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(54) Electrical socket connector

(57) A jack connector unit comprises especially a socket connector fitted out so as to receive a front end of a plug connection (4) of a first contact (15), and a second ground contact (17) inside a cavity (5) to receive this front end. Furthermore, the socket connector comprises a third contact (22) to carry out a holding function and/or an additional electrical function.

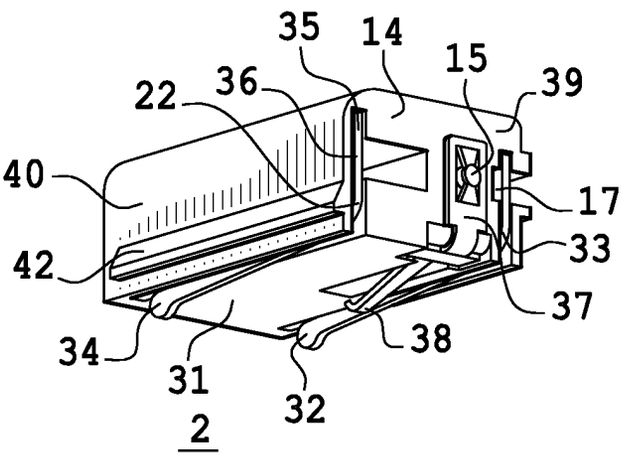

Fig. 3

EP 1 296 420 A1

Description

[0001] An object of the present invention is an electrical socket connector. It can be used more particularly in the field of "jack" type connectors, especially to perform charging functions. In the prior art, there are known connectors called "charge jacks" or "charging jacks". Each such jack has two electrical contacts: a first charging contact and a second ground contact. Geometrical dimensions of these connectors are governed by regulations to make them compatible with a wide variety of matching devices. The value of the invention is that while complying with the geometrical dimensions as laid down by the regulations, it proposes a charging jack type of connector comprising an additional contact.

[0002] In the prior art, there are known jack connector assemblies comprising a socket connector and a plug connector that match each other. In the context of a "charging jack", the plug connector is generally wired and connected to a power supply device while the plug connector is, for example, mounted inside a device to be charged. The plug connector has an insulating body mounted around the cable, and has a front connection end. This front connection end is a projecting end, and is designed to be inserted into a corresponding receptacle of the socket connector.

[0003] In particular, the front connection end forms a hollow cylindrical tube. This cylindrical tube comprises a conductive sleeve lying against an inner wall and a conductive tube lying against an outer wall. The conductive tube and the conductive sleeve are insulated from each other by an insulating body of the tube. The inner conductive sleeve is generally designed for charging and, therefore, the outer conductive tube is designed to ensure ground continuity. The conductive sleeve as well as the conductive tube are connected, at the rear of the insulating body around which they are mounted, to strands of the cable by means of wiring boards.

[0004] When the front connection end is inserted into the matching receiver of the socket connector, the conductive charging sleeve and the conductive ground tube respectively are connected with distinct, matching contacts of the socket connector.

[0005] Indeed, conventionally a socket connector comprises an insulating body so that it can be mounted for example on a substrate of the device to be charged. The body comprises a receiver within which the matching contacts are mounted. In particular, this receiver has a cylindrical shape adjusted in order to receive the cylindrical front connection end. The socket connector has a first charging contact generally made to stand so that it is perpendicular to a bottom of the receptacle. The charging contact extends along an axis of symmetry generated by revolution of the cylinder of this receiver. It is designed to be made to penetrate the inner conductive sleeve presented by the plug connector. Furthermore, an inner rim of this receptacle is provided with a conductive sleeve applied against this rim.

[0006] As described in the document GB-A-2307113, this conductive sleeve of the rim is applied under stress against the external conductive ground connection tube of the plug connector when it is inserted into the socket connector. Indeed, to favour the contact, the sleeve of the receptacle is truncated and the connector tube therefore abuts this rim to ensure ground continuity.

[0007] In the prior art, the teaching of the document US-A-6,056,602 describes an assembly of "jack" type electrical connectors. According to this document, the plug connector comprises a pin with a first front portion defined by a first diameter and a second rear portion defined by a second diameter, in such a way that the first diameter is smaller than the second diameter. A pin of this kind is designed to be inserted into a cavity of the socket connector. The cavity of this socket connector has flexible contact strips oriented towards the interior of this cavity in such a way that they are stressed against respectively the first portion and the second portion when the plug connector is inserted into this cavity. Furthermore, this plug connector comprises a ground contact. The ground contact is stressed against a matching ground contact. This matching ground contact is for example a sleeve mounted around the pin.

[0008] The "jack" type connector assemblies described raise a problem inasmuch as the dimensional constraints of the plug connector and the plug connector are difficult to comply with, especially when it is necessary to propose reliable and quality connections. Now, the major drawback of prior art "jack" type connectors is that the plug connector is poorly retained in the socket connector. Solutions known in the prior art provide for external devices to hold the plug connector in the socket connector. However, the substantial geometrical space requirement of this type of external holding device is incompatible with the miniaturisation constraints imposed on the connectors and the devices that contain them. In particular, they are incompatible with the miniaturisation constraints of mobile telephones.

[0009] The combined teachings of the prior art do not contain any teaching, for those skilled in the art, on a socket connector having both a first axial contact and a second flexible blade type of contact. The prior art "jack" type connectors pose a problem because, firstly, none of them meets the required conditions of miniaturisation and, secondly, none of them ensures the efficient holding of a plug connector in a socket connector without proposing a superfluous, external holding device.

[0010] It is an object of the invention to resolve these problems by proposing a "jack" type connector in which it is possible to insert a third contact, where this third contact can be made so that it is alternately or jointly designed to improve the holding of the connection between the socket connector and the plug connector and/or for example provide a function of back control of the charging operation. To this end, the socket connector of a connector according to the invention comprises a first contact placed so that it is perpendicular to a bottom of

a cavity of an insulating body of the socket connector. This socket connector furthermore comprises a second contact that extends elastically beyond an inner border of the cavity. Finally, this socket connector comprises a third contact that also extends beyond the inner border of this same cavity.

[0011] In particular, in a preferred embodiment, the invention provides for the possibility of having the three contacts connected to a printed circuit board on which the socket connector may be mounted for example. A socket connector according to the invention provides, in any case, that the three contacts will co-operate with at least one of the contacts of a matching plug connector that has to be inserted into the cavity.

[0012] An object of the invention is a socket connector comprising an insulating body, a first charging contact and a second ground contact, the first contact being laid along the middle of a cavity of the body, and the second contact elastically extending beyond an inner border of this cavity, characterised in that the socket connector comprises a third contact extending elastically beyond the inner border, and these three contacts co-operating with a plug connector designed to be introduced into the cavity.

[0013] The invention will be understood more clearly from the following description and from the accompanying figures. These figures are given purely by way of an indication and in no way restrict the scope of the invention. Of these figures:

- Figure 1 shows a sectional view of a socket connector according to the invention, receiving a matching plug connector;
- Figure 2 shows a front view in perspective of a socket connector according to the invention;
- Figure 3 shows a view in perspective of a rear face of a socket connector according to the invention;
- Figure 4 shows a sectional view of a variant of a socket connector according to the invention.

[0014] Figure 1 shows a connector unit 1 according to the invention. The connector unit 1 has, firstly, a socket connector 2 and secondly a plug connector 3. The socket connector 2 and the plug connector 3 match each other. The plug connector 3 comprises, in particular, a front connection end 4 designed to be inserted into a cavity 5 of the socket connector 2. A connection between the plug 3 and the socket 2 is made by the translation of the plug connector 3 along an axis 6, towards the cavity 5. In a preferred embodiment, the connector unit 1 is a "jack" type connector unit and, especially, a "charging jack" type of connector unit. A socket connector 2 is mounted, for example, in a mobile electronic device that needs to be regularly recharged. In this case, the plug connector 3 is wired and connected to a supply device. The mobile device calling for this type of socket connector 2 is, for example, a mobile telephone. The plug connector 3 is then connected to an adaptor adapted to a national power distribution network.

[0015] The plug connector 3 comprises a body 7 in which a first charging contact 8 and a second ground contact 9 are placed. This charging contact 8 and this ground contact 9 are connected to a cable. They are insulated from each other by an insulator. Inside the body 7, the charging contact 8 and the ground contact 9, which are conductive, are connected to strands (not shown) of a cable by means of wiring pits 13. The wiring pits 13 as well as parts of the front insulator 10 ensure that the front connection end 4 is held in the body 7.

[0016] The front connection end 4 is designed so that a front insulator 10 projects out of the body 7. This front insulator 10 has the charging contact 8 in an inner hollow, the charging contact 8 forming a conductive sleeve therein. The front insulator 10 has an aperture 11 to provide a possibility of access to the inner conductive sleeve 8.

[0017] The front end 4 is preferably cylindrical. The ground contact 9 surrounds an outer part of this front end 4, this ground contact being tube-shaped. This front end 4 is designed to have an outer diameter, especially at the level of the conductive tube, such that it can be inserted into the cavity 5. The socket connector 2 also has a body 14. This body 14 is insulating. The cavity 5 is formed in this body 14. This body 14 has a roughly parallelepiped shape.

[0018] The socket connector 2 has a first contact 15. This first contact 20 is, for example, a pin inside the cavity 5. The conductive pin 15 is, for example, a charging contact. For example, this pin 15 stands so as to be perpendicular to a bottom 16 of the cavity 5. In other words, the pin 15 extends along the axis 6. Thus, when the front connection end 4 is made to approach the cavity 5, the axis of the conductive inner sleeve 8 of the plug connector 3 is preferably presented along this same axis 6. Thus, by simple translation, the pin 15 is inserted into the conductive sleeve 8.

[0019] The socket connector 2 furthermore comprises a second ground contact 17. The ground contact 17 is, for example a metal strip comprising a flexible portion 18 placed in the cavity 5. Indeed, preferably, the contact strip 17 extends in parallel to the axis 6 inside the cavity 5 and is preferably presented at an inner border 19 of the cavity 5. This inner border 19 is preferably also orthogonal to the bottom 16 of this cavity 5. The flexible portion 18 preferably comprises a domed feature 20 oriented perpendicularly to the axis 6 so as to project slightly out of the inner border 19. When the flexible strip 18 is not stressed, the domed feature 20 extends into the interior of the cavity 5 in such a way that an inner diameter 21 defined by the inner borders such as 19 of this cavity 5 is slightly smaller than the outer diameter 12 of the insertion front end 4. Thus, when the front end 4 is inserted into the cavity 5, the latter elastically pushes back the flexible strip 18 in coming into contact with the domed feature 20. The flexible strip 18 is then pushed back into a recess of the cavity 5.

[0020] In this connected position, when the insertion front end 4 is completely inserted into the cavity 5, the domed feature 20 comes into contact with the outer conductive tube 9. Thus, the ground continuity is ensured. At the same time, in this position, the charging pin 15 is inserted into the conductive inner sleeve 8. Thus, the charging continuity is also ensured.

[0021] The socket connector 2 also comprises a third contact 22. This third contact 22 is, for example, a metal strip lying in a reclined position inside the insulating body 14 so that at least one flexible portion 23 is presented inside the cavity 5. For example, the third contact 22 is a strip comprising several elbows in such a way that it has a first portion 24 lying parallel to the axis 6 inside the body 14. This first portion 24 is connected to an elbow 25 so as to present a second portion 26 of the strip, this second portion 26 being slightly oblique with respect to the first portion 22. This second portion 26 has the flexible portion 23 at an elbow 2. Finally, this second portion 26 is connected at the second elbow 27 to a second portion 28 of the strip. This third portion 28 is folded beneath the second portion 26, namely between this second portion 26 and the first portion 24.

[0022] This third contact 22 is flexible and the amplitude of the flexible portion 23 inside the cavity 5 is given by the first elbow 25. Furthermore, the co-operation between the second elbow 27 and the third portion 28 limits the flexibility of this flexible portion 23. Thus, the third contact needs to undergo great stress in order to be flexed and pushed back inside the cavity 5. In particular, when the front connection end 4 is inserted into the cavity 5, the flexible end 23 is highly stressed against a recess 29 of this front end 4. Inasmuch as this flexible portion 23 itself has a slightly domed feature, it co-operates with the recess 29 to favour the holding of the front connection end 4 inside the cavity 5. The presence of this third contact 22 therefore improves the connection between the socket connector 2 and the plug connector 3.

[0023] In a preferred embodiment, the second flexible contact 17 and the third flexible contact 22 preferably rest on diametrically opposite points the front connection part 4, these points being possible offset with respect to each other along the axis 6. Thus, the stress exerted by the flexible part 23 inside the cavity 5 against the front end 4 ensures a reliable connection between the second contact 17 and the outer tube 9.

[0024] As shown in figure 2, the body 14 has a generally parallelepiped shape such that the cavity 5 opens at the level of a front face 30, this front face 30 being perpendicular to a lower face 31 designed to be placed against a printed circuit board (not shown). The contact pin 15, as well as the second contact 17 and the third contact 22 comprise protruding features extending out of the side of the inner face 31.

[0025] Indeed, as shown in figure 3, the second contact 17 comprises a flexible tongue 32, this flexible tongue being also formed in the contact strip used to form the flexible strip 18. This flexible tongue 32 has an elbow 33 to tolerate flexibility in a direction perpendicular to the inner face 31. To this end, the inner face 31 has an aperture to let this flexible tongue 32 go beyond said face.

[0026] Similarly, should the third contact 22 be designed to carry out a signal transmission function, it also comprises a flexible tongue 34. The flexible tongue 34 is preferably formed identically to the elastic tongue 32. Indeed, the elastic tongue 34 is made out of the same metal foil used to make at least the flexible end 23. This flexible tongue 34 also goes beyond the lower face 31. This tongue 34 is given flexibility by means of an elbow 35 formed at a rear zone 36 of the contact 22.

[0027] The second and third contact 17 and 22 respectively are preferably made by being cut out of a thin metal foil; then the pattern designed in this metal foil is folded into different elbows oriented along two orthogonal axes so as to make it possible to provide both elastic tongues and flexible portions, designed to be flexed inside the cavity 5.

[0028] Similarly, the pin 15 is connected, on the lower side 31, by means of a connecting strip 37 to a flexible portion 38 of the lower side 31. This connecting strip 37 comprises a first portion comprising an aperture to receive a rear end of the pin 15, this first portion being connected to the flexible portion 38. The portion 38 forms a flexible tongue. Thus, when the socket connector 2 is placed on, a printed circuit board, the elastic tongues 32, 34 and 38 respectively rest against conductive zones of this board 15 positioned so as to face each other respectively.

[0029] The pin 15 is obtained, for example, by machining so as to form an almost cylindrical leading portion. In one variant, it can be planned that the pin 15 will be obtained by cutting out and then winding a metal foil.

[0030] The contacts 15, 17 and 22 are preferably inserted into the body 14 from a rear face 39. The rear face 39 is perpendicular to the lower face 31 and opposite the front face 30. To this end, the rear face 39 has distinct cavities to respectively receive each of the contacts.

[0031] Finally, to ensure the mounting of the socket connector 2 on a printed circuit board, the body 14 has recesses and/or hollows on lateral faces 40. These side faces 40 are orthogonal both to the inner face 31 and to the front face 30 and rear face 39. In particular, a side face 40 may comprise a slide-way or channel 41 to co-operate with a rail provided on a casing of a mobile telephone (not shown) comprising a printed circuit board. Furthermore, another side face may also comprise a rail 42 to co-operate with a matching slide-way also presented on the casing of the mobile telephone. In this case, the socket connector is mounted by translation on the printed circuit board. It abuts, for example, a stop 43 of the slide-way 41 to prevent all involuntary motions of the socket connector 2. Indeed, through stops such as 43 on the slide-ways made either on the casing 14, or on the printed circuit board, the casing 14 is thus held in

position on the printed circuit board 2. When the front connection end 4 is inserted into the cavity 5, the socket connector 2 remains stable and immobile on the printed circuit board.

[0032] Referring to figure 4, in one variant, the third contact 22 is designed to come into contact with a third conductive part 44 of the front connection end 4. In this case, the third contact 22, working together with the third conductive part 44, may fulfil a pilot contact function, for example a function to improve the planned charging functions by means of this connector unit. In this case, when the third contact strip 22 gets linked with a conductive track of the printed circuit, the information conveyed through this third contact 22 may be processed by the printed circuit to enable the control of the charging.

[0033] In this variant, the third conductive part 44 is at an outer rim of the front end 4. It is insulated respectively from the conductive inner sleeve 8 by the front insulator 10, and from the conductive tube 9 by an insulating intermediate tube 45. This intermediate insulating tube 45 surrounds an almost cylindrical rim partially along the axis 6, this almost cylindrical rim being formed by the conductive part 44. Indeed, it allows a zone of the conductive part 44 to appear flush with the front end 4 so that this zone can be connected with the domed feature 20 of the flexible strip 18 forming part of the third contact 22.

[0034] The outer rim of the front end 4 may be schematically subdivided into several successive zones along the axis 6. Successively, this outer rim has a first insulator zone corresponding to the projecting part of the front insulator 10, this first zone being juxtaposed with a second zone corresponding to the third conductive part 44. This second zone is itself positioned between the first zone and a third insulating zone formed by the tube 45. Preferably, each of these zones is distributed so that the outer rim of the front end 4 has a continuous profile.

Claims

1. Socket connector (2) comprising an insulator body (14), a first charging contact (15), and a second ground contact, the first contact lying along the middle of a cavity (5) of the body, and the second contact (17) extending elastically beyond an inner border (19) of this cavity, **characterised in that** it comprises a third contact (22) extending elastically beyond the inner border, these three contacts co-operating with a plug connector (3) designed to be introduced into the cavity.

2. Connector according to claim 1, **characterised in that** one end (23) of the third contact ensures the holding of the plug connector.

3. Connector according to one of the claims 1 to 2, **characterised in that** it is mounted on a printed circuit board.

4. Connector according to one of the claims 1 to 3, **characterised in that** it comprises a rail (42) or a slide-way (41) on side faces (40) of the body to co-operate with a holding device that matches.

5. Connector according to one of the claims 1 to 4, **characterised in that** each of the contacts extends beyond a lower face (31) of the body to respectively come into contact with conductive zones of a printed circuit board.

6. Connector according to claim 5, **characterised in that** each contact comprises a tongue (32, 34, 38) elastically extending beyond the lower face.

7. Connector according to one of the claims 1 to 6, **characterised in that** the third contact fulfils a charging control function.

8. Connector according to one of the claims 1 to 7, **characterised in that** the second and third contacts are cut out of metal foils and then prestressed.

9. Connector according to one of the claims 1 to 8, **characterised in that** the first contact is obtained by machining or by cutting out followed by a winding operation.

10. Connector according to one of the claims 1 to 9, **characterised in that** it is mounted in a mobile telephone, and **in that** the matching contacts of the plug connector are wired and connected to a power supply.

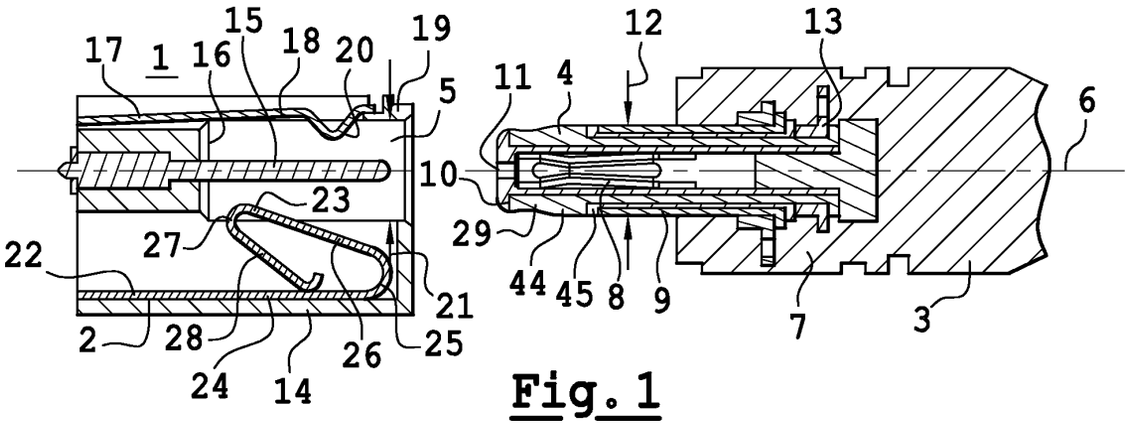

Fig. 1

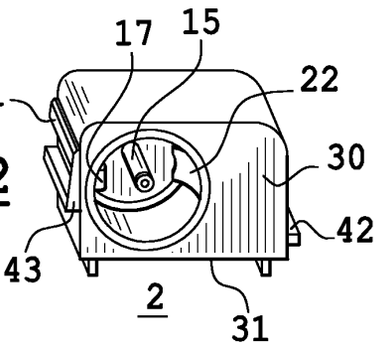

Fig. 2

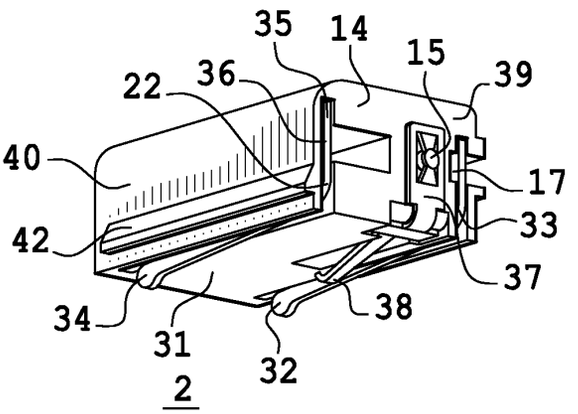

Fig. 3

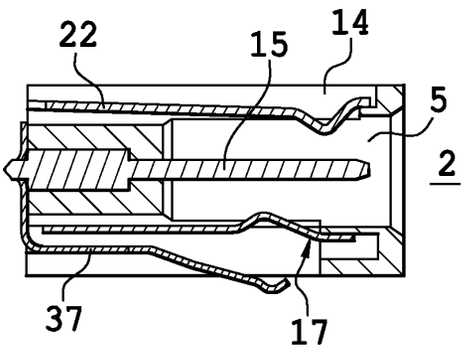

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 02 10 2374

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.7)
X	US 5 580 261 A (MEYNIER CHRISTOPHE) 3 December 1996 (1996-12-03)	1	H01R24/04
Y	* column 2, line 32 - column 3, line 34 *	2-10	
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A	US 6 270 380 B1 (UNO YUTAKA ET AL) 7 August 2001 (2001-08-07) * column 5, line 20 - column 10, line 2 *	1-10	

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
THE HAGUE	11 December 2002	Demol, S

CATEGORY OF CITED DOCUMENTS

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