



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
27.09.2000 Bulletin 2000/39

(51) Int Cl.7: **H01R 12/16**, H01R 13/658

(21) Application number: **00400616.9**

(22) Date of filing: **07.03.2000**

(84) Designated Contracting States:  
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE**  
Designated Extension States:  
**AL LT LV MK RO SI**

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(30) Priority: **24.03.1999 FR 9903846**

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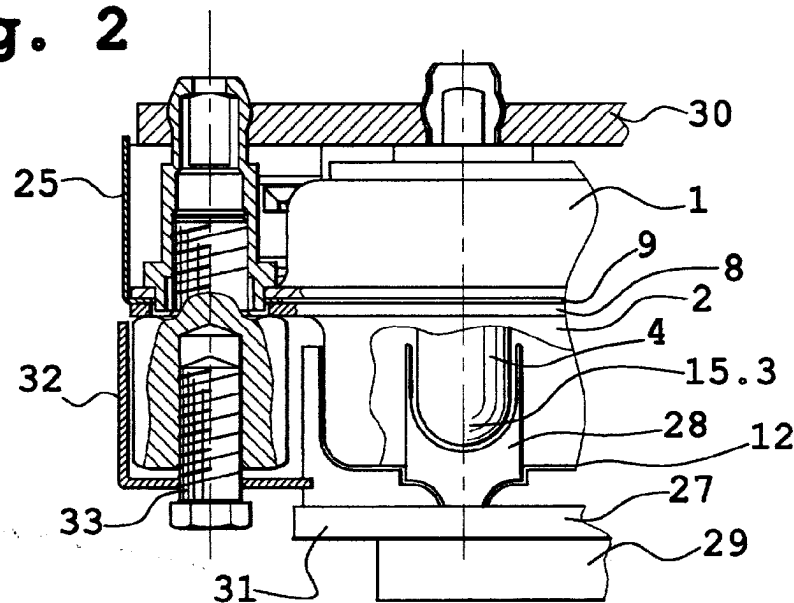
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(54) **Connector with shielding shell**

(57) A connector composed of two housings (1, 2), surrounded by a shielding shell (9), for protection of a first housing (1), a front face of the skirt being trapped between the two housings. The second housing (2) is protected by the shielding shell (32) of a complementary connector (27) mounted on this housing. The first hous-

ing comprises press-fit contacts (4) to be force fitted into a printed circuit (30) and has, at another end of the contacts, a pin (14) to be inserted into contacts (28) comprised in the complementary connector. Further, the connector has a harpoon (18) and a lock (19) for holding the housings together. The lock also allows to hold the complementary connector onto the second housing.

**Fig. 2**



## Description

**[0001]** The present invention relates to a connector having a shielding shell. More particularly, it finds use in applications wherein connections are established in noisy electromagnetic environments. Thus, such shielding shell has the function to protect these connections from external noise, especially the one generated by annexed circuits. Further, it also finds use in applications with high frequency currents passing through the contacts of such connectors. In this case, the shielding shell has the function to protect the external environment from the electromagnetic noise generated by these currents.

**[0002]** A shielded connector generally consists of a front housing and of an insulator holding contacts and covered by a shielding shell mounted onto the periphery thereof, as described, for example, in patent US-A-5,163,851.

**[0003]** In prior art, a shielded connector having a shielding shell has a single housing, e.g. of the Delta D or sub D type. A Delta D housing has contacts secured in an insulator whose connection face is D-shaped. The shielding shell of such connector is shaped similarly to the housing. Such connector generally has press-fit contacts, one end thereof having the form of a harpoon. Nevertheless, such connector can also have contacts to be soldered. These harpoon-like ends are to be force fitted directly in the plated through holes of a printed circuit. In the related application, the shielding shell is mounted onto the outer periphery of the insulator. It covers all the outer faces of the insulator except the back face, whereas the projecting part of the front housing is not covered by the shielding shell. The back face, not covered by this shell, has at one end harpoon-shaped contacts to be inserted into plated through holes of the printed circuit, as well as contacts to be soldered onto the printed circuit. Further, the second ends of the contacts stemming from the insulator are held inside the front housing. The second ends of the contacts are to be connected to a complementary connector, for example attached to a cable.

**[0004]** Such prior art connector has a drawback. This connector is first connected onto a printed circuit, and then connected to a complementary connector. A complementary connector to be mounted onto the first connector must be secured to the front face of the shielding shell resting on the periphery of the front housing of this first connector. The first connector has a coupling part all along its periphery. However, this coupling part is modified by the presence of this shielding shell. The shielding shell is superposed to and has a less precise geometry than the housings. The external geometry of the shielding shell, then, is such that it does not provide a good alignment between the contacts of the first connector and the contacts of the complementary connector, which would be mounted on the front face of the shielding shell. This bad alignment can cause faulty con-

nections. It can even cause a permanent deformation of contacts. The shielding shell hinders proper positioning of the complementary connector on the first connector. Securing a complementary connector onto a prior art connector is thus a rather difficult and inaccurate operation.

**[0005]** The invention has the object to obviate the above mentioned drawback by providing a connector at a first level, corresponding to a rear housing, shielded by means of a shielding shell. Shielding at the second level, corresponding to the front housing, is effected by means of a shielding shell of a complementary connector, surrounding the front housing upon connection thereof onto this first connector. Hence, the first connector comprises a first rear housing and a second front housing. The first rear housing comprises a contact supporting insulator. The shielding shell of the first connector is trapped between the front housing and the rear housing. No portion of the front housing is this any longer surrounded by said first shielding shell. The front housing has a regular and precise structure allowing to ensure an effective connection with the complementary connector. Also, the two front and rear housings trapping the shielding shell therebetween are held together by a fastening system as described in patent FR-B-2 740 913. This fastening system has a screw for securing the complementary connector thereto. The complementary connector is secured onto the front housing. Hence, the second shielding shell of the complementary connector surrounds the front housing. The second shielding shell extends towards the first shielding shell so as to ensure continuous shielding of the first connector.

**[0006]** The solution provided by the invention consists in that there is provided a coupling area which is proper, unmodified, hence perfectly plane, because it consists of the front housing without any further superposed element. The front housing has contacts suitably arranged for alignment with the contacts of the complementary connector. Therefore, mounting of the complementary connector onto the first connector is facilitated.

**[0007]** The invention thus relates to a connector characterized in that it comprises a rear housing, a front housing piled up on the rear housing, an insulator in the rear housing, contacts comprised in the front housing and in the rear housing, and projecting out of the insulator on both sides, a shielding shell only covering the rear housing, a front face of the shielding shell being trapped between the front housing and the rear housing held together by a fastening system.

**[0008]** The invention will be understood more clearly by reading the following description and by analyzing the accompanying figures. The latter are only shown by way of example and do not intend to limit the invention in any manner. The figures show:

Figure 1: a sectional exploded view of a connector according to the invention;

Figure 2: a sectional view of a connector according

to the invention mounted on a printed circuit and topped by a complementary connector.

**[0009]** Figure 1 shows a connector in accordance with the invention, said connector comprising a first rear housing 1 and a second front housing 2. The rear housing 1 contains an insulator 3 and contacts 4. The rear housing 1 has an extension 5 starting from one of its faces 6. Similarly, the front housing 2 has an extension starting from one of its faces 8. The two extensions 5 and 7 approximately have a flange shape. These flanges allow to associate the two housings 1 and 2 together. A shielding shell 9 is held between the rear housing 1 and the front housing 2, so that it only surrounds the rear housing 1. The shielding shell 9 forms a wall extending along the periphery of the rear housing 1. The shell 9 is made of metal or of a metal plated material. The rear housing 1 can thus be placed inside the housing formed by the shielding shell 9.

**[0010]** The face 6 of the rear housing 1 projects at the level of an inner surface 10.1 of a flange 10 of the housing formed by the shielding shell 9. The front housing 2 is secured to an outer surface 10.2 of this flange 10. The face 8 of the front housing 2 is in contact with the outer surface 10.2 of the flange 10. The face 6 of the rear housing 1 is open, having an aperture for the introduction of the insulator 3 into the rear housing 1. A face 11 of the rear housing 1, opposite to the face 6, has a hole. This hole allows the projection of the contacts and of the bottom of the insulator 3 therebeyond.

**[0011]** The insulator 3 consists of a matrix of receptacles acting as supports for the contacts 4. The contacts 4 project out of the insulator 3 on both sides. The insulator 3 being placed in the rear housing 1, the contacts 4 project out of the faces 11 and 6 of the rear housing 1. The contacts 4 extend beyond the level of the flange 10. Thus, the contacts 4 project out of the outer surface 10.2 of the flange 10. As a variant, the flange 10 forms a continuous skin between the faces 6 and 8. This skin has holes for the passage of the contacts 4. Hence, it allows to hold the insulator 3. The contacts 4 also project out of the face 8 of the front housing 2, abutting against the outer surface 10.2. Moreover, the front housing 2 also has a face 12 opposite to the face 8. This face 12 has one or more holes. These holes make an end 13 of the contacts 4 accessible for connection with a complementary connector. Conversely, the contacts 4 do not project out of the face 12.

**[0012]** The contact 4 has a pin 15. The pin 15 has a cavity 15.1 at one end 15.2. The pin 15 has a cylindrical shape closed at a second end 15.3 opposite to the end 15.2. The cavity 15.1 allows to accommodate a harpoon 14. The harpoon 14 is for instance screwed into the cavity 15.1. In this case, the cavity 15.1 is provided with nut threads. The harpoon could be also force fitted inside the cavity 15.1. A portion of the cylinder formed by the pin 15, comprised between the ends 15.2 and 15.3 is housed in the insulator 3. In one example, this portion

is force fitted into the insulator 3, through the second end 15.3.

**[0013]** The harpoon 14 is of the press-fit type. It is for instance described in document FR-B-2 740 913. The harpoon has a barrel 16, topped by a flange 16.1. The flange 16,1 has two shanks such as 17 extending from one face 16.2 of the flange, in a direction substantially perpendicular to said face 16.2. The two shanks 17 are joined together at an end opposite to their point of attachment to the flange 16.1. The shanks 17 are slightly arched, so as to define a slot 17,1 there between. Further the arched shanks 17 form protuberances 17.2. These protuberances 17.2 act as a harpoon. In fact, they can be deformed when introduced into a hole. This hole can particularly be a metal plated through hole of a printed circuit. The protuberances 17,2 forced in such through hole ensure a permanent contact with the edges of the hole. In one example, the harpoon 14 is of the power press-fit type, which means that the contact has a large diameter. Nevertheless, the harpoon may be of the signal press-fit type, in which case the contact can transmit electric high frequency signals. As a variant, the pin 15 is a simple contact whose tail may also be soldered onto a printed circuit.

**[0014]** The rear housing 1 is held in the shielding shell 9 by a fastener disposed on both sides of the faces 6 and 10. Preferably, this fastener also ensures fastening of the front housing 2 on the shielding shell 9. This fastener has parts projecting out of the faces 6 and 8 on both sides. This fastener is preferably disposed at the same level as the extensions 5 and 7, which have holes 5,1 and 7,1 respectively.

**[0015]** The fastener comprises a harpoon 18 and a screw lock 19. The harpoon 18 is preferably also of the press-fit type. The harpoon 18 is placed on one side of the face 6 of the rear housing 1. The screw lock 19 is placed on one side of the face 8 of the front housing 2. The harpoon 18 has, at one end, a protuberance 20 and, at another end, a receptacle 21 with threads formed therein. In this case, the harpoon 18 has the same structure as the harpoon 14, particularly the harpoon 18 also has a flange and shanks arising from said flange, the arms being joined together to form a slot. The protuberance 20, like protuberances 17.2, acts as a harpoon and may be deformed when introduced into a hole. The protuberance 20 introduced into a through hole of the printed circuit permanently abuts against the walls of said hole. Further, the screw lock 19 comprises, at a first end, screw threads 22 and at a second end a receptacle 23 also having threads. The screw 22 is to be tightened in the receptacle 21. The screw 22 passes through the hole 7,1, a hole 24 of the flange 10 and the hole 5.1. By tightening the lock 19 into the harpoon 18, cohesion is ensured between the housings 1 and 2. Thus, the faces 6 and 8 are as close as possible. The shielding shell 9, held between the two housings 1 and 2 therefore covers the rear housing 1.

**[0016]** A side 25 of the shielding shell 9 extends par-

allel to the harpoon 18 and protects the whole height of the rear housing 1. The harpoon 18 and the harpoon 14 project out of the side 25. Hence, the side 25 does not hinder the, insertion of pins 14 and harpoons 18 into a printed circuit.

**[0017]** The lock 19 comprises nut threads 26. The face 8 with no superposed part thereon allows a complementary connector 27 to be easily mounted thereon, as shown in figure 2. In fact, the periphery of the front housing 2 is totally free. Further, the nut 26 can act as a fastener for the complementary connector 27 onto the front housing 2. By accurately positioning the periphery of the front housing 2 and of the nut 26 with respect to the front housing 2, proper and reproducible positioning of the complementary connector 27 can be achieved. Also, the electric connection between the end 15.3 of the contact 4 and a contact 28 of the complementary connector 27 is established inside the front housing 2. The complementary connector 27 is, for instance, a connector fitted onto a cable 29. The conductors of the cable 29 can be put in contact with the plating of a printed circuit 30.

**[0018]** In fact, the printed circuit 30 is connected by the harpoon 14 to a first connector. The complementary connector 27 comprises a housing 31. The complementary connector 29 has a shielding shell 32. The shielding shell 32 extends along the walls of the housing 31 formed by the complementary connector 27. It surrounds the front housing 2. The connection of a complementary connector 27 onto the front housing 2 protects the front housing 2 from external noise, through the shielding 32. Then, the first connector, composed of the housings 1 and 2, connected to the printed circuit 30, 15 integrally protected through two shielding shells 25 and 32. The connector 27 is fastened, for instance, by a screw 33 engaged with the internal threads 26.

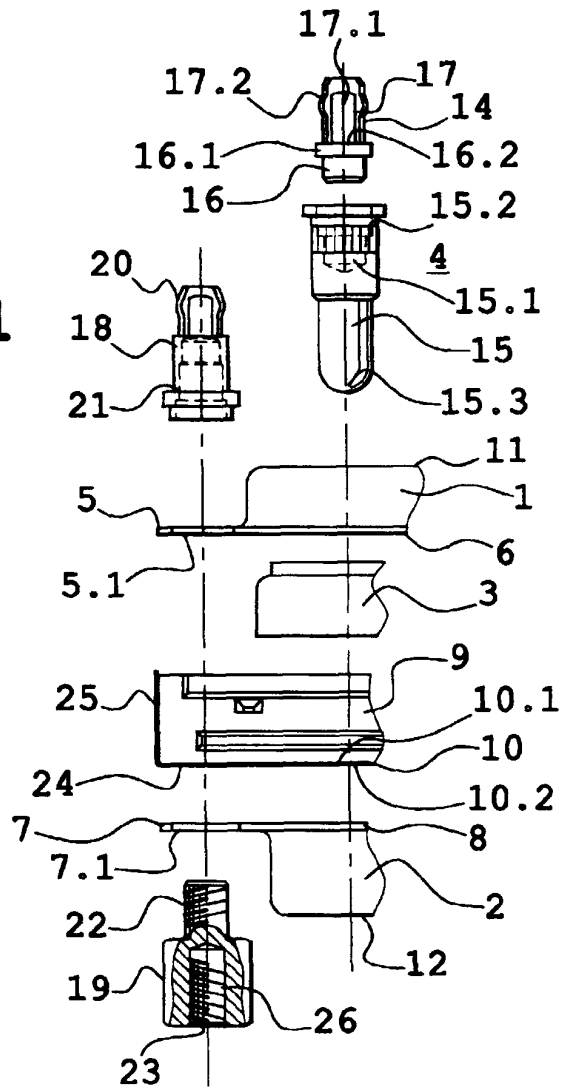
that the shielding shell covers the rear housing and the harpoon.

## Claims

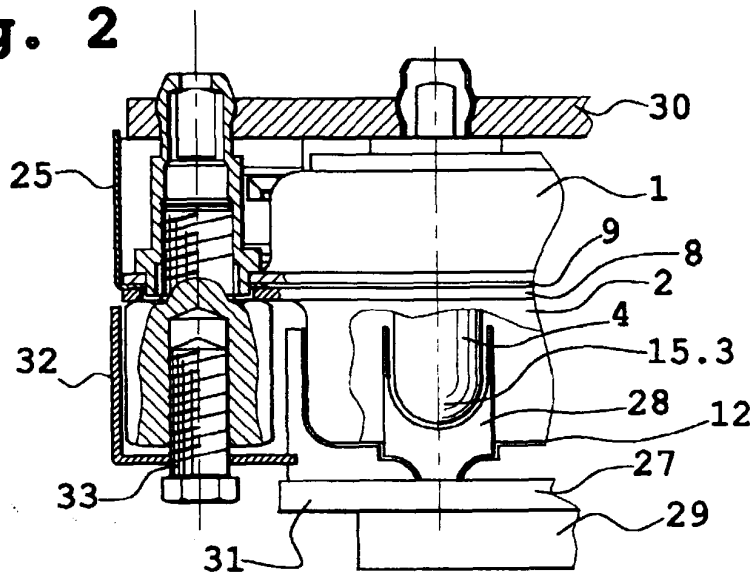
1. A connector characterized in that it comprises a rear housing (1) a front housing (2) piled up on the rear housing, an insulator (3) in the rear housing, contacts (4) comprised in the front housing and in the rear housing, and projecting out of the insulator on both sides, a shielding shell (9) only covering the rear housing, a front face of the shielding shell being trapped between the front housing and the rear housing held together by a fastening system.
2. A connector as claimed in claim 1, characterized in that the rear housing and the front housing, the shielding shell, the insulator and the contacts are held together by a fastening system comprising a hollow (21) harpoon (18) and by a lock (19) screwed into the hollow of the harpoon.
3. A connector as claimed in claim 2, characterized in

4. A connector as claimed in any one of claims 2 to 3, characterized in that the screw lock is tightened by one of its ends (22) into the hollow harpoon and has at another end a cavity (23) with nut threads (26) formed therein.
5. A Connector as claimed in any one of claims 2 to 4, characterized in that, upon connection to a complementary connector (27) to be coupled to the front housing, complementary contacts (28) are put in contact with an end of the contacts comprised in the front housing, while a screw (33) is tightened into a cavity (23) of the screw lock having nut threads (26) formed therein, said complementary connector having a complementary shielding shell (32) surrounding the front housing of the connector.
6. A connector as claimed in any one of claims 1 to 5, characterized in that contacts are of the power press-fit type.
7. A connector as claimed in any one of claims 1 to 6, characterized in that contacts are of the signal press-fit type.
8. A connector as claimed in any one of claims 1 to 7, characterized in that contacts are contacts to be soldered.

**Fig. 1**



**Fig. 2**





European Patent  
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EUROPEAN SEARCH REPORT

Application Number  
EP 00 40 0616

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The present search report has been drawn up for all claims			
Place of search <b>THE HAGUE</b>		Date of completion of the search <b>29 May 2000</b>	Examiner <b>Tappeiner, R</b>
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	

EPO FORM 1503 03.92 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
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