
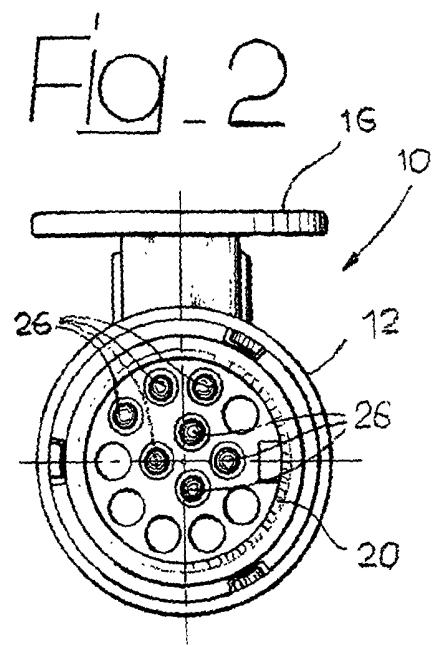
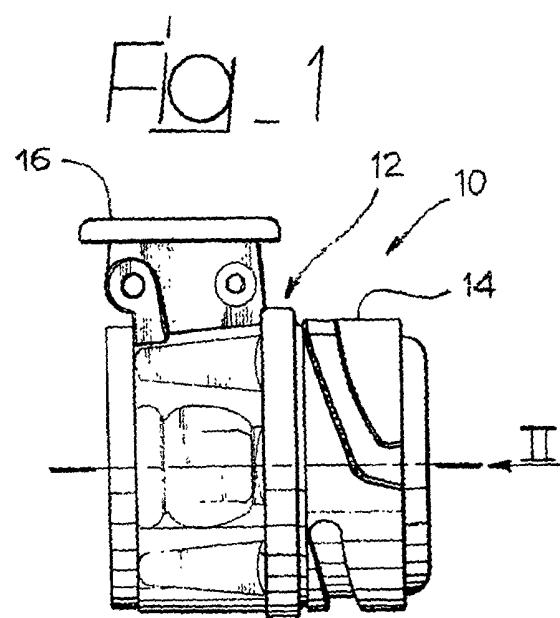
4. Adapter according to claim 1, **characterised in that** the contacts (26, 28) present projecting pins (34) which are inserted and riveted in the respective holes (32) of the printed circuit (24) to establish the mechanical connection of the contacts (26, 28) with respect to the plate (24) and the electrical connection of the contacts (26, 28) with respect to the conducting races (30) of the printed circuit (24).

**Claims**

1. Adapter for the electrical connection between a plug and a socket presenting a different number of poles, comprising an external casing (12) with bayonet connection (14) for connecting to a socket, a first and a second set of contacts (26, 28) suitable respectively to engage the contacts of a socket and a plug which contacts (26) of the first set are electrically connected to the corresponding contacts (28) of the second set, **characterised in that** the contacts (26, 28) of the first and second set are fastened to a printed circuit (24) equipped with conducting races (32) for the electrical connection between the corresponding contacts of the first and second set (26, 28).

2. Adapter according to claim 1, **characterised in that** the contacts (26, 28) of the first and second set and the printed circuit (24) form a pre-fit contact group (22) on which plastic material is injection-moulded so to form a contact board (20).

3. Adapter according to claim 1, **characterised in that**



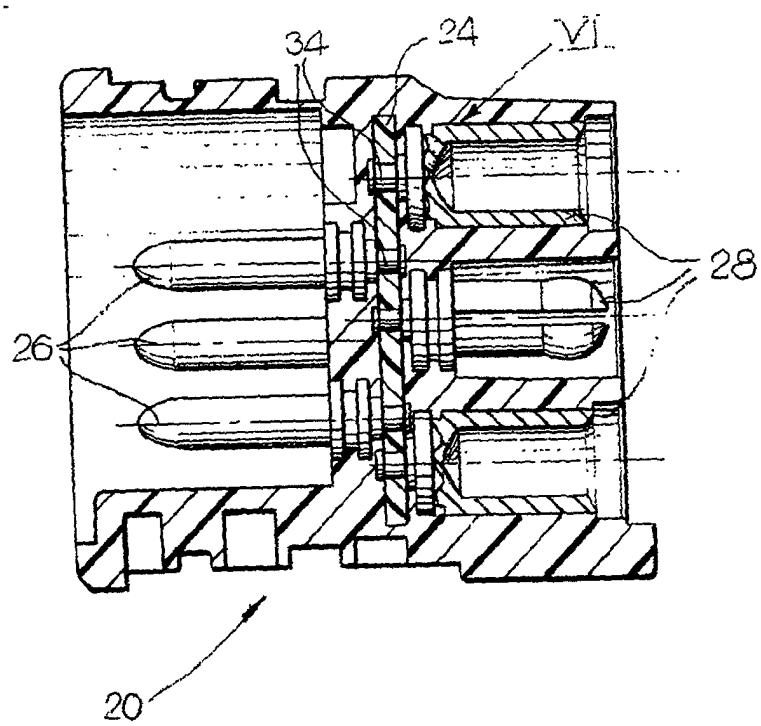


Fig. 5

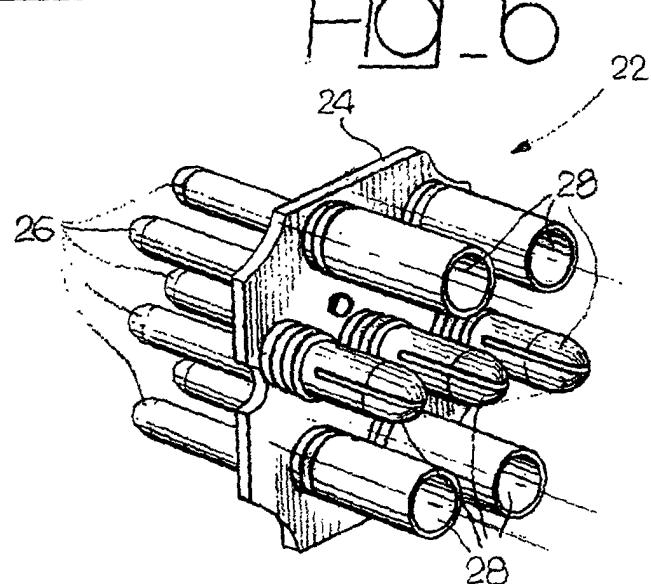


Fig. 6

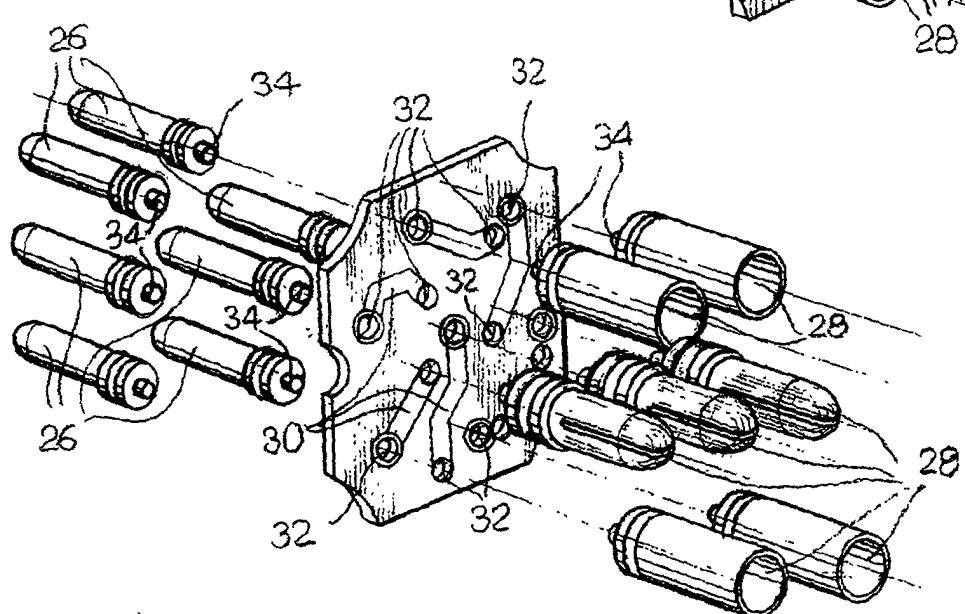


Fig. 7



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## EUROPEAN SEARCH REPORT

Application Number  
EP 00 11 8663

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
Y	DE 296 01 228 U (GERBL LUTZ ; LAM FAI CLINTON (HK)) 4 April 1996 (1996-04-04) * page 3, line 19 - page 4, line 25; figures 1-5 *	1-3	H01R31/06 H01R13/66
Y	US 5 554 049 A (REYNOLDS JEFFREY) 10 September 1996 (1996-09-10) * column 4, line 59 - column 5, line 15; figures 1A, 4 *	1-3	
A	US 5 443 389 A (HUGHES MICHAEL T) 22 August 1995 (1995-08-22) * column 4, line 29 - column 5, line 35; figure 3D *	1-4	
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			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			H01R
The present search report has been drawn up for all claims			
Place of search	Date of completion of the search	Examiner	
BERLIN	2 March 2001	Stirn, J-P	
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X : particularly relevant if taken alone	T : theory or principle underlying the invention		
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**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 00 11 8663

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

02-03-2001

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