Nov. 3, 1959 R. E. KIRK 2,911,610

TERMINAL CONNECTOR FOR CIRCUIT BOARDS

Filed Feb. 17, 1958

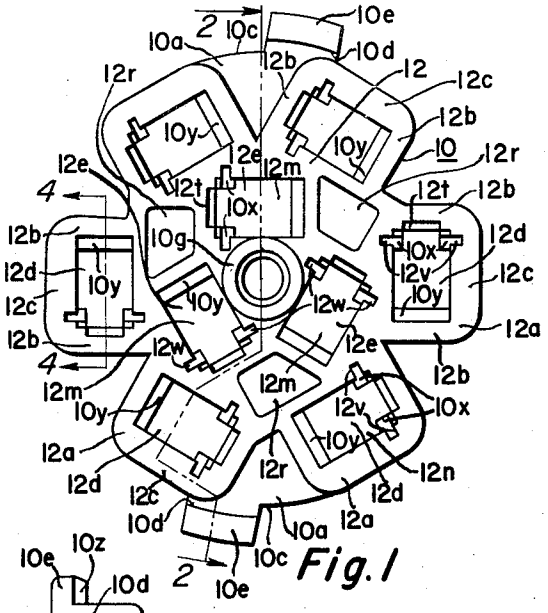


Fig. 1

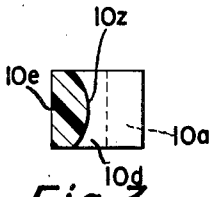


Fig. 3

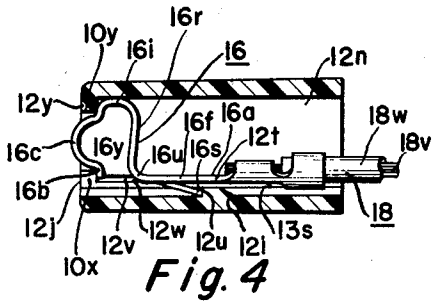


Fig. 4

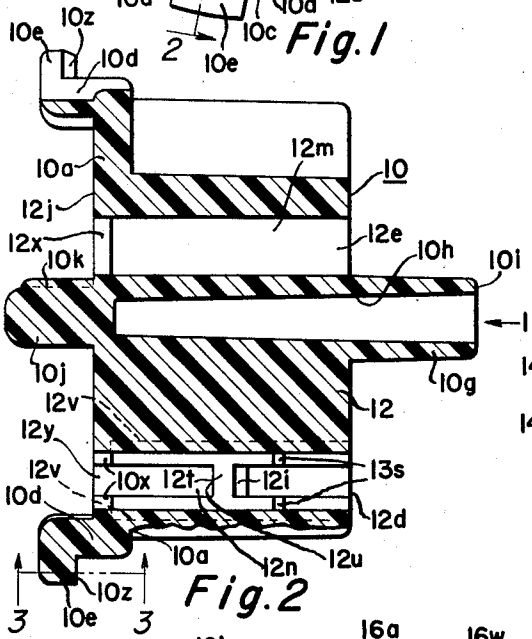


Fig. 2

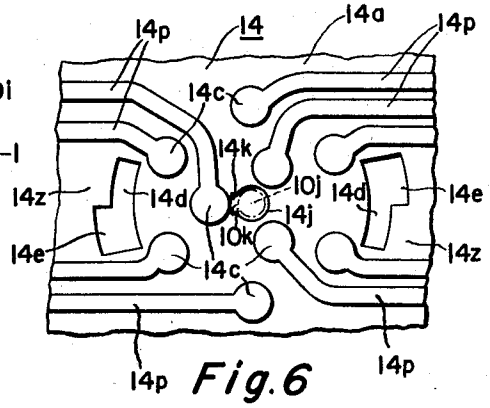


Fig. 6

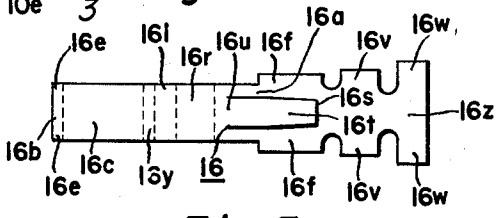


Fig. 5

INVENTOR.
Robert E. Kirk
BY
John T. Marvin
His Attorney

United States Patent Office 2,911,610 Patented Nov. 3, 1959

2,911,610

TERMINAL CONNECTOR FOR CIRCUIT BOARDS

Robert E. Kirk, Warren, Ohio, assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application February 17, 1958, Serial No. 715,680

4 Claims. (Cl. 339—17)

This invention relates to electrical connectors, and, particularly, to a multiple chamber connector body having therein terminal means adapted to establish electrical connections relative to a printed circuit board.

An object of this invention is to provide a new and improved terminal and connector for use with a printed circuit board.

Another object of this invention is to provide a connector means having a multiple chamber connector body adapted to receive a terminal having a looped end portion engageable against a printed circuit conducting material of an insulating panel adapted for mounting the connector body.

Another object of this invention is to provide a connector means having an insulating body provided with a guide means and mounting flanges engageable with a mounting panel on which there is provided a printed circuit conducting material electrically connectible with projecting ends of terminal means inserted and locked into recesses of the insulating body.

Another object of this invention is to provide a terminal means adapted to be locked into a chamber of an insulating body by engagement of lateral portions and a tongue projecting from a body of the terminal means into recessed portions of the chamber and having a terminal-means looped-end portion projecting from an end of the chamber and adapted to have a crown of the end portion resiliently engageable against a printed circuit conducting material and adapted to have at least one shoulder of the looped end portion engageable against an abutment adjacent to an opening near one end of the chamber.

A further object of this invention is to provide a terminal means for an insulator connector body that is adapted to be mounted relative to a panel having a printed circuit of conducting material thereon, the terminal means having a body providing lateral wing portions for connection of wiring to the terminal means and providing lateral projections slidable into guide grooves provided on opposite sides of a chamber in the insulating body, the terminal means also having an end loop portion with at least one shoulder engageable against a projection extending inwardly relative to the chamber of the insulating body adjacent to one end opening through which a crown of the looped-end portion projects, and the terminal means further having a tongue projecting from the terminal body in a direction away from the crown and engageable against a shoulder provided in the insulating body extending inwardly toward an intermediate portion of the terminal means.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is an end view of a terminal connector of the present invention taken looking in the direction of arrow 1 in Fig. 2.

Fig. 2 is a cross sectional view taken along line 2—2 of Fig. 1.

Fig. 3 is a fragmentary sectional view taken along line 3—3 of Fig. 2.

Fig. 4 is a fragmentary sectional view taken along line 4—4 of Fig. 1 and showing a terminal means inserted in a chamber of the connector.

Fig. 5 is a plan view of a blank used for making the terminal shown in Fig. 4.

Fig. 6 is a plan view of a fragment of an insulating board or panel on which there is provided a printed circuit conducting material adapted to be engaged by the connector and terminal means of the present invention.

With particular reference to Fig. 1 there is shown an electrical connector means generally indicated by numeral **10** having an insulating body **12** provided with a plurality of radially outwardly extending projecting portions **12***a*. In the specific connector means illustrated in Fig. 1, there are six of these radially outwardly projecting body portions **12***a* and each of these portions is provided with a pair of substantially radial walls **12***b* which are connected relative to each other at their radial outer ends by a lateral wall **12***c*. At the radially inner ends of the walls **12***b* there is an inner connection between each of the portions **12***a* as well as the walls **12***b* because the body **12** joins all of the portions **12***a* into a single hexagonal-type structure as illustrated in Fig. 1.

Each of the portions **12***a* is provided with a passage or opening **12***d* and, in addition to the six passages **12***d* provided in the portions **12***a*, the body **12** is further provided with similar passages or openings **12***e* located in the central body portion of the connector. It is to be understood that the passages or openings **12***d* and **12***e* are substantially identical to each other and fulfill a purpose which will be apparent in the following description. Cavities or recesses **12***r* can be provided in between passages or openings **12***e* in the central body portion.

The connector **10** as illustrated in Fig. 1 does not illustrate mounted therein terminal means in accordance with the present invention for use in the body portions **12***a*. The terminal means are omitted from the view of Fig. 1 for purposes of clarity and are shown more clearly in another view of the drawings to be described in detail below. It is to be noted that the connector **10** shown in Fig. 1 is provided with a pair of web portions **10***a* located diametrically opposite each other and extending laterally between pairs of adjacent body portions **12***a*. These webs **10***a* have an outer peripheral edge **10***c* which coincides substantially with an outer surface edge of the lateral wall **12***c* of each of the body portions **12***a*. The webs **10***a* also are provided with laterally outwardly extending flange portions **10***d* which project radially at substantially diametrically opposite locations as indicated in Fig. 1 and which each terminate in a lug portion **10***e* adapted to be locked into engagement relative to a mounting panel having complementary slots for forming a bayonet-type fastening relative to the connector means **10**. The connector means **10** is further provided with a central guide pin **10***g* visible in Fig. 1 as well as in Fig. 2.

The guide pin **10***g* and the lugs **10***e* can be better seen in the view of Fig. 2 taken along line 2—2 of Fig. 1. As visible in Fig. 2, the body **12** is integral with the guide pin **10***g* which extends longitudinally of the body and projects outwardly at opposite ends of the body. At the end of the body opposite to the end where the flanges **10***a* and lugs **10***e* are provided, the guide pin **10***g* is provided with a hollow interior **10***h* which can be adapted to be engageable by a tool insertable in the hollow por-

tion **10***h* for positioning and removing the connector means **10** relative to a mounting panel. However, since the connector pin **10***g* extends longitudinally of the surface of the body **12** at the side where the hollow portion **10***h* is provided, it is also possible for the extending portion that terminates at an annular edge **10***i* to be used as a handle engaged by fingers or other means for inserting and removing the connector means **10** relative to a mounting panel.

At the opposite end of the guide pin **10***g* there is provided a projecting longitudinal portion **10***j* located centrally relative to the body **12**. The projecting portion **10***j* is provided with a key **10***k* extending laterally outwardly from one side of the projecting portion **10***j*. This key has an arcuate dimension of approximately one-sixteenth of an inch. It is to be understood that the projecting portion **10***j* could also be provided with a laterally or radially inwardly-extending recess or slot extending longitudinally of the projecting portions **10***j* and having a dimension twice the above sample dimension so that a projecting pin of a mounting panel can be inserted relative to the key or recess. When such a structure is provided, the projecting portions of the mounting panel should preferably have an arcuate dimension half that of the arcuate width or dimension of the key-slot or recess portion. In the embodiment illustrated, the projecting portion **10***j* is adapted to be inserted through an opening in an insulating panel, and the projecting portion **10***j* as well as the lugs **10***e* and flange portions of the lugs **10***d* are insertable relative to a mounting panel having openings provided with slots complementary to laterally-outwardly extending key **10***k* and lugs **10***e*.

In Fig. 6 there is shown a mounting panel generally indicated by numeral **14** including an insulating board **14***a* provided with a central opening or passage **14***j* including a radial key or slot portion **14***k* adapted to be complementary to the projecting portion **10***j* and key **10***k* of the body **12** illustrated in Fig. 2. The key **10***k* extends radially outwardly and has a lateral dimension substantially less than the lateral dimension of the key slot **14***k*. It is to be understood that if the key and slot relationship of the projecting portion and panel are reversed, the same relative difference between the lateral dimensions of the relative projecting portions and slots is required so that the connector body **12** can be turned in a clockwise or counterclockwise direction for effecting locking engagement of the lugs **10***e* relative to the insulating board **14***a*. The insulating board **14***a* is provided with an arcuate cutout portion **14***d* located substantially diametrically opposite to each other relative to the central passage **14***j* and each of the cutout portions **14***d* is provided at diametrically opposite positions with radially outwardly extending slots **14***e* through which the lugs **10***e* can be inserted. As the lugs **10***e* are inserted through the radially outwardly extending slots **14***e*, it is necessary that the key **10***k* be aligned in the corner of the slot **14***k* which is diametrically in alignment between the slots **14***e*. In other words, the key **10***k* must be in the lower left hand corner of key-slot **14***k* so that there is proper alignment of the lugs **10***e* relative to the radially outwardly extending slots **14***e*. Terminal means are adapted to be fitted inside the insulating body **12** for connection relative to conducting material portions provided on the insulating body **14***a*.

Fig. 6 illustrates a plurality of conducting material portions **14***p* attached to or carried on the insulating board **14***a*. Each of these conducting material portions **14***p* terminates in a substantially cylindrically shaped contact **14***c* as illustrated in Fig. 6. It is apparent that the cylindrical contact portions **14***c* of the conducting material **14***p* on the insulating board **14***a* are provided in substantially the same pattern as the openings **12***d* provided with each of the portions **12***a* of the insulating body **12** described in Fig. 1. Also there are three contact portions **14***c* substantially in alignment with openings **12***e* mentioned in the description earlier. The key **10***k* insertable relative to the key-slot **14***k* assures proper alignment of these passages or openings relative to the contact portions **14***c*.

It is apparent that the flange portions **10***d* provided extending radially outwardly from the web portions **10***a* also extend longitudinally of the body **12** for a predetermined distance parallel to the projecting portion **10***j* of the guide means or pin **10***g*. The longitudinal dimension of the flange portions **10***d* is dependent upon the thickness of the insulating board **14***a*. In any event, the body **12** has a surface **12***j* adjacent to the projecting portion **10***j* and this surface **12***j* is substantially perpendicular relative to the projecting portion **10***j*. Longitudinally spaced from the surface **12***j* there is a curved lug surface **10***z* which is seen most clearly in the view of Fig. 3. This arcuate lug surface **10***z* extends longitudinally toward the surface **12***j* but is located radially outwardly thereof and is spaced longitudinally thereof at all times. As the lugs **10***e* are inserted through the radial slots **14***e* of the insulating board **14***a*, the crown or central portion of the lug surface **10***z* is substantially in alignment relative to an under surface of the insulating board **14***a*. Thus the arcuate or crown surface **10***z* of each of the lugs **10***e* is adapted to be locked into engagement underneath a flange portion **14***z* of the insulating board **14***a* in a bayonet-type fastening provided as the insulating body **12** is rotated in a clockwise direction relative to the insulating board **14***a* as viewed in Fig. 6.

As illustrated in Fig. 2, the insulating body **12** of the connector **10** is provided with longitudinally extending cavities or chambers **12***m* and the projecting portions **12***a* of the body **12** are provided with longitudinal chambers **12***n*. The chambers **12***m* are open at one end through the passages or openings **12***e* mentioned earlier and are open at an opposite end through an aperture **12***x*. Similarly, each of the cavities or chambers **12***n* is open at one longitudinal end through the passage or opening **12***d* and open at an opposite end through an aperture **12***y*. It is to be understood that apertures **12***x* and **12***y* are provided for each of the chambers or cavities having the openings or passages **12***e* and **12***d*, respectively, described earlier. Each of the cavities **12***m* are provided with undercut portions or laterally extending grooves **12***w* and each of these cavities or chambers **12***n* have undercut portions or grooves **12***v*. The undercut portions or grooves **12***w* and **12***v* extend laterally outwardly from sidewalls of the chambers **12***m* and **12***n* and are adapted to provide longitudinal guide slots for positioning of terminal means generally indicated by numeral **16** of Fig. 4. A pair of inclines or sloped shoulders **13***s* are provided for each guide slot on one side of transverse portion **12***t*. These inclines or sloped shoulders **13***s* serve as guides for facilitating wedging of lateral portions of the terminal means into the undercuts such as **12***v*.

The terminal means **16** are clearly visible in the cross sectional view of Fig. 4 and each of the terminal means **16** is formed of a blank stamped out of a sheet of metal as shown in a developed view of the blank provided in Fig. 5. The terminal means **16** includes a body **16***a* and laterally extending flanges **16***f* projecting outwardly from the body **16***a* at locations opposite to each other. The flange or lateral portions **16***f* as illustrated in Fig. 5 have a greater width than the body **16***a*. The flanges **16***f* are adapted to be slidable longitudinally into the undercut portions such as **12***w* and **12***v* provided extending laterally outwardly of the cavities or chambers in the insulating body **12**. The body portion **16***a* is further provided with a tongue **16***t* that is attached at one end **16***u* relative to the body portion but which has a free end **16***s* provided extending away from the body portion between the flange or lateral portions **16***f*. The free end **16***s* of the tongue **16***t* is adapted to be engageable against an abutment or shoulder **12***t* provided extending transversely relative to the chamber into which the terminal means **16** is inserted.

The abutting relationship of the end **16***s* relative to the transverse shoulder **12***t* can be best seen in Fig. 4.

The terminal means **16** is further provided with a terminal end portion **16***z* extending longitudinally from body portion **16***a* adjacent to the flange or lateral portions **16***f*. The terminal end portion **16***z* is provided with two pairs of laterally extending tangs **16***v* and **16***w* which are adapted to be crimped and bent into engagement with a wire **18***v* and an insulating portion **18***w* of a conductor generally indicated by numeral **18** as shown in Fig. 4. The body portions **16***a* further extends in a direction opposite to the direction of the terminal end portion **16***z* and forms a terminal-contact end including multiple segments. The body portion at the contact end is bent to include a resilient arm segment **16***r* extending transversely relative to the flange or lateral portions **16***f*. The width dimension of the body portion **16***a* is substantially equal to the width of the chamber such as **12***m* or **12***n* provided extending longitudinally through the insulating body **12** or radial portions **12***a* of the insulating body. The contact end of body portion **16***a* is formed further to include a longitudinally extending segment **16***i* which is located intermediate the resilient arm segment **16***r* and a laterally inwardly bent shoulder segment **16***y* engageable against an inwardly extending flange **10***y* provided adjacent to and extending laterally of the opening **12***y* mentioned earlier. The flange **10***y* serves as a stop to limit insertion of the terminal means **16** relative to the insulating body **12** having the cavities or chambers into which each of the terminal means is fitted.

The terminal means **16** extends further from the shoulder segment **16***y* into a crown or curved contact segment **16***c* clearly shown in Fig. 4. The contact segment **16***c* is an arcuate or semi-annular section that extends longitudinally outwardly through the opening **12***y* and has an intermediate outer periphery that projects longitudinally beyond the surface **12***j* of the insulating body **12** so that the crown or contact segment **16***c* can be engaged resiliently against the cylindrical contact portions **14***c* of the conducting material **14***p* carried on the insulating board **14***a* of mounting panel **14**. The curved or semi-annular or circular crown segment **16***c* is positioned in the aperture **12***y* between flange **10***y* and a pair of lugs or abutments **10***x* extending laterally inwardly from the insulating body relative to the opening **12***y* at locations in corners opposite the location of the flange **10***y*. The terminal means has an end segment **16***b* bent over to extend laterally from the semi-arcuate or crown segment **16***c*. Laterally opposite ends **16***e* of the bent end segment **16***b* are adapted to be engageable against the lugs **10***x*. Thus the contact segment **16***c* is maintained in engagement relative to the insulating body due to the cooperation of the flange segment **16***y* and ends or tips **16***e* of bent end segment and lugs **10***x* of the insulating body.

Since the free end **16***s* of tongue **16***t* is engageable relative to the transverse portion **12***t* located in an intermediate position relative to the chamber in which the terminal is inserted, there is a locking of the terminal means **16** relative to the insulating body by engagement of the end **16***s* relative to portion **12***t*, of segments **16***y* relative to flange **10***y*, and ends or tips of bent end segment **16***b* relative to lugs **10***x* as illustrated in Fig. 4. Lateral movement of the terminal means **16** is prevented due to engagement of the flanges or lateral portions **16***f* relative to the undercut laterally-extending slots such as **12***v* and **12***w* provided extending laterally outwardly relative to each of the chambers in the insulating body.

It is to be noted that when the connector and terminal means of the present invention are locked into engagement with the mounting panel **14**, the surface **12***j* is positioned adjacent to a top surface of the insulating board **14***a* as well as a top surface of the conducting material **14***p*. The arcuate shape of the surface **10***z* of the lugs **10***e* used for the bayonet fastening of the connector **10** relative to the insulating board **14***a* is provided to assure a resilient

locking action of the insulating body relative to the insulating board. It is to be noted also that the opposite ends **16***e* of the bent end segment **16***b* of the terminal means **16** are each completely free to be moved away from engagement relative to lugs **10***x* as the crown or semi-annular segment **16***c* of the terminal means is resiliently engaged relative to a cylindrically shaped contact portion **14***c* of the conducting material **14***p* of the printed-circuit-type provided on insulating board **14***a*. Whenever the crown or semi-annular contact segment **16***c* is engaged relative to the circular or cylindrically shaped contact **14***c* there is a flexing of the crown or semi-annular contact segment **16***c* relative to flange portion **16***y* and intermediate segment **16***i* relative to resilient arm segment **16***r* causing longitudinal separation of the opposite ends **16***e* of bent segment **16***b* from the lugs **10***x*. The contact-segment flexing about flange segment **16***y* through intermediate segment **16***i* and resilient arm segment **16***r* causes force to be transmitted longitudinally from the contact end of the terminal means body portion **16***a* as far as a connecting portion **16***u* between the body portion **16***a* and the tongue **16***t* that extends laterally away from the body portion and terminates in the free end **16***s* engageable against the transverse portion **12***t*. The tongue **12***t* transmits reaction force from the transverse portion **16***t* of the connector body resisting and counterbalancing the flexing force. Lugs **10***e* of the connector body resiliently abut against the underside of the mounting panel and flexing of the contact segment **16***c* enhances resilient engagement of the connector relative to the panel. The terminal means permits resilient displacement of the crown or contact segment **16***c* but does not permit the terminal means **16** to be displaced out of engagement with the transverse portion **12***t* because the tongue end **16***s* is firmly locked into engagement with the transverse portion **12***t*.

The transverse portion **12***t* has a lateral surface **12***u* against which the end portion **16***s* abuts and also an inclined surface **12***i* over which the tongue **16***t* passes as the terminal is inserted longitudinally into the cavity **12***n* as illustrated in Fig. 4. Whenever the crown or contact segment **16***c* is engaged resiliently against the printed circuit conducting material or contacts **14***c*, the semi-circular crown or contact segment is moved as a unit into a longitudinally retracted position located within the opening **12***y*. The crown portion can also be referred to as a hooked-end portion or looped contact which is resiliently engageable relative to the cylindrical or circular-shaped contact **14***c*. The flange portions **16***f* and tongue **16***t* as well as flange segment **16***y* and bent end segment **16***b*, serve to stabilize the terminal against lateral and longitudinal movement relative to the insulating body chamber in which the terminal is inserted. The terminal means can be removed from the chamber if a tool or blunt instrument like a screw driver is inserted in space between lugs **10***x* and is forced longitudinally underneath the tongue **16***t* for disengaging end portion **16***s* from transverse portion **12***t*.

Since the insulating body illustrated in the drawings is provided with multiple chambers it is possible to provide an electrical connection between multiple conductors such as **18** relative to multiple contact portions **14***c* provided with a printed circuit carried on an insulating board as illustrated in the drawings. At least two contact portions and at least two chambers should be provided for establishing connection of a pair of conductors such as **18** relative to a pair of printed circuit contact portions **14***c*.

The mounting flanges **10***d* to which the lugs **10***e* are attached are insertable into openings **14***d* provided in the insulating board and are adapted to form a bayonet type fastening between the insulating body **12** and the insulating board or mounting panel as described. The guide **10***g* having the projecting end **10***j* insertable in the opening **14***j* and adapted to have the key **10***k* engageable and

complementary relative to the keyslot 14*k* is provided for assuring proper alignment of the bayonet fastening as well as proper alignment of the contact portions 14*c* relative to the terminal means crown or contact segments 16*c* resiliently engageable relative to each of the contact portions 14*c*.

While the embodiments of the present invention as herein disclosed constitute a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A connector and terminal means for use relative to a printed circuit board, comprising, a connector body of insulating material having at least two chambers extending parallel to each other axially therethrough, said connector body having lateral, longitudinally-extending slots on opposite sides of each of the chambers, a terminal means having lateral flanges provided to be positioned in the lateral slots, means for locking said terminal means in the chamber, and a crowned, looped-end portion of said terminal means resiliently engageable relative to the printed circuit board, said looped-end portion protruding at least in part from an opening at one end of the chamber.

2. The connector and terminal means of claim 1 wherein said connector body has a guide pin located between the chambers and protruding from at least one side of said body, a key means provided by said pin and adapted to be complementary to an opening in the printed circuit board against which said connector and terminal means is engageable, and a pair of lugs, protruding from said body in locations parallel to said guide pin, said lugs being adapted to be complementary and engageable relative to a pair of slots in the printed circuit board relative to which said guide pin aligns said body for aligned connection of said looped-end portions of said terminal means relative to the printed circuit board.

3. The connector and terminal means of claim 1 wherein said means for locking said terminal means in the chamber include a transverse shoulder portion provided in said body, a tongue projecting outwardly from said terminal means and having a free end engageable against said shoulder portion, a flange extending inwardly from said body on one side of an opening at one end of the chamber, a pair of abutments extending inwardly from said body in opposite corners across from said flange in the opening, said looped-end portion having shoulders adjacent thereto for engaging said shoulder portion and said abutments, one of the shoulders of said looped-end portion being engageable at free terminating ends thereof against said abutments laterally spaced relative to each other.

4. A connector and terminal means for use relative to a printed circuit board, comprising, a connector body of insulating material having at least two chambers extending parallel to each other axially therethrough, said connector body having lateral, longitudinally-extending slots on opposite sides of each of the chambers, a terminal means having lateral flanges provided to be positioned in the lateral slots, a tongue projecting outwardly from said terminal means, a transverse shoulder portion provided in said body and having one surface engaged by said tongue for preventing removal of said terminal means longitudinally from the chamber, said shoulder portion having an inclined surface over which said tongue is guided to the surface engaged for preventing removal of said terminal means, a flange extending inwardly from said body on a side of the chamber opposite said shoulder portion and located on one side of an opening at one end of the chamber, a pair of abutments extending inwardly from said body in opposite corners across from said flange in the opening, and a semi-annular contact portion of said terminal means having shoulders engageable against said flange and said pair of abutments, said abutments providing space therebetween through which said tongue can be reached and suitably flexed to effect dislocation of said tongue from the locking surface of said transverse shoulder portion to permit removal of said terminal means from said body.

References Cited in the file of this patent

UNITED STATES PATENTS

2,496,732	Lyman	Feb. 7, 1950
2,682,038	Johnson	June 22, 1954