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(71) Applicant (for all designated States except BR, CA, MX, US): FCI ASIA PTE. LTD [SG/SG]; 159 Kampong Ampat, #04-01/04 KA Place 368328 (SG).

(71) Applicant (for BR, CA, MX, US only): FCI AMERICAS TECHNOLOGY LLC [US/US]; 502 East John Street, Carson City, Nevada 89706 (US).

(72) Inventors: **COPPER, Charles**; c/u FCI USA LLC, 825 Old Trail Road, Etters, Pennsylvania 17319 (US). **FRY, JR., Rubert**; c/u FCI USA LLC, 825 Old Trail Road, Etters, Pennsylvania 17319 (US).

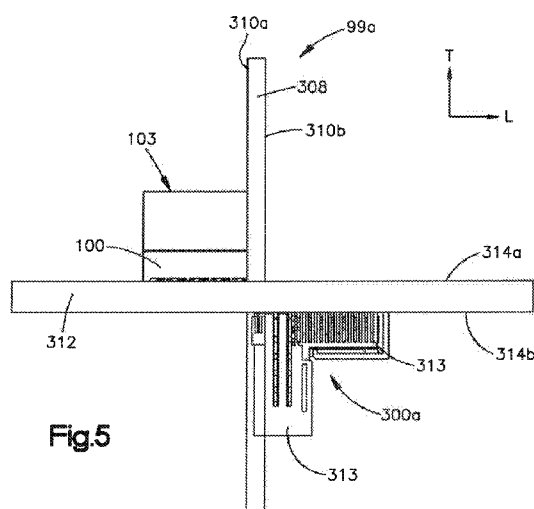
(74) Agent: **GEIBEL, Dean, E.**; Fci Usa LLC, 825 Old Trail Road, Etters, Pennsylvania 17319 (US).

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[Continued on next page]

(54) Title: ORTHOGONAL ELECTRICAL CONNECTOR SYSTEM



(57) Abstract: In accordance with one embodiment, an electrical connector system can include an electrical signal connector and an electrical power connector. The electrical signal connector and the electrical power connector can be mounted on opposed surfaces of a printed circuit board. The electrical power connector can be constructed as a hermaphroditic power connector that includes at least one header power contact supported by a connector housing, and at least one receptacle power contact supported by the connector housing.



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

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INTERNATIONAL SEARCH REPORT

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A. CLASSIFICATION OF SUBJECT MATTER

INV. H01R12/72 H01R12/73 H05K3/36 H01R12/70 H01R24/84
H01R43/20 H05K7/14

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

H01R H05K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2013/273781 A1 (BUCK JONATHAN E [US] ET AL) 17 October 2013 (2013-10-17) cited in the application paragraph [0254] - paragraph [0270] figures 19C-25	1-14
X	US 2008/045079 A1 (MINICH STEVEN E [US] ET AL) 21 February 2008 (2008-02-21) paragraph [0039] paragraph [0066] - paragraph [0070] figures 1, 5, 6, 9, 10	1
A	US 6 102 747 A (PAAGMAN BERNARDUS L F [NL]) 15 August 2000 (2000-08-15) column 6, line 50 - line 67 figure 15	11,13



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

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European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Henrich, Jean-Pascal

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 00/16445 A1 (TVM GROUP INC [US]) 23 March 2000 (2000-03-23) page 12, line 24 - page 13, line 17 figures 21, 22	9, 10
X	----- US 7 435 095 B1 (YI CHONG [US]) 14 October 2008 (2008-10-14) the whole document	15-25
A	----- EP 0 494 759 A1 (PLESSEY TELECOMM [GB]) 15 July 1992 (1992-07-15) column 2, line 54 - column 3, line 50 figures 1, 2, 5, 6	17-19, 22
X	----- EP 0 924 806 A1 (BERG ELECTRONICS MFG [NL]) 23 June 1999 (1999-06-23) paragraph [0105] - paragraph [0108] figure 20	63-65
X	----- JP 2001 307846 A (JAPAN AVIATION ELECTRON) 2 November 2001 (2001-11-02)	69-79
A	the whole document	16, 23, 24
A	----- JP 2003 317831 A (TYCO ELECTRONICS AMP KK) 7 November 2003 (2003-11-07) figures 4, 5	25, 71, 73

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2015/039850

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☒ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
1-25, 63-65, 69-79
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-14

Electrical connector system comprising a printed circuit board presenting two opposite surfaces, an electrical connector being mounted on each of said surfaces, each connector presenting a mating interface configured to mate with a complementary electrical connector.

2. claims: 15-25, 63-65

Electrical connector system comprising two perpendicular printed circuit boards, each printed circuit board presenting a signal connector and a power connector, both being mounted on opposite surfaces of each printed circuit board; both printed circuit boards are connected in signal and in power and are perpendicularly disposed. The corresponding method resulting in said electrical connector system is also disclosed.

3. claims: 26-32

Electrical connector system comprising a matrix of printed circuit boards connected together in signal and power; a first plurality of printed circuit boards being perpendicular to the second plurality of printed circuit boards.

4. claims: 33, 34

Method for mating a connector with another connector, both presenting complementary mating interfaces.

5. claims: 35-40

Power connector assembly comprising a header electrical power connector and a receptacle electrical power connector; the header electrical power connector presenting a mating interface which is received in the receptacle electrical power connector such as the mating action is completed even when both connector appears as not physically totally mated.

6. claims: 41-44

Method of teaching cooling an orthogonal electrical connector system

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

7. claims: 45-51

Method of selling an electrical connector assembly.

8. claims: 52-57

Method of ordering an electrical connector assembly.

9. claims: 58-62

Method of connecting two perpendicular PCBs in power through the steps of mounting a first electrical power connector to a surface of a first PCB, mounting a second electrical power connector on a surface of a second PCB, mating both electrical power connectors.

10. claims: 66-68

Electrical connector system providing a PCB connectable, on opposite, in signal and power with an offset between the signal connector and the power connector.

11. claims: 69-79

Hermaphroditic power connector presenting a header power contact and a receptacle power contact, the mating interface of said connector comprising a mating portion and a complementary receptacle portion in form of a slot.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2015/039850

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2013273781 A1	17-10-2013	CN 103378434 A CN 203277706 U EP 2837066 A1 EP 2958197 A2 JP 2015513207 A TW 201401663 A US 2013273781 A1 WO 2013155147 A1	30-10-2013 06-11-2013 18-02-2015 23-12-2015 30-04-2015 01-01-2014 17-10-2013 17-10-2013
US 2008045079 A1	21-02-2008	CN 101507053 A TW 200818620 A US 2008045079 A1 US 2009124101 A1 WO 2008024275 A2	12-08-2009 16-04-2008 21-02-2008 14-05-2009 28-02-2008
US 6102747 A	15-08-2000	DE 69833904 T2 EP 0918376 A2 JP H11224742 A US 5924899 A US 6102747 A	22-02-2007 26-05-1999 17-08-1999 20-07-1999 15-08-2000
WO 0016445 A1	23-03-2000	AU 6248599 A CN 1304568 A CN 1619889 A DE 69934593 T2 EP 1114492 A1 US 6402566 B1 US 2001023143 A1 US 2002081909 A1 US 2003143876 A1 WO 0016445 A1	03-04-2000 18-07-2001 25-05-2005 15-11-2007 11-07-2001 11-06-2002 20-09-2001 27-06-2002 31-07-2003 23-03-2000
US 7435095 B1	14-10-2008	CN 101364673 A US 7435095 B1	11-02-2009 14-10-2008
EP 0494759 A1	15-07-1992	AU 1004392 A CA 2059022 A1 CN 1063590 A EP 0494759 A1 FI 920079 A GB 2251730 A IE 914459 A1 JP H077176 A	16-07-1992 10-07-1992 12-08-1992 15-07-1992 10-07-1992 15-07-1992 15-07-1992 10-01-1995
EP 0924806 A1	23-06-1999	DE 69728548 D1 DE 69728548 T2 EP 0924806 A1 JP H11251004 A US 2001049213 A1	13-05-2004 24-02-2005 23-06-1999 17-09-1999 06-12-2001
JP 2001307846 A	02-11-2001	JP 3706996 B2 JP 2001307846 A	19-10-2005 02-11-2001
JP 2003317831 A	07-11-2003	NONE	