

(19) World Intellectual Property
Organization
International Bureau



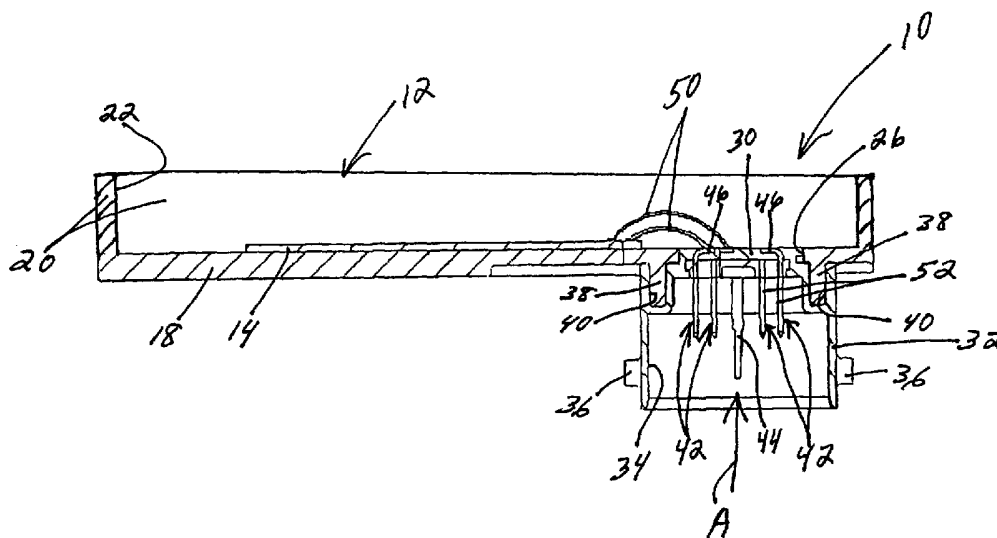
(43) International Publication Date
15 April 2004 (15.04.2004)

PCT

(10) International Publication Number
WO 2004/032285 A1

- (51) International Patent Classification⁷: **H01R 13/40**, 12/02
- (21) International Application Number: PCT/US2003/030534
- (22) International Filing Date: 26 September 2003 (26.09.2003)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data: 10/262,986 2 October 2002 (02.10.2002) US
- (71) Applicant: **MOLEX INCORPORATED** [US/US]; 2222 Wellington Court, Lisle, IL 60532 (US).
- (72) Inventors: **MARCEAU, Scott, P.**; 14012 South Danbury Drive, Plainfield, IL 60544 (US). **BERG, Paul, C.**; 1356 Schiedler Drive, Batavia, IL 60510 (US). **COLE, Mark, A.**; 49 Sundance Road, Matteson, IL 60443 (US). **LOHMAN, Jonathan, D.**; 131 Arbor Avenue, West Chicago, IL 60185 (US).
- (74) Agent: **CALDWELL, Stacey, E.**; Molex Incorporated, 2222 Wellington Court, Lisle, IL 60532 (US).
- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).
- Published:**
— with international search report
— with amended claims
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: ELECTRICAL CONNECTOR ASSEMBLY



(57) Abstract: An electrical connector termination assembly includes a dielectric pin holder. A plurality of elongated terminal pins extend through the pin holder in a pattern of at least two rows of pins with the pins in the respective rows being aligned transversely of the rows. Each of at least some of the terminal pins defining a longitudinal axis and including an arm at a termination end of the pin offset from the longitudinal axis. The arm is bent to define a termination pad extending transversely of the longitudinal axis.

ELECTRICAL CONNECTOR ASSEMBLY

Field of the Invention:

This invention generally relates to the art of electrical connectors and, particularly, to an electrical connector assembly which includes a plurality of terminals providing a unique termination pattern.

Background of the Invention:

Generally, a typical electrical connector includes some form of dielectric housing mounting a plurality of conductive terminals. The housing may include a mating end for interengaging a mating connector or other complementary connecting device, as well as a terminating end at which the terminals are terminated to various electrical transmission components ranging from circuit boards to discrete electrical wires. High density connectors are well known in the electronic industry as well as the automotive industry. In both industries, the ever-increasing miniaturization and high density of the circuits has created design problems in terminal spacing and configuration. An example is in a header connector which uses closely-spaced terminal pins.

For instance, the terminating ends of the terminal pins in some header connectors may be "wire bonded" to a plurality of discrete electrical wires. The wire bonding is carried out by surface connection with the use of ultrasonic energy and the application of pressure. The discrete electrical wires may have a given, sometimes short length and lead from the terminating ends of the terminal pins to contact pads on an adjacent printed circuit board. There are limitations in the length of such wires which creates design problems. In other words, in any given application, the wires may have a maximum length beyond which vibrations will cause the wires to touch each other.

Another problem involves the pattern or array of the terminal pins at the mating end of the connector. Most often, the terminal pins are arranged in rows. In order to achieve a high density pattern, the pins in adjacent rows are offset or staggered relative to each other in directions perpendicular to the rows. However, there are applications wherein offset terminal pins is not desirable. The pins may be required to be in a "square" pattern, i.e., the pins in the adjacent rows are aligned with each other. This square pattern of pins at the mating end of the connector creates problems at the terminating end of the connector where the terminating ends of the terminal pins may be wire bonded to discrete electrical wires.

The present invention is designed to solve these various problems, including the provision of a unique terminal configuration which allows the terminal pins to be disposed in a square pattern while the terminating ends of the pins are in an offset pattern.

30

Summary of the Invention:

An object, therefore, of the invention is to provide a new and improved electrical connector assembly of the character described.

In the exemplary embodiment of the invention, an electrical connector termination assembly
5 includes a dielectric pin holder. A plurality of elongated terminal pins extend through the pin holder in a pattern of at least two rows of pins, with the pins in the respective rows being aligned transversely of the rows. Each of at least some of the terminal pins define a longitudinal axis and include an arm at a termination end of the pin offset from the longitudinal axis. The arm is bent to define a termination pad extending transversely of the
10 longitudinal axis.

As disclosed herein, one embodiment of a dielectric pin holder includes a plurality of passages within which the terminal pins are press-fit. The pin holder is provided as a generally flat wafer. In another embodiment, the pin holder is a plastic member overmolded about portions of the terminal pins, leaving the termination pads exposed.

15 According to one aspect of the invention, the arm at the termination end of each pin is bent generally at a right-angle to the longitudinal axis of the respective terminal pin. The termination pad is formed on a side of the arm and includes a generally flat surface in a plane generally perpendicular to the longitudinal axis of the respective terminal pin. The flat surface is wider than the respective terminal pin.

20 According to another aspect of the invention, the arms at the termination ends of the terminals in one row thereof are offset to one side of the terminals longitudinally of the row. The arms at the termination ends of the terminals in the other row thereof are offset to an opposite side of the terminals longitudinally of the row. The arms at the termination ends of the terminals in each row thereof may be bent toward the other row of terminals.

25 Other objects, features and advantages of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings.

Brief Description of the Drawings:

The features of this invention which are believed to be novel are set forth with particularity in the appended claims. The invention, together with its objects and the advantages thereof, may be best understood by reference to the following description taken in conjunction with the accompanying drawings, in which like reference numerals identify like elements in the figures and in which:

FIG. 1 is an electrical connector assembly incorporating the termination assembly of the invention, with the discrete electrical wires removed to facilitate the illustration and avoid cluttering the depiction;

FIG. 2 is a vertical section taken generally along line 2-2 of FIG. 1;

FIG. 3 is a bottom plan view of the assembly of FIG. 1;

FIG. 4 is a vertical section taken generally along line 4-4 of FIG. 1;

FIG. 5 is an enlarged, somewhat schematic illustration of the discrete electrical wires extending between the termination pads of the terminals and the contact pads of the printed circuit board;

FIG. 6 is a perspective view of a pair of terminals with one terminal being taken from each of a pair of adjacent rows thereof;

FIG. 7 is a perspective view looking at the back-side of FIG. 6; and

FIGS. 8 and 9 are mutually perpendicular, side elevational views of one of the terminals.

Detailed Description of the Preferred Embodiment:

Referring to the drawings in greater detail, and first to FIGS. 1-4, an electrical connector assembly, generally designated 10, includes a frame, generally designated 12, a printed circuit board 14 disposed within the frame, and a termination assembly which includes a header connector, generally designated 16, which projects from the bottom of the frame.

Frame 12 of connector assembly 10 includes a generally square bottom wall 18 bounded by four upstanding side walls 20 to define a cavity 22 within which printed circuit board 14 is mounted on bottom wall 18. Header connector 16 is mounted within a recessed area 24 at the bottom of frame 12, with the header connector being exposed in cavity 22 through an opening 26 in bottom wall 18.

Header connector 16 includes a wafer-like pin holder 30 which substantially fills opening 26 in bottom wall 18 of frame 12. A shroud 32 projects downwardly below the frame from the pin holder. The wafer-like pin holder and the shroud may be molded of dielectric material such as plastic or the like in a one-piece structure. In essence, pin holder 30 defines a terminating end of header connector 16, and shroud 32 defines a mating end of the connector. The shroud is generally hollow to define an interior cavity 34 for receiving a mating connector in the direction of arrows "A" (Figs. 2 and 4). A pair of latch bosses 36 project outwardly from opposite sides of shroud 32 for engaging appropriate latch means on the mating connector. Bottom wall 18 of frame 12 includes a continuous flange 38 positioned into a groove 40 in the connector assembly as best seen in FIG. 4 to mount the header connector to the frame either by a press-fit or by using appropriate adhesives.

A plurality of terminals, generally designated 42 (Figs. 2 and 4), are mounted in the wafer-like pin holder 30 of header connector 16. The terminal pins are mounted in two rows on each opposite side of a ground plate 44. The terminal pins are elongated and define longitudinal axes. The terminal pins may be press-fit in terminal-receiving passages in pin holder 30, or the pin holder may be overmolded about portions of the pins.

It should be noted in FIG. 3 that terminal pins 42 in each of the two rows on opposite sides of ground plate 44 are in a "square" pattern. In other words, the pins in one row are aligned with the pins in the second row in a direction transversely of the rows. However, it should be noted in FIG. 1 that the pins have termination pads 46 exposed at the top of pin holder 30, and the termination pads in each pair of rows are offset or staggered relative to

each other. The configurations of the terminal pins for converting the square pattern of pins to the offset pattern of termination pads will be described hereinafter.

Referring to FIG. 5 in conjunction with FIG. 4, printed circuit board 14 is shown with a plurality of contact pads 48 which are arranged in two rows, with the contact pads in each row being offset or staggered relative to each other. The array of termination pads 46 of terminal pins 42 (Figs. 2 and 4) also are shown. It can be seen that a plurality of discrete electrical wire lengths 50 interconnect termination pads 46 of the terminal pins with contact pads 48 of the printed circuit board. FIG. 4 shows that the electrical wires are at different vertical levels so that they do not touch each other. The electrical wires are "wire bonded" to the termination pads as described in the Background, above. Again, it can be seen that termination pads 46 of the terminal pins are in an offset or staggered array or pattern in each of the two rows thereof, whereas the terminal pins 42, themselves, are mounted in pin holder 30 in a square pattern as shown in FIG. 3.

FIGS. 6 and 7 show the configurations of terminal pins 42 in greater detail. The pins may be stamped and formed of sheet metal material. Each pin includes a pin portion 52 which projects into shroud 32 as seen in FIGS. 2 and 4, for mating with appropriate terminals of the mating connector. Each pin includes a widened retention section 54 which is press-fit into one of the terminal-receiving passages in pin holder 30. The terminal pins are elongated, and pin portions 52 define longitudinal axes 56 of the respective pins. FIGS. 6 and 7 are arranged to depict a terminal pin from each row in one of the pair of rows, and to show that pin portions 52 of the two terminal pins are aligned with each other transversely of the rows.

Still referring to FIGS. 6 and 7, each terminal pin 42 includes an arm 58 at a termination end of the pin offset to one side of axis 56 of the respective pin. It can be seen that arm 58 is bent generally at a right-angle to longitudinal axis 56 of the respective terminal pin. The arm is widened at a distal end thereof to form one of the termination pads 46 having a generally flat surface 46a at a side of the arm. With the arm bent, flat surface 46a lies in a plane generally perpendicular to the longitudinal axis 56 of the respective terminal pin, with the flat surface being wider than arm 58 and, in fact, wider than pin portion 52 of the terminal. FIGS. 8 and 9 show elevational views of the left-hand terminal pin 42 as is viewed in FIG. 6.

Referring either of FIGS. 6 or 7, it can be seen that arm 58 at the termination end of the terminal pin in one row thereof is offset to one side of the terminal pin longitudinally of the row, and the arm at the termination end of the terminal pin in the other row thereof is

offset to an opposite side of the terminal pin longitudinally of the row. In the specific illustration in FIG. 6, arm 58 of the left-hand terminal pin 42 is offset to the left-hand side of the pin (i.e., axis 56), and arm 58 of the right-hand terminal pin 42 is offset to the right of axis 56 of the right-hand terminal pin. This staggered relationship of the arms of transverse pairs of terminal pins repeats lengthwise of the two rows of pins whereupon the staggered array of termination pads 46 as shown in FIG. 5 is effected. In addition, as clearly seen in FIGS. 2 and 4, the arms of terminal pins 42 in the left-hand pair of rows are bent inwardly (i.e., to the right) whereas the arms of the terminal pins in the right-hand pair of rows are bent inwardly at an opposite direction (i.e., to the left). In other words, the arms at the termination ends of the terminal pins in each pair of rows are bent toward the termination ends of the terminal pins in the other pair of rows. This results in a tighter or more closely-spaced array of termination pads 46 for all four rows combined.

It will be understood that the invention may be embodied in other specific forms without departing from the spirit or central characteristics thereof. The present examples and embodiments, therefore, are to be considered in all respects as illustrative and not restrictive, and the invention is not to be limited to the details given herein.

CLAIMS:

What is claimed is:

1. An electrical connector termination assembly, comprising:
a dielectric pin holder; and
a plurality of elongated terminal pins extending through the pin holder in a pattern of at least two rows of pins with the pins in the respective rows being aligned transversely of the rows, each of at least some of the terminal pins defining a longitudinal axis and including an arm at a termination end of the pin offset from the longitudinal axis, the arm being bent to define a termination pad extending transversely of the longitudinal axis.
2. The electrical connector termination assembly of claim 1 wherein said dielectric pin holder includes a plurality of passages within which the terminal pins are press-fit.
3. The electrical connector termination assembly of claim 2 wherein said dielectric pin holder comprises a generally flat wafer.
4. The electrical connector termination assembly of claim 1 wherein said dielectric pin holder is a plastic member overmolded about portions of the terminal pins leaving said termination pads exposed.
5. The electrical connector termination assembly of claim 1 wherein each said terminal pad is wider than the respective terminal pin.
6. The electrical connector termination assembly of claim 1 wherein said arm is bent generally at a right-angle to the longitudinal axis of the respective terminal pin.
7. The electrical connector termination assembly of claim 6 wherein said termination pad is formed on a side of the arm of the respective terminal pin.

8. The electrical connector termination assembly of claim 6 wherein said termination pad comprises a generally flat surface in a plane generally perpendicular to the longitudinal axis of the respective terminal pin.

9. The electrical connector termination assembly of claim 8 wherein said flat surface is wider than the respective terminal pin.

10. The electrical connector termination assembly of claim 1 wherein the arms at the termination ends of the terminal pins in one row thereof are offset to one side of the terminal pins longitudinally of the row, and the arms at the termination ends of the terminal pins in the other row thereof are offset to an opposite side of the terminal pins longitudinally
5 of the row.

11. The electrical connector termination assembly of claim 10 wherein the arms at the termination ends of the terminal pins in each row thereof are bent toward the other row of terminal pins.

12. An electrical connector termination assembly, comprising:
a dielectric pin holder; and
a plurality of elongated terminal pins extending through the pin holder in a pattern of
at least two rows of pins with the pins in the respective rows being aligned transversely of the
5 rows, each of at least some of the terminal pins defining a longitudinal axis and including an
arm at a termination end of the pin offset from the longitudinal axis, the arm being bent
generally at a right-angle to the longitudinal axis of the respective terminal pin to define a
termination pad on a side of the arm with the pad forming a generally flat surface in a plane
generally perpendicular to said longitudinal axis, the arms at the termination ends of the
10 terminal pins in one row thereof being offset to one side of the terminal pins longitudinally of
the row, and the arms at the termination ends of the terminal pins in the other row thereof
being offset to an opposite side of the terminal pins longitudinally of the row.

13. The electrical connector termination assembly of claim 12 wherein said flat surface is wider than the respective terminal pin.

14. The electrical connector termination assembly of claim 12 wherein said dielectric pin holder includes a plurality of passages within which the terminal pins are press-fit.

15. The electrical connector termination assembly of claim 12 wherein said dielectric pin holder comprises a generally flat wafer.

16. The electrical connector termination assembly of claim 12 wherein said dielectric pin holder is a plastic member overmolded about portions of the terminal pins leaving said termination pads exposed.

17. The electrical connector termination assembly of claim 12 wherein the arms at the termination ends of the terminal pins in each row thereof are bent toward the other row of terminal pins.

18. An electrical connector termination assembly, comprising:
a dielectric pin holder; and
at least one elongated terminal pin extending through the pin holder and defining a longitudinal axis, the terminal pin including an arm at a termination end of the pin offset from
5 the longitudinal axis, and the arm being bent to define a termination pad extending transversely of the longitudinal axis.

19. The electrical connector termination assembly of claim 18 wherein each said terminal pad is wider than the respective terminal pin.

20. The electrical connector termination assembly of claim 19 wherein said arm is bent generally at a right-angle to the longitudinal axis of the respective terminal pin.

21. The electrical connector termination assembly of claim 20 wherein said termination pad is formed on a side of the arm of the respective terminal pin.

22. The electrical connector termination assembly of claim 20 wherein said termination pad comprises a generally flat surface in a plane generally perpendicular to the longitudinal axis of the respective terminal pin.

AMENDED CLAIMS

**[Received by the International Bureau on 12 March 2004 (12.03.04):
original claims 1-22 amended; (4 pages)]**

1. An electrical connector termination assembly (16), comprising:
a dielectric pin holder (30); and
a plurality of elongated terminal pins (52) extending through the pin holder in a
pattern of at least two rows of pins with the pins in the respective rows being aligned transversely
of the rows, each of at least some of the terminal pins defining a longitudinal axis (56) and including
an arm (58) at a termination end of the pin offset from the longitudinal axis, the arm being bent to
define a termination pad (46) extending transversely of the longitudinal axis (56), the arms (58) of
the terminal pins (52) of the at least two rows of pins being offset from respective ones of the pin
longitudinal axes such that all of the termination pads (46) of pins in the respective rows are offset
transversely of the rows, the arms (58) at the termination ends of the terminal pins in one row
thereof being offset to one side of the terminal pins longitudinally of the row, the arms (58) at the
termination ends of the terminal pins in the other row thereof being offset to an opposite side of the
terminal pins longitudinally of the row, and the arms (58) at the termination ends of the terminal
pins in each row thereof being bent toward the other row of terminal pins.

2. The electrical connector termination assembly of claim 1 wherein said dielectric
pin holder (30) includes a plurality of passages within which the terminal pins are press-fit.

3. The electrical connector termination assembly of claim 2 wherein said dielectric
pin holder (30) comprises a generally flat wafer.

4. The electrical connector termination assembly of claim 1 wherein said dielectric
pin holder (30) is a plastic member overmolded about portions of the terminal pins (52) leaving
said termination pads (46) exposed.

5. The electrical connector termination assembly of claim 1 wherein each said
terminal pad (46) is wider than the respective terminal pin (52).

6. The electrical connector termination assembly of claim 1 wherein said arm (58)
is bent generally at a right-angle to the longitudinal axis (56) of the respective terminal pin (52).

2 7. The electrical connector termination assembly of claim 6 wherein said termination pad (46) is formed on a side of the arm (58) of the respective terminal pin.

2 8. The electrical connector termination assembly of claim 6 wherein said termination pad (46) comprises a generally flat surface (46a) in a plane generally perpendicular to the longitudinal axis (56) of the respective terminal pin (52).

2 9. The electrical connector termination assembly of claim 8 wherein said flat surface (46a) is wider than the respective terminal pin (52).

2 10. The electrical connector termination assembly of claim 1 wherein the arms (58) at the termination ends of the terminal pins (52) in one row thereof are offset to one side of the terminal pins longitudinally of the row, and the arms (58) at the termination ends of the terminal pins (52) in the other row thereof are offset to an opposite side of the terminal pins longitudinally of the row.

2 11. The electrical connector termination assembly of claim 10 wherein the arms (58) at the termination ends of the terminal pins in each row thereof are bent toward the other row of terminal pins.

2 12. An electrical connector termination assembly (16), comprising:
2 a dielectric pin holder (30); and
4 a plurality of elongated terminal pins (52) extending through the pin holder in a pattern of at least two rows of pins with the pins in the respective rows being aligned transversely of the rows, each of at least some of the terminal pins defining a longitudinal axis (56) and including
6 an arm (58) at a termination end of the pin offset from the longitudinal axis, the arm (58) being bent generally at a right-angle to the longitudinal axis of the respective terminal pin to define a
8 termination pad (46) on a side of the arm with the pad forming a generally flat surface (46a) in a plane generally perpendicular to said longitudinal axis, all of the arms (58) at the termination ends
10 of the terminal pins in one row thereof being offset to one side of the terminal pins (52) longitudinally of the row, and all of the arms (58) at the termination ends of the terminal pins (52)

2 in the other row thereof being offset to an opposite side of the terminal pins longitudinally of the row, and the arms (58) of the termination ends of the terminal pins in each row thereof being bent toward the other row of terminal pins.

2 13. The electrical connector termination assembly of claim 12 wherein said flat surface (46a) is wider than the respective terminal pin (52).

2 14. The electrical connector termination assembly of claim 12 wherein said dielectric pin holder (30) includes a plurality of passages within which the terminal pins are press-fit.

2 15. The electrical connector termination assembly of claim 12 wherein said dielectric pin holder (30) comprises a generally flat wafer.

2 16. The electrical connector termination assembly of claim 12 wherein said dielectric pin holder (30) is a plastic member overmolded about portions of the terminal pins (52) leaving said termination pads (46) exposed.

2 17. The electrical connector termination assembly of claim 12 wherein the arms (58) at the termination ends of the terminal pins in each row thereof are bent toward the other row of terminal pins.

4 18. An electrical connector termination assembly (16), comprising:
6 a dielectric pin holder (30); and
8 at least one elongated terminal (52) having a single terminal pin extending through the pin holder and defining a longitudinal axis (56), the terminal pin including a single arm (58) at a termination end of the pin offset from the longitudinal axis and offset from and outside the body of the single terminal pin, and the arm being bent to define a termination pad (46) extending
10 transversely of the longitudinal axis (56).

2 19. The electrical connector termination assembly of claim 18 wherein each said terminal pad (46) is wider than the respective terminal pin (52).

2 20. The electrical connector termination assembly of claim 19 wherein said arm (58) is bent generally at a right-angle to the longitudinal axis (56) of the respective terminal pin (52).

2 21. The electrical connector termination assembly of claim 20 wherein said termination pad (46) is formed on a side of the arm (58) of the respective terminal.

2 22. The electrical connector termination assembly of claim 20 wherein said termination pad (46) comprises a generally flat surface (46a) in a plane generally perpendicular to the longitudinal axis (56) of the respective terminal pin (52).

FIG. 1

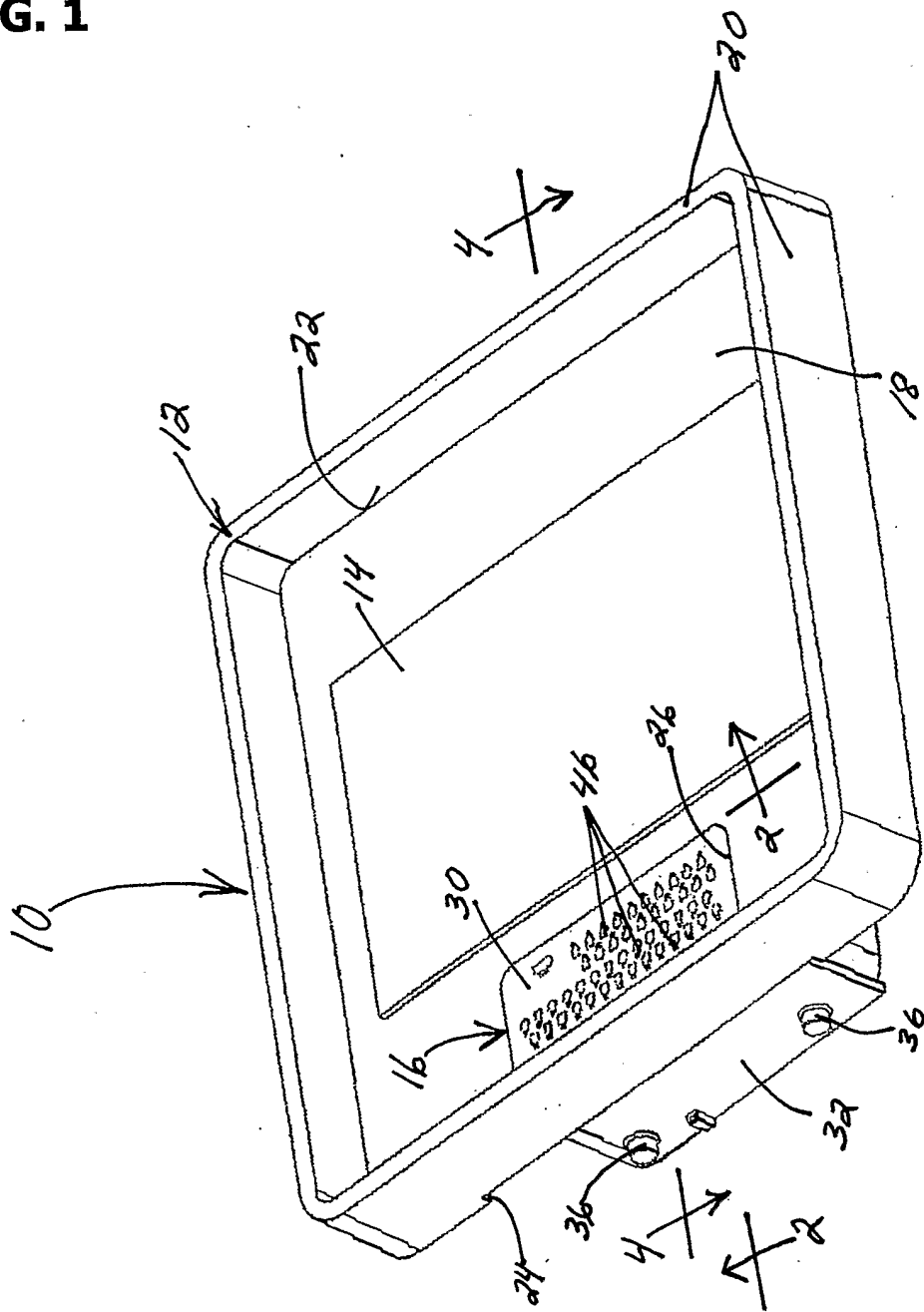


FIG. 2

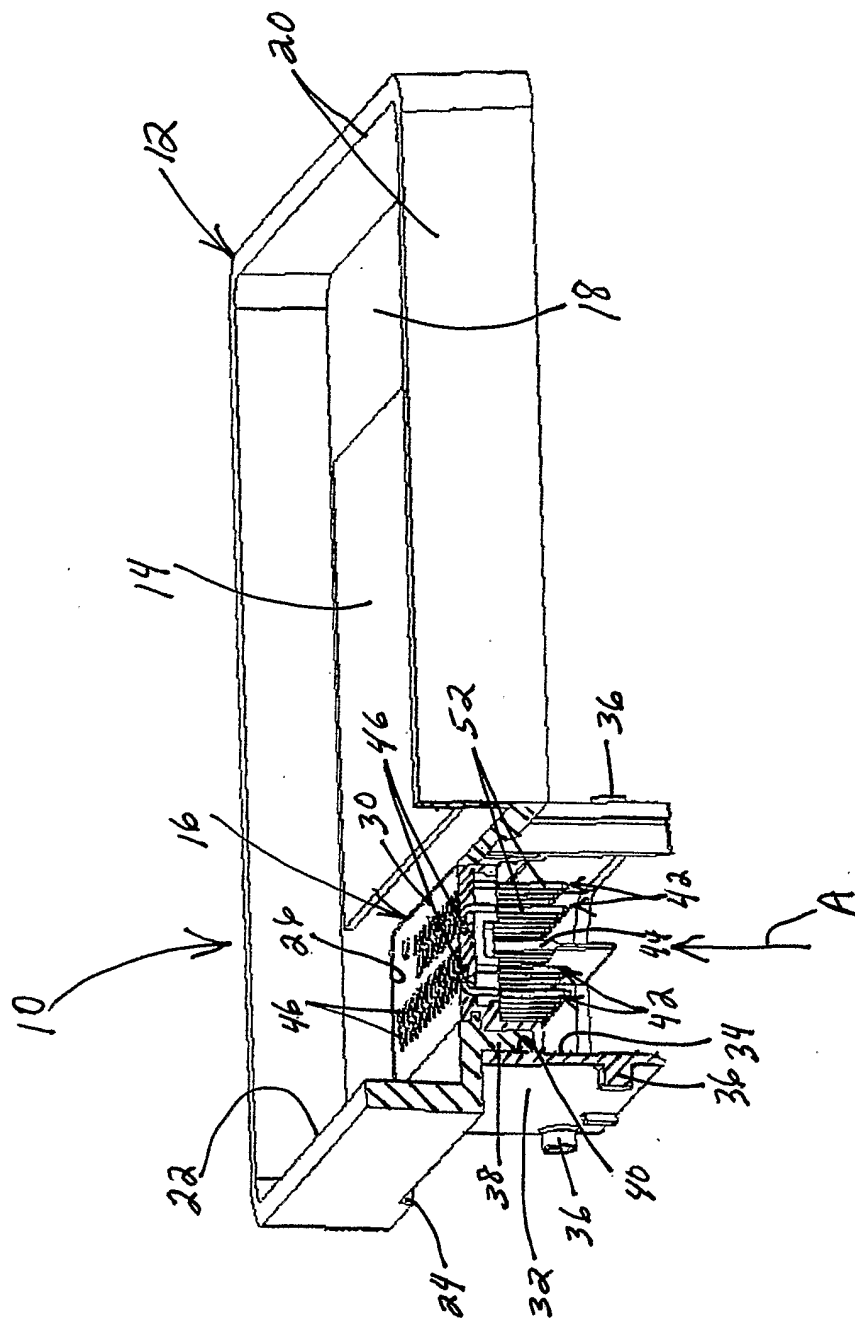


FIG. 3

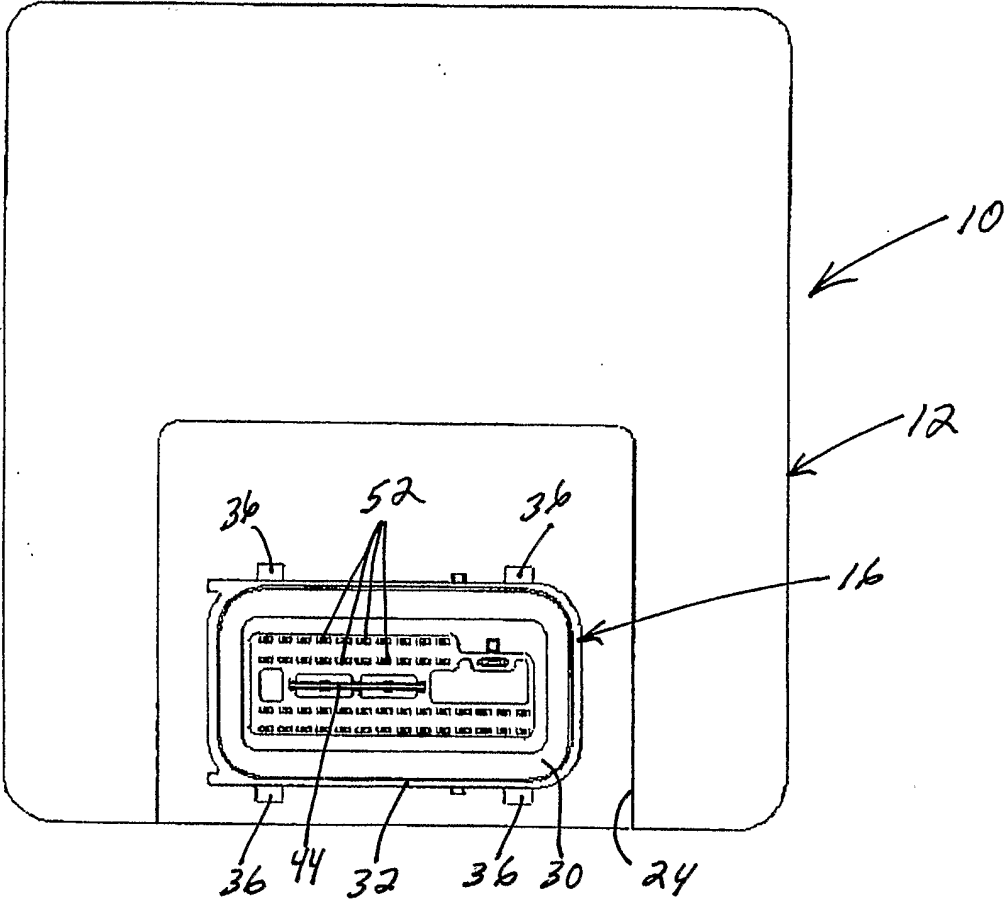


FIG. 4

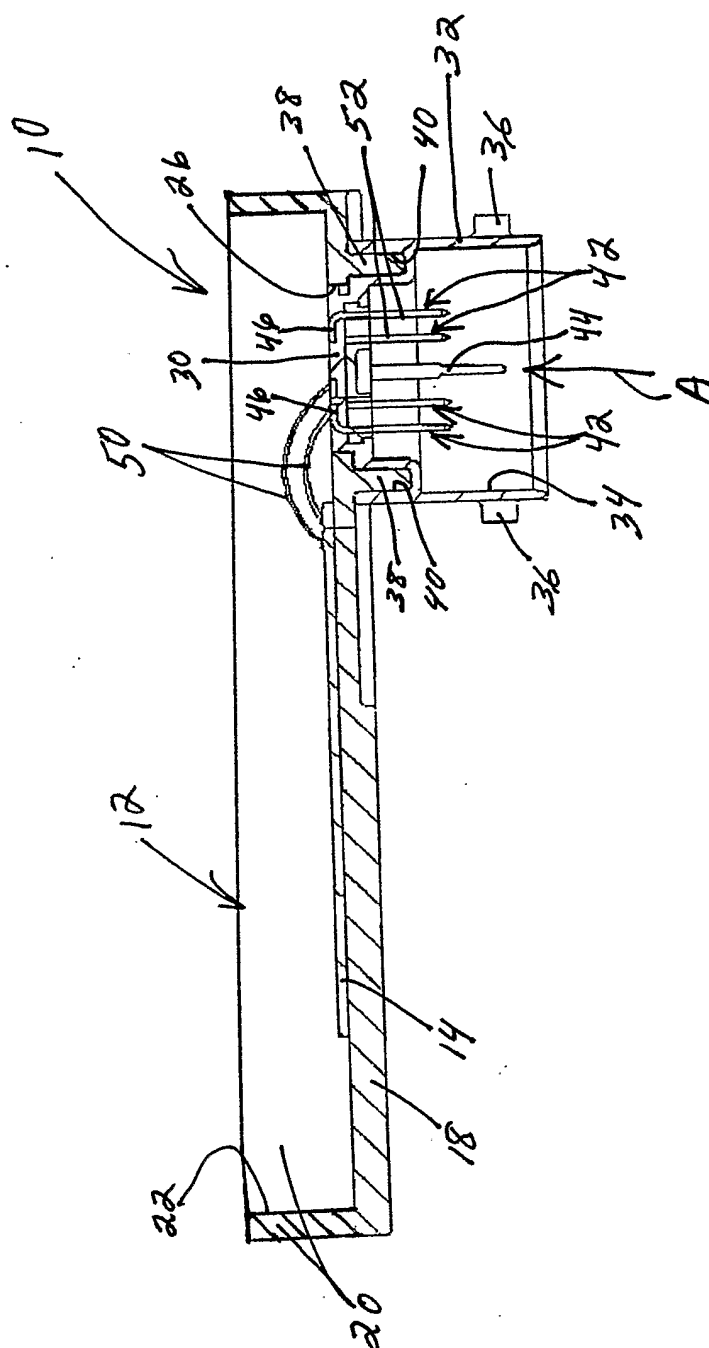


FIG. 5

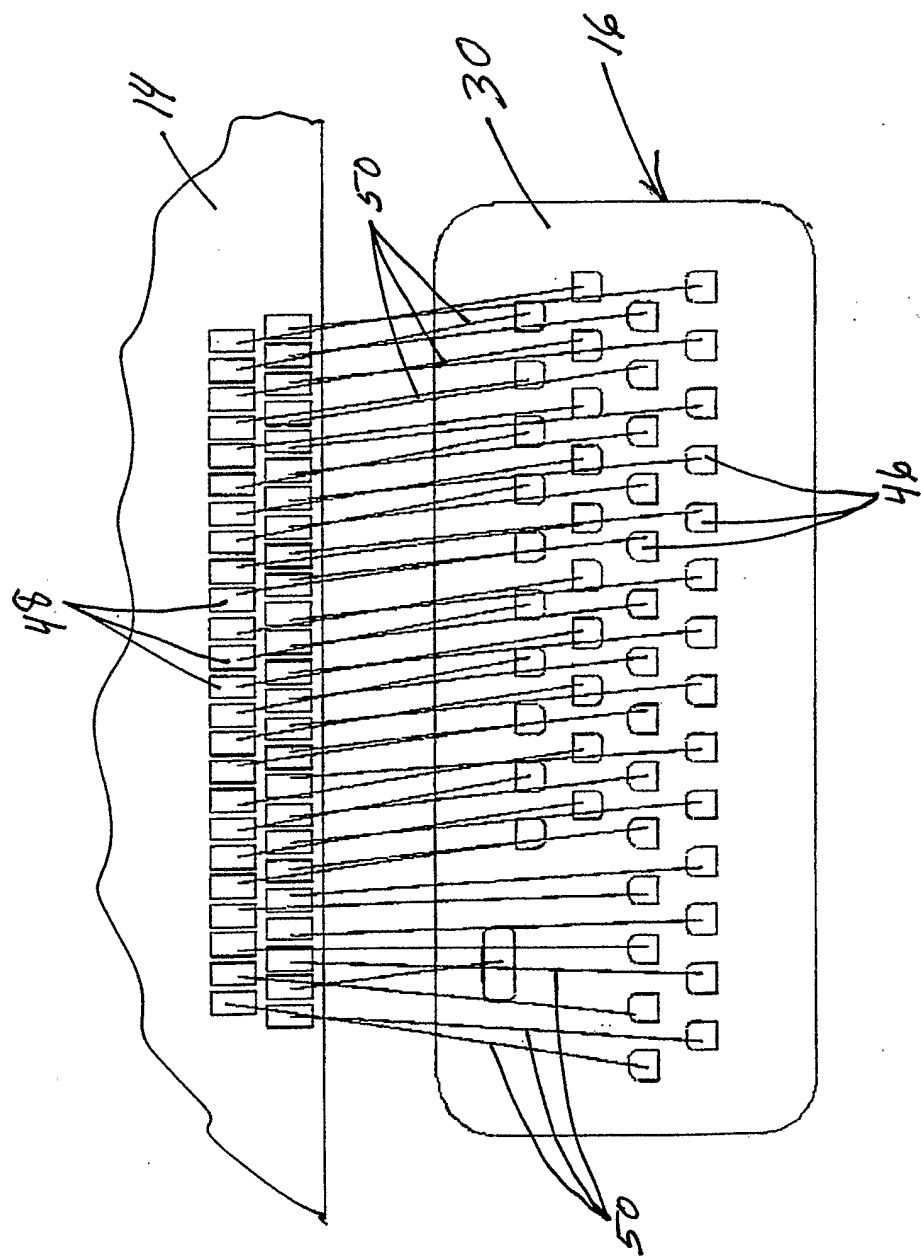


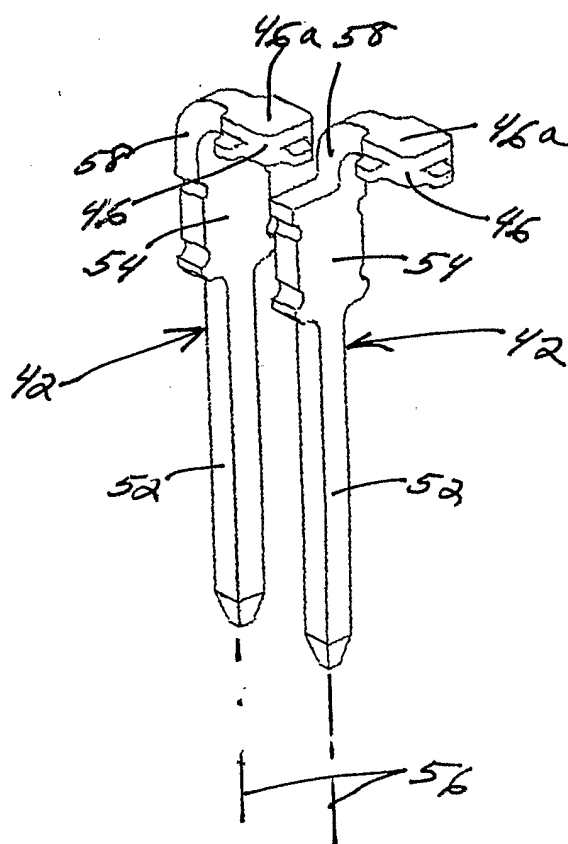
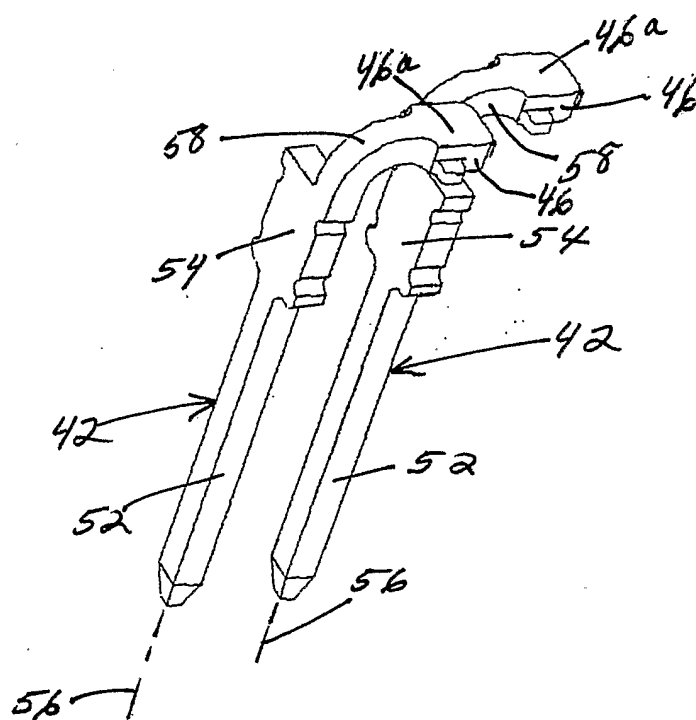
FIG. 6**FIG. 7**

FIG. 8

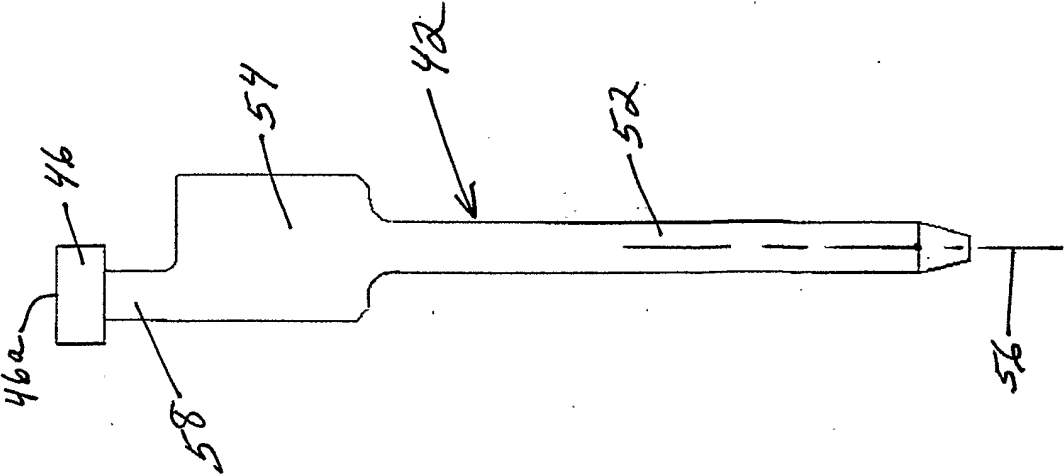
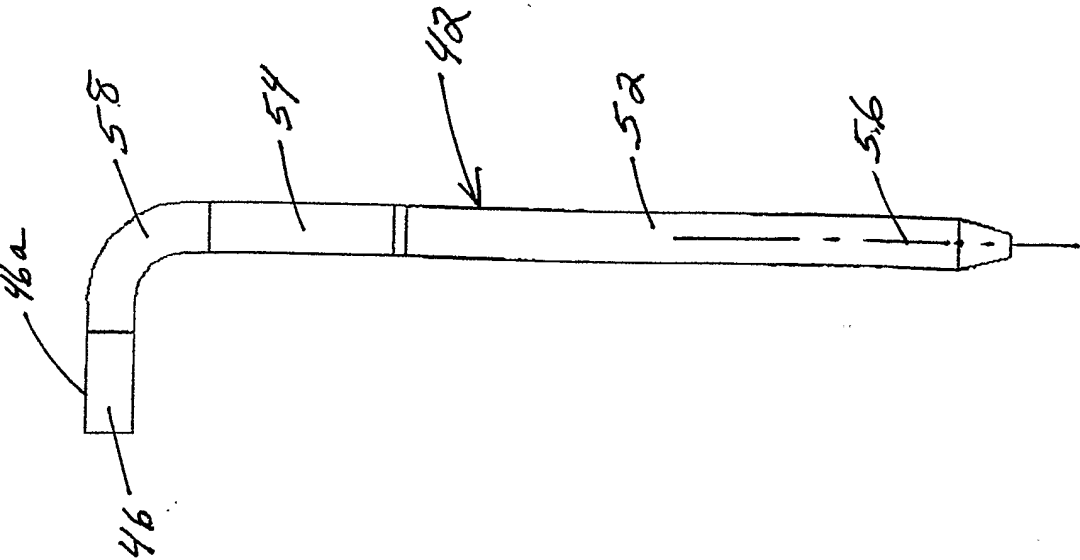


FIG. 9



INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/30534

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 H01R13/40 H01R12/02

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)
IPC 7 H01R

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 practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 409 857 A (JOHN KINKAID ROBERT ET AL) 5 November 1968 (1968-11-05) column 2, line 49 -column 6, line 50 ----	1-22
A	EP 0 438 165 A (TOKYO SHIBAURA ELECTRIC CO) 24 July 1991 (1991-07-24) ----	
A	US 5 667 393 A (GRABBE DIMITRY ET AL) 16 September 1997 (1997-09-16) ----	
A	DE 11 11 261 B (ELEKTROSCHALTGERAETE EISENACH) 20 July 1961 (1961-07-20) ----	
A	EP 0 902 602 A (SEB SA) 17 March 1999 (1999-03-17) -----	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in 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 document 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

Date of the actual completion of the international search

6 January 2004

Date of mailing of the international search report

13/01/2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Bertin, M

INTERNATIONAL SEARCH REPORT

Internat
PCT/US 03/30534

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 3409857	A	05-11-1968	DE 1590025 B1	03-12-1970
			GB 1108856 A	03-04-1968
			NL 6610792 A	24-02-1967
			US 3514746 A	26-05-1970
EP 0438165	A	24-07-1991	JP 2054528 C	23-05-1996
			JP 3212962 A	18-09-1991
			JP 7083080 B	06-09-1995
			DE 69126714 D1	14-08-1997
			DE 69126714 T2	11-12-1997
			EP 0438165 A2	24-07-1991
			KR 9502193 B1	14-03-1995
			US 5285106 A	08-02-1994
US 5667393	A	16-09-1997	WO 9704505 A2	06-02-1997
DE 1111261	B	20-07-1961	NONE	
EP 0902602	A	17-03-1999	FR 2767972 A1	05-03-1999
			DE 69802764 D1	17-01-2002
			DE 69802764 T2	14-08-2002
			EP 0902602 A1	17-03-1999