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(71) Applicant: **Heavy Power Co., Ltd.**
**Taipei Hsien, Taiwan (TW)**

(72) Inventor: **Tseng, Peter**
**Wuku Industrial Park**
**Taipei Hsien (TW)**

(74) Representative: **Neugebauer, Jürgen et al**
**Schroeter Lehmann Fischer & Neugebauer**
**Wolfratshauser Strasse 145**
**81479 München (DE)**

(54) **Connector for terminal block**

(57) A connector (23) for a terminal block (200) for adjoining a pair of wires for providing electrical conduction between the wires is disclosed. The connector has a cylindrical body having one screw hole (231) near each end of the body and a wire end plate (232) formed internally to and at substantially the longitudinal center of the body for limiting wire insertion. A conduction plate (25) is inserted into the hollow space of the cylindrical body and has a length substantially the same as that of the cylindrical body along the longitudinal direction thereof. The conduction plate has a concaved surface conforming to the generally spherical cross section of the wires for partially enclosing the wires when inserted for adjoining. The concaved surface provides low electrical resistance between the adjoined wires when two screws (24) mating with the screw holes are installed and each driven firmly onto the corresponding one of the adjoining wires thereby squeezing the wires firmly onto the conduction plate.

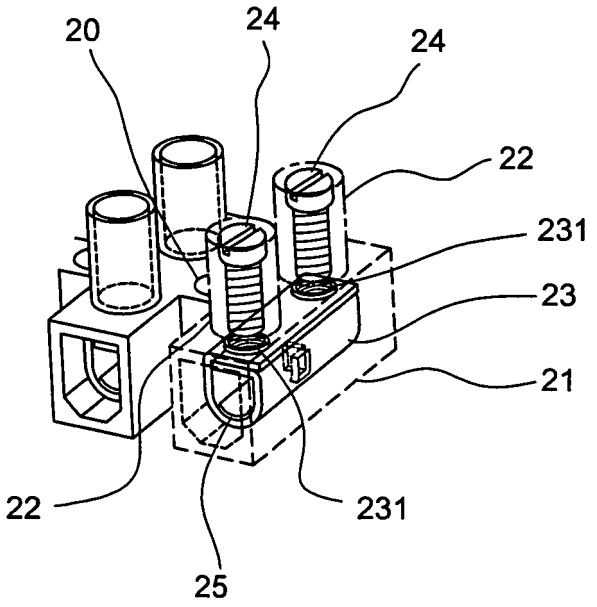


FIG. 4

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## Description

### Background

#### Field of the Invention

**[0001]** The present invention relates in general to an electrical connector for wires and, more particularly, to a connector for terminal blocks used for connecting multiple wires electrically together.

#### Description of the Related Art

**[0002]** Terminal blocks in the form of a multiplicity of parallel and individual connectors each capable of adjoining at least two wires are popular. A typical terminal block is shown in FIG. 1. A conventional terminal block such as shown in FIG. 1 has at least two wire-adjoining connectors 13 housed in their respective elongated poles 11 parallel to one another. All the poles 11 of a terminal block are structurally connected by a common traverse connecting bar 12 and provide electrical insulation for the connectors they house. Such a terminal block can be used to provide electrical conductivity between pairs of electrical wires or cables connected via the connectors 13 of the block.

**[0003]** FIG. 2 shows a conventional connector for the terminal block of FIG. 1. The drawing depicts the housing of a connector 13 inside its elongated pole 11 (shown in phantom lines) of the mass block. Two wires to be electrically connected for either power or signal relay purposes can be inserted each into the two opposite openings of a connector 13. A screw 15 is provided near each end of the connector 13 that can be screwed into its corresponding screw hole 131, which is opened through the entire thickness of the wall of the connector's generally cylindrical body and allows the passing through of its corresponding screw 15. The screw 15 sinks into a screw well 16 provided on the pole 11 of the mass block.

**[0004]** An electrically conductive resilient cover plate 14 is provided ahead of the opening of the screw hole 131 along the screw-in direction of each of the screws 15. When a wire to be adjoined has its exposed conductive end inserted into the end opening of the connector 13, the screw 15 can be driven inward so as to push the cover plate 14 onto the wire end. The screw-in of the screw 15 allows the wire end to be squeezed between the plate 14 and the cylindrical housing wall of the connector 13 opposite the screw hole 131. With sufficient screwing force, the connector 13 allows to both prevent the break off of the wire and ensure good electrical contact between the wire and the electrically conductive housing of the connector 13.

**[0005]** In order to ensure best possible electrical conduction between the pair of adjoining wires, either for the power or signal relay application, the connector 13 is usually made of metal or alloy such as brass of sufficient copper content. Also, for manufacturing cost considerations, typical connectors 13 for terminal blocks are made from sheet metal (such as brass) via machining processes such as press-forming. However, there is only a portion of the connector for a terminal block that is in direct contact with the adjoined wire. Making a connector entirely of an optimized conductive material becomes expensive.

### Summary of the Invention

**[0006]** There is therefore the need for a wire adjoining connector for terminal blocks for adjoining pairs of wires that is less costly to produce while provides improved electrical conduction for the adjoined wire pairs.

**[0007]** The present invention achieves the above by providing a connector for a terminal block for adjoining a pair of wires for providing electrical conduction between said wires, said connector comprising a cylindrical body having one screw hole near each end of said body and a wire end plate formed internally to and at substantially the longitudinal center of said body for limiting insertion of said wires; and a conduction plate inserted into the hollow space of said cylindrical body, said conduction plate having a length substantially the same as that of said cylindrical body along the longitudinal direction thereof; wherein said conduction plate having a concaved surface conforming to the generally spherical cross section of said wires for partially enclosing said wires when inserted for said adjoining; said concaved surface providing low electrical resistance between said adjoining wires when two screws mating with said screw holes are installed and each driven firmly onto the corresponding one of said adjoining wires thereby squeezing said wires firmly onto said conduction plate.

**[0008]** The present invention further provides a terminal block for adjoining at least one pair of wires, said terminal block comprising an insulating housing having a plurality of elongated hollow poles arranged in parallel and structurally connected by a common traverse connecting bar; and a plurality of connectors each for installation into everyone of said poles of said housing for adjoining a pair of wires for providing electrical conduction between said wires, said connector comprising a cylindrical body having one screw hole near each end of said body and a wire end plate formed internally to and at substantially the longitudinal center of said body for limiting insertion of said wires; and a conduction plate inserted into the hollow space of said cylindrical body, said conduction plate having a length substantially the same as that of said cylindrical body along the longitudinal direction thereof; wherein said conduction plate having a concaved surface conforming to the generally spherical cross section of said wires for partially enclosing said wires when inserted for said adjoining; said concaved surface providing low electrical resistance between said adjoining wires when two screws mating with said screw holes are installed and each driven firmly onto the corresponding one of said adjoining wires thereby squeez-

ing said wires firmly onto said conduction plate.

**Brief Description of the Drawing**

**[0009]**

FIG. 1 shows a conventional terminal block.
FIG. 2 shows a conventional connector for the terminal block of FIG. 1.
FIG. 3 is a perspective view of a terminal block in accordance with a preferred embodiment of the present invention.
FIG. 4 shows a connector for the terminal block of FIG. 3 in accordance with a preferred embodiment of the present invention.
FIG. 5 is a perspective view of the connector of FIG. 4.
FIG. 6 is a cross-sectional view of the terminal block of FIG. 4 taken along the A-A line.

**Detailed Description of the Preferred Embodiment**

**[0010]** FIG. 3 is a perspective view of a terminal block in accordance with a preferred embodiment of the present invention. A terminal block 200 for providing electrical connection between multiple pairs of adjoining wires or cables has an electrically insulating housing having a selected number of elongated hollow poles 21 arranged in parallel and structurally connected by a common traverse connecting bar 20. One wire-adjoining connector 23 is housed inside each pole 21. One screw well 22 is provided at each end of each pole 21 of the block 200 that can be used to shield a screw used for the secured adjoining of a wire to be described in the following paragraphs. Terminal block 200 of the present invention can be used to provide electrical conduction between pairs of electrical wires or cables connected via connectors 23 installed in the block.

**[0011]** FIG. 4 shows a connector for the terminal block of FIG. 3 in accordance with a preferred embodiment of the present invention. The drawing depicts the housing of a connector 23 inside its elongated hollow pole 21 (shown in phantom lines) of the mass terminal block of FIG. 3. Two wires to be electrically connected for either power or signal relay purposes are each inserted into its corresponding end openings of the connector 23.

**[0012]** A wire securing means, preferably a screw 24 as is shown in the drawing, is provided near each end of the connector 23 that can be screwed into its corresponding screw hole 231. In the case of a screw securing means, the corresponding screw hole 231 is opened through the entire thickness of the wall of the connector's generally cylindrical body and allows the passing through of its corresponding screw 24. The screw 24 sinks into a screw well 22 provided on the pole 21 of the mass terminal block 200.

**[0013]** FIG. 5 is a perspective view of the connector 23 of FIG. 4. The connector 23 shown is a preferred embodiment in accordance with the present invention and has a generally cylindrical-shaped body configuration. The connector 23 shown with its two wire-securing screws removed is made from rolling of a metallic sheet material via, preferably, a press-form machining procedure.

**[0014]** The depicted preferred embodiment of the wire adjoining connector 23 of the present invention as illustrated herein has an end shape that resembles the capital English letter "D." Preferably, the two screw holes 231 for the wire-securing screws are formed on the flat portion of the cylindrical body of the connector 23, as is see in FIG. 5. Preferably, the flat portion of the cylindrical body of the connector 23 is where the two ends of the roll-formed sheet material meet.

**[0015]** Also, as is shown in the drawing, the preferred connector 23 has its two ends overlapped one on top of the other. This arrangement provides the benefit of structural integrity of the entire connector 23 when the two wires to be adjoined is inserted and the securing screws driven firmly into place. Such an arrangement reduces, or even eliminates, the need for secure bonding, via welding for example, between the two overlapped edges of the connector sheet material.

**[0016]** The generally cylindrical-shaped configuration of the connector 23 of FIG. 5 encloses a hollow internal space, in which a conduction plate 25 can be inserted. The conduction plate 25 is preferably made of a commercially optimized electrical conduction material, brass with sufficient copper content for example. Preferably, the conduction plate 25 has an end shape in conformity with the curved segment of the letter "D" end shape of the connector 23 opposite to the straight vertical segment thereof as it is inserted into the hollow space of the connector 23 directly next to that curved wall. Preferably, the conduction plate 25 should be fixed to its correspondingly shaped inner sidewall of the connector 23 via, for example, spot welding that allows best possible electrical conduction between the two. Preferably, the conduction plate 25 has a length along the longitudinal direction of the connector 23 that is substantially equal to the length of the connector in which it is inserted.

**[0017]** An electrically conductive resilient cover plate 233 as shown in the perspective view of FIG. 5 is provided ahead of the opening of the screw hole 231 along the screw-in direction of each of the screws 24. When a wire to be adjoined has its exposed conductive end inserted into the end opening of the connector 23, the screw 24 can be driven inward so as to push the cover plate onto the inserted end of the wire to be adjoined.

**[0018]** FIG. 6 is a cross-sectional view of the terminal block of FIG. 4 taken along the A-A line. The cross-sectional view shows the connector 23 in the state of securely adjoining two wires 3. An additional wire end plate 232 is also illustrated that can be used to assist alignment of the inserted wires along the longitudinal direction as they are inserted from both ends of the connector 23 inwardly for adjoining. The wire end plate 232 serves to prevent

both inserted wires from over insertion as anyone of both is abutted against it. Preferably, this wire end plate 232 can be formed from a portion of the sidewall of the connector 23 of appropriate size via punching through the sidewall and bending inwardly toward the hollow space of the connector when machining, as is shown in phantom lines 232 in FIG. 5. There is one single punching through the connector body sidewall is shown in FIG. 5, however, two punchings each with smaller bent wall than in the case of one single bent plate are also applicable. The two smaller bent plates formed substantially at the middle along the longitudinal length of the connector body can be aligned opposite to each other to make up an equivalent single wire end stopping plate 232.

**[0019]** The screw-in of the wire-securing screw 24 allows the wire end to be tightly squeezed between the screw tip (or the resilient cover plate should one be used) and the concaved inner surface of the conduction plate 25. With sufficient screwing force, the wire adjoining connector 23 of the present invention allows to both prevent the break off of the wires and ensure good electrical contact between the two adjoined wires. The electrical conduction between any pair of adjoined wires is significantly better than that is provided by conventional terminal blocks. This improved electrical conduction is due to the presence of the contoured conduction plate in the connector body. The inwardly curved surface of the conduction plate conforms to and perfectly partially encloses the generally spherical cross section of any wire to be adjoined.

**[0020]** In addition to the improved electrical conduction provided by the conduction plate, the connector for the terminal block in accordance with the teaching of the present invention can also enjoy the benefit of cost reduction. This is possible since the connector body can be made of structurally strong and yet cheap metallic or alloy material. For example, plated steel sheets, which are much cheaper than brass, can be used to make the connector body. Steel sheet provides good structural strength for the connector while is also electrically conductive. Therefore, a wire adjoining connector in accordance with the teaching of the present invention having a steel body and an inner lining brass conduction plate is capable of achieving optimized price-performance characteristics.

**[0021]** While the above is a full description of the specific embodiments, various modifications, alternative constructions and equivalents may be used. Therefore, the above description and illustrations should not be taken as limiting the scope of the present invention, which is defined by the appended claims.

## Claims

**1.** A connector for a terminal block for adjoining a pair of wires for providing electrical conduction between said wires, said connector comprising:

a cylindrical body having one screw hole near each end of said body and a wire end plate formed internally to and at substantially the longitudinal center of said body for limiting insertion of said wires; and

a conduction plate inserted into the hollow space of said cylindrical body, said conduction plate having a length substantially the same as that of said cylindrical body along the longitudinal direction thereof; wherein

said conduction plate having a concaved surface conforming to the generally spherical cross section of said wires for partially enclosing said wires when inserted for said adjoining; said concaved surface providing low electrical resistance between said adjoining wires when two screws mating with said screw holes are installed and each driven firmly onto the corresponding one of said adjoining wires thereby squeezing said wires firmly onto said conduction plate.

**2.** The connector of claim 1, wherein said conduction plate is contoured with a shape corresponding to the sidewall of said cylindrical body for fixed contact and electrical conduction therebetween.

**3.** The connector of claim 1, wherein said cylindrical body having a D-shaped cross-section.

**4.** The connector of claim 1, wherein said cylindrical body is made of plated steeL

**5.** The connector of claim 1, wherein said conduction plate is made of brass.

**6.** The connector of claim 1, further comprising a resilient cover next to each of said screw hole ahead of the drive-in direction said wire securing screw.

**7.** A connector for a terminal block for adjoining a pair of wires for providing electrical conduction between said wires, said connector comprising:

a cylindrical body having one screw hole near each end of said body and a wire end plate formed internally to and at substantially the longitudinal center of said body for limiting insertion of said wires; and

a conduction plate inserted into the hollow space of said cylindrical body, said conduction plate having a length substantially the same as that of said cylindrical body along the longitudinal direction thereof; wherein

said conduction plate being contoured with a shape corresponding to the sidewall of said cylindrical body for fixed contact and electrical conduction therebetween; and

said conduction plate having a concaved surface conforming to the generally spherical cross section of said wires for partially enclosing said wires when inserted for said adjoining; said concaved surface providing low electrical resistance between said adjoining wires when two screws mating with said screw holes are installed and each driven firmly onto the corresponding one of said adjoining wires thereby squeezing said wires firmly onto said conduction plate.

**8.** The connector of claim 7, wherein said cylindrical body having a D-shaped cross-section.

**9.** The connector of claim 7, wherein said cylindrical body is made of plated steel.

**10.** The connector of claim 7, wherein said conduction plate is made of brass.

**11.** The connector of claim 7, further comprising a resilient cover next to each of said screw hole ahead of the drive-in direction said wire securing screw.

**12.** A terminal block for adjoining at least one pair of wires, said terminal block comprising:

an insulating housing having a plurality of elongated hollow poles arranged in parallel and structurally connected by a common traverse connecting bar; and
a plurality of connectors each for installation into everyone of said poles of said housing for adjoining a pair of wires for providing electrical conduction between said wires, said connector comprising:

a cylindrical body having one screw hole near each end of said body and a wire end plate formed internally to and at substantially the longitudinal center of said body for limiting insertion of said wires; and
a conduction plate inserted into the hollow space of said cylindrical body, said conduction plate having a length substantially the same as that of said cylindrical body along the longitudinal direction thereof; wherein
said conduction plate having a concaved surface conforming to the generally spherical cross section of said wires for partially enclosing said wires when inserted for said adjoining; said concaved surface providing low electrical resistance between said adjoining wires when two screws mating with said screw holes are installed and each driven firmly onto the corresponding one of said adjoining wires thereby squeezing said wires firmly onto said conduction plate.

**13.** The terminal block of claim 12, wherein said conduction plate is contoured with a shape corresponding to the sidewall of said cylindrical body for fixed contact and electrical conduction therebetween.

**14.** The terminal block of claim 12, wherein said cylindrical body having a D-shaped cross-section.

**15.** The terminal block of claim 12, wherein said cylindrical body is made of plated steeL

**16.** The terminal block of claim 12, wherein said conduction plate is made of brass.

**17.** The terminal block of claim 12, further comprising a resilient cover next to each of said screw hole ahead of the drive-in direction said wire securing screw.

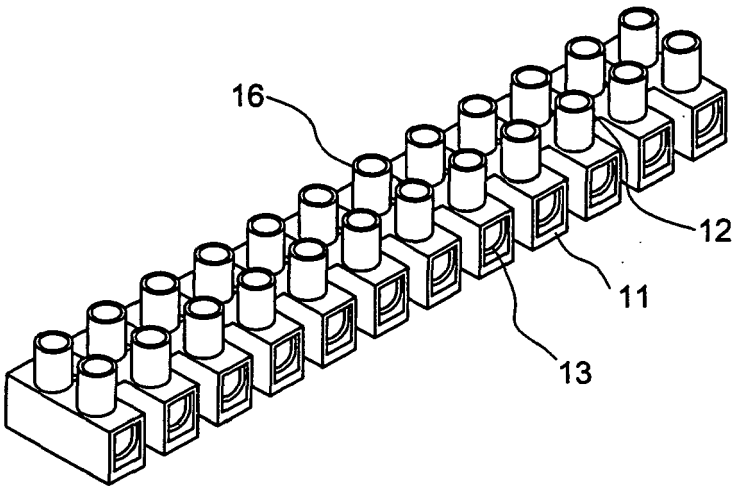


FIG. 1 Prior Art

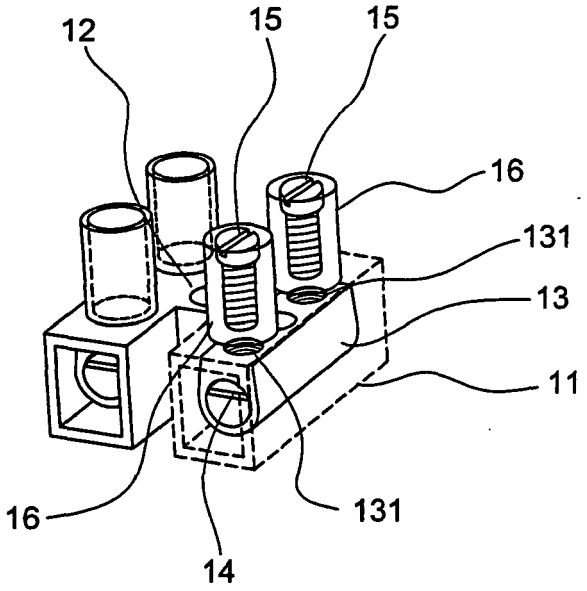


FIG. 2 Prior Art

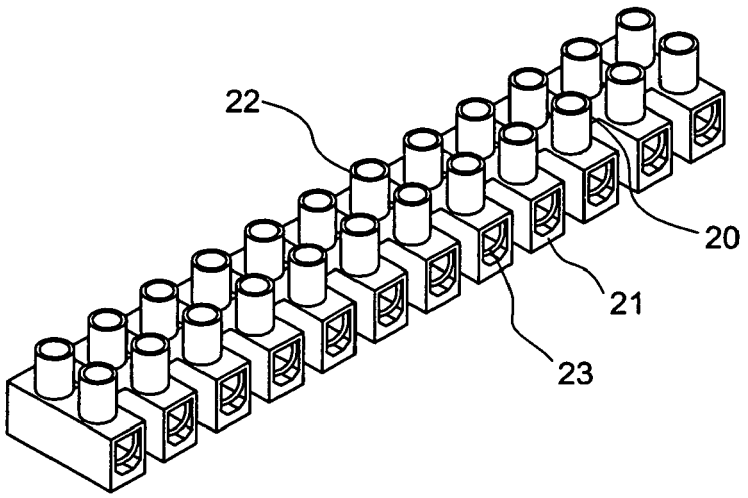


FIG. 3

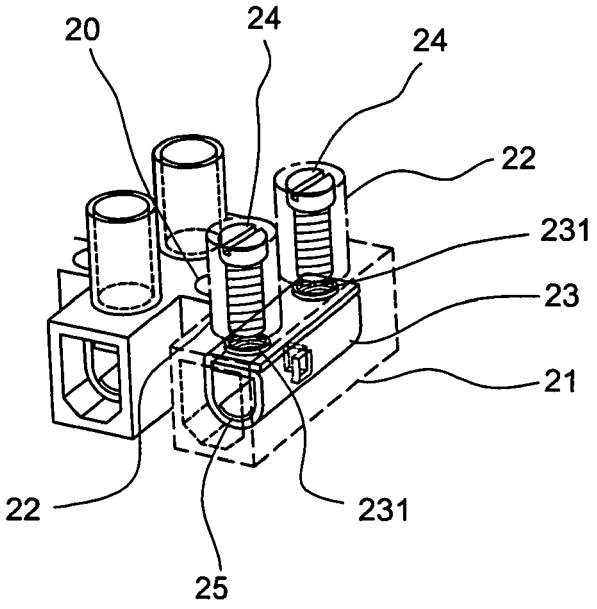


FIG. 4

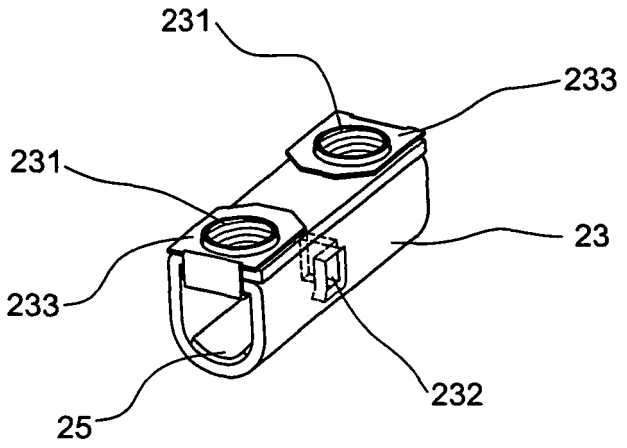


FIG. 5

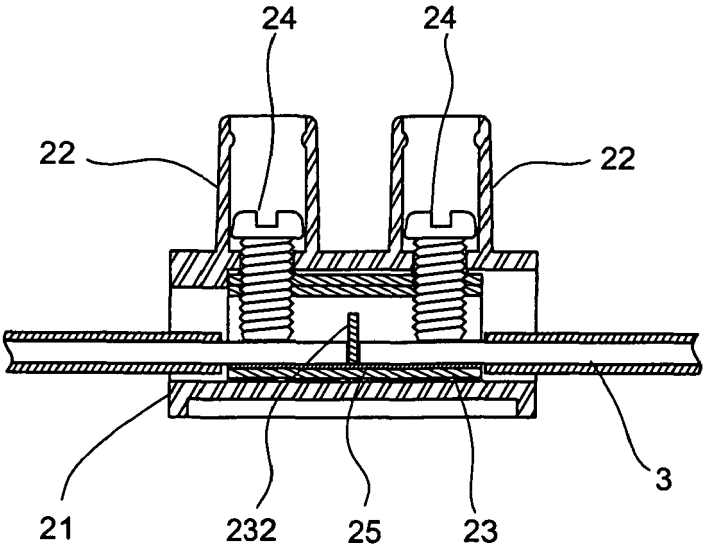


FIG. 6

European Patent Office

# EUROPEAN SEARCH REPORT

Application Number
EP 06 00 9052

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (IPC) |
|---|---|---|---|
| X<br><br>Y | DE 32 45 136 A1 (FLIER GUSTAV; TEUTSCH GERD) 7 June 1984 (1984-06-07)<br><br>* figures *<br><br>----- | 1-3,5,7, 8,10, 12-14,16<br><br>4,6,9, 11,15,17 | INV. H01R4/36 |
| Y | EP 0 406 510 A (GIBI ELETTRO SRL [IT]) 9 January 1991 (1991-01-09)<br>* column 5, line 41 - line 46; figures *<br>----- | 4,6,9, 11,15,17 | |
| | | | TECHNICAL FIELDS SEARCHED (IPC)<br>H01R |

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| Munich | 12 October 2006 | Langbroek, Arjen |

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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& : member of the same patent family, corresponding document

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## ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 06 00 9052

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
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12-10-2006

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---|---|---|
| DE 3245136 A1 | 07-06-1984 | NONE | |
| EP 0406510 A | 09-01-1991 | IT 1230304 B | 18-10-1991 |

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82