United States Patent

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[73] Assignee **The United States of America as represented by the Secretary of the Air Force**

[54] **UNIVERSAL ELECTRICAL CONNECTOR FOR MINIATURE ELECTRONIC MODULES**
9 Claims, 8 Drawing Figs.

[52] **U.S. Cl.** **339/36,** 200/51.12, 339/66, 339/75, 339/174
[51] **Int. Cl.** **H01r 13/54,** H01r 33/44, H01r 33/66
[50] **Field of Search** ..... 339/36—40, 75, 174, 44, 42, 66; 324/51, 52, 53; 200/16, 17, 76, 77, 78, 51.09, 51.12, 61.39, 61.58, 153—158

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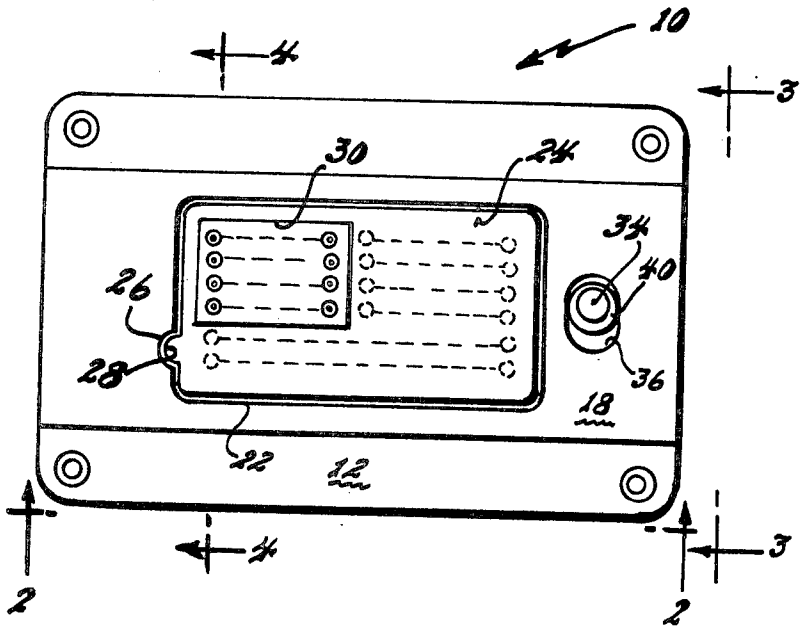
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ABSTRACT: A universal electrical connector for mounting miniature electronic modules having a plurality of pins thereon. The connector has a case containing a plurality of sockets therein. A slip plate is located on said case and has a plurality of holes therein substantially aligned with said sockets. A locking shaft mounted on said case is capable of moving said slip plate and thereby the holes of said slip plate into and slightly out of alignment with said sockets. The module is located within said slip plate and the pins are inserted in said holes and said sockets. Since said holes and said sockets are of a greater diameter than said pins, in one position of the slip plate the pins are in the center of the sockets and out of contact therewith and in another position of the slip plate the pins engage a wall of said sockets in order to make electrical contact therewith.



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SHEET 1 OF 2

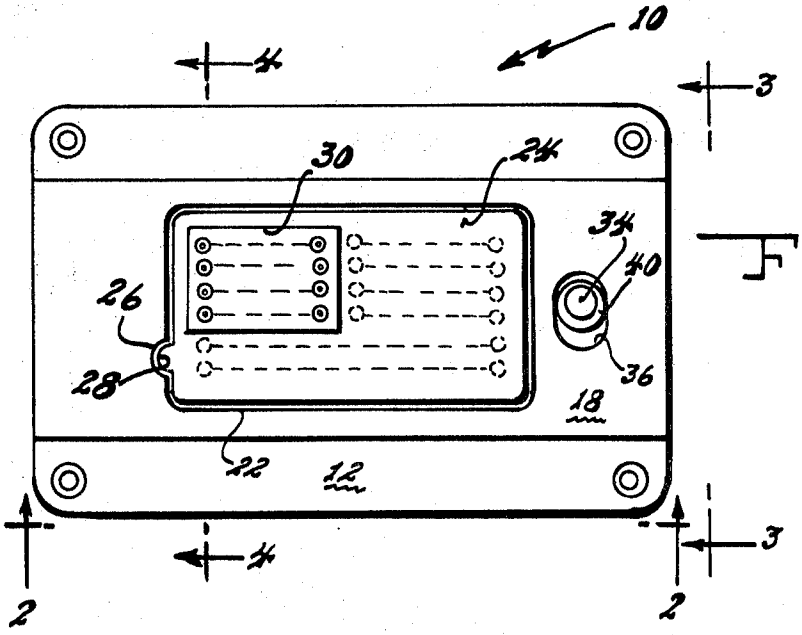


FIG. 1

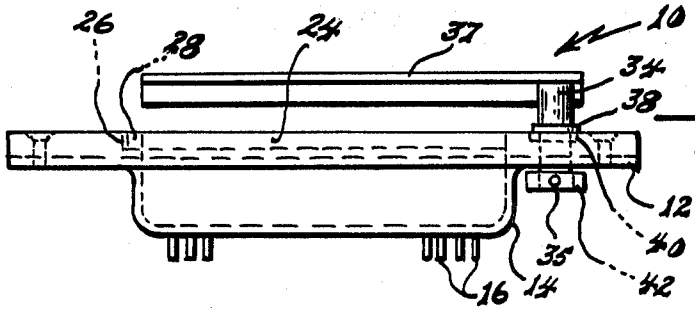


FIG. 2

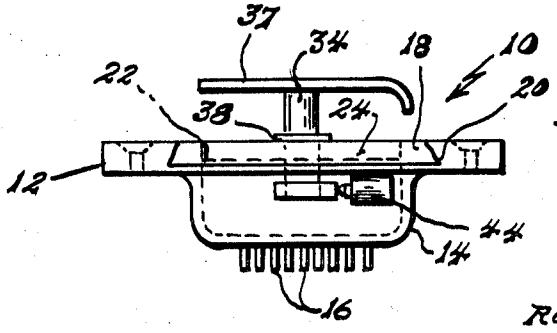


FIG. 3

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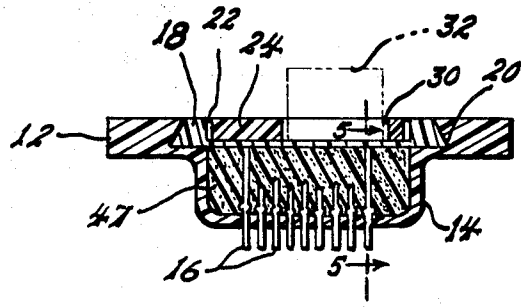


FIG. 4

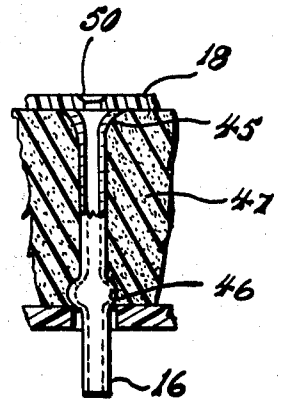


FIG 5

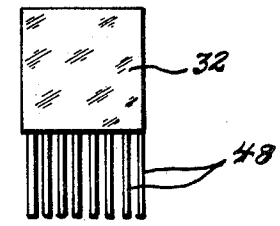


FIG. 8

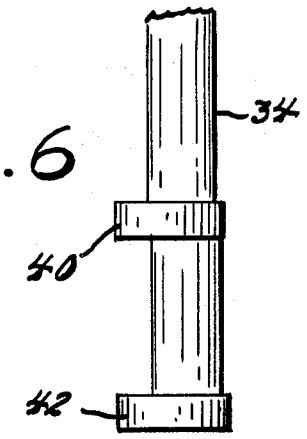


FIG. 6

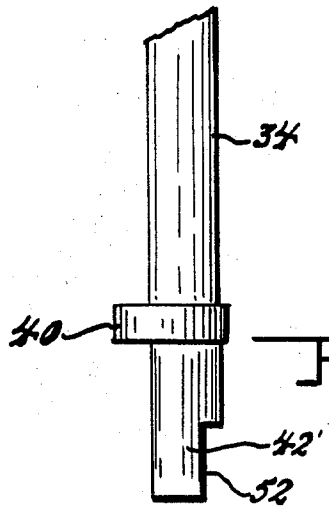


FIG. 7

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UNIVERSAL ELECTRICAL CONNECTOR FOR MINIATURE ELECTRONIC MODULES

BACKGROUND OF THE INVENTION

This invention relates generally to electrical connectors and, more particularly to a zero-insertion-force electrical connector which finds utility, for example, as a connector in a testing apparatus for miniature electronic modules or in computer program panels.

Miniature electronic modules are used extensively in printed circuit assemblies as standardized building blocks to provide complete circuit functions in an easily replaced, expendable package. Typically, these modules are molded epoxy rectangular prisms, with electrical connections provided by wire pins, arranged in a matrix. On a printed circuit board, connection to the pins are normally made by means of small, staked-in sleeves which provide spring action to grip the pins.

Most of these electronic modules must be given certain electrical tests to determine whether or not they are suitable for use. The time required for the testing operations depends largely upon the time required to make the electrical connections with the leads of the components to include them in predetermined circuits of test sets.

Problems arise when these miniature electronic modules are to be inserted within the test equipment. Heretofore the connection of these modules to an electrical circuit was accomplished by a spring action sleeve to grip the pins of the electronic modules. Due to the considerable force required to insert the pins simultaneously into the spring action sleeves of the test equipment, extreme care had to be exercised in replacing a module to prevent damage to the pins and to the sleeves. Therefore, testing of these modules became not only extremely time consuming but also resulted frequently in the damaging of the pins during the insertion or removal processes.

Another problem arose when the spring sleeves used in the test equipment engaged the incorrect row or column of pins on the modules, thereby causing possible electrical damage to the module circuits. Furthermore in many instances the test equipment applied power to the modules at an improper time during the insertion or removal of the module from the test equipment.

Not only would problems arise when testing these miniature electronic modules, similar problems also came about when these modules were to be used in, for example, computer program panel receptacles wherein it was necessary for such a module to have a density of as many as 100 pins per square inch. Due to the density of the pins it became impractical to insert these modules within the conventional spring-type sleeves of the receptacles, due to the excessive insertion force necessary for mating. The problems which arose for the test equipment explained hereinabove also arose when inserting these modules in computer program panels.

SUMMARY OF THE INVENTION

The universal electrical connector of this invention overcomes the problems heretofore encountered and as set forth in detail hereinabove.

The electrical connector of this invention is preferably made of a molded plastic case which in addition to providing a means of mounting the electronic module also houses the socket sleeves and the slip plate.

The socket sleeves into which the pins of the electronic module are to be inserted are a length of thin walled copper or brass tubing, slightly flared at one end and crimped near the other. The sleeves are located within a pocket or depression located at the bottom of the case and are slightly oversized with respect to the pins of the electronic module, thereby allowing for a slight sidewise movement of the pin within the sleeve. The space between the individual sleeves is filled with a low density foam or resin which provides a restoring force to the sleeves and holds them in place.

A slip plate having a recessed section containing a matching matrix of holes to the sleeves is located within an indented portion of the case above the pocket containing the sleeves. The slip plate further has an elongated hole therein which engages a cam provided on a locking shaft.

The locking shaft located at one end of the case has two cams thereon, one for engaging the elongated hole in the slip plate in order to provide translational movement to the slip plate, and another to activate a switch on, for example, the energizing means of a test apparatus.

There is a removable key plate, which has a window therein to provide a means to properly locate the electronic module with respect to the socket matrix, located in the slip plate. A separate key plate is used for each different sized module to be tested or for each different sized module to be inserted within a computer program panel. A module restraining bar is mounted on the locking shaft and is positioned in such a manner making it virtually impossible to insert or remove a module within the key plate when the locking shaft is in the locked position.

It is therefore an object of this invention to provide universal electrical connector which is of high reliability and which requires zero-insertion-force to thereby preclude damage to either the module pins or socket sleeves during module insertion or extraction.

It is another object of this invention to provide a universal electrical connector which has a foolproof electrical interlock which prevents the application of power to the module during the insertion or removal process.

It is still another object of this invention to provide a universal electrical connector which is economical to produce and which utilizes conventional, currently available components that lend themselves to standard mass producing manufacturing techniques.

For a better understanding of the present invention, together with other and further objects thereof, reference is made to the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

DESCRIPTION OF THE DRAWING

FIG. 1 of the drawing is a plan view of the universal electrical connector of this invention with the locking shaft and restraining bar not shown;

FIG. 2 is a side elevation view of the universal electrical connector of this invention taken along line 2–2 of FIG. 1;

FIG. 3 is an end view of the universal electrical connector of this invention taken along line 3–3 of FIG. 1;

FIG. 4 is a cross sectional view of the universal electrical connector of this invention taken along line 4–4 of FIG. 1;

FIG. 5 is a cross-sectional view of a sleeve taken along line 5–5 of FIG. 4;

FIG. 6 is a side elevational view of a portion of the locking shaft of the universal electrical connector of this invention showing the two cams thereon;

FIG. 7 is a side elevational view of a portion of a modified locking shaft of the universal electrical connector of this invention; and

FIG. 8 is a side elevational view of the electronic module to be utilized with the universal electrical connector of this invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The universal electrical connector 10 of this invention is best shown in FIGS. 1 through 3 of the drawing. The universal connector 10 is made up of a case 12 preferably of hard molded plastic, which has formed on the bottom thereof a pocket 14 or depression (best shown in FIGS. 2—4) wherein a plurality of socket sleeves 16 are located.

Referring now to FIGS. 4 and 5, it is shown that the socket sleeves 16 are lengths of thin walled tubing made of any suitable material such as copper or brass flared slightly at one end

44 and crimped at 46 (shown in FIG. 5). The sleeves 16 are of an internal diameter slightly greater than the diameter of the pins 48 of the electronic module 32 (shown in FIG. 8). The larger internal diameter of the sleeves 16 allow for slight sidewise movement of the pins 48 within the sleeves 16, the purpose of which will be explained hereinbelow. A flexible foam or suitable resin 47 such as Sylgard 184 fills the pocket 14 of case 12 after the sleeves 16 have been inserted therein and holds the sleeves 16 securely in place.

A slip plate 18 made of any suitable material such as hard plastic is located within an indented section of the upper portion of case 12 and is mounted in slideable relation therewith. The slip plate 18 as best shown in FIGS. 3 and 4 is prevented from any other movement outside of the slideable movement within case 12 by a mating dovetail arrangement 20 or by any other suitable arrangement which would prevent the slip plate 18 from being removed from the case 12. The slip plate 18 also has a recessed section 22 therein. The bottom portion of recess 22 contains a plurality of holes 50 (see FIG. 5) corresponding to the sleeves 16. The holes 50 also have an internal diameter slightly greater than the diameter of pins 48 and are further countersunk to provide lead-ins for the module pins 48.

A removable key plate 24 (shown in FIGS. 1 and 4), also preferably made of hard plastic, is located within recessed section 22. This key plate 24 can be inserted within the recessed section 22 of slip plate 18 in only one position. The desired position being determined by any suitable alignment means such as female portion 26 within slip plate 18 and male portion 28 on key plate 24 (see FIG. 1). The removable key plate 24 has a window 30 located therein which provides a means to properly locate the electronic module 32 (shown in FIGS. 4 and 8) with respect to the socket sleeves 16. A separate key plate 24 would be utilized with each different sized module 32.

Referring again to FIG. 2, a locking shaft 34 is mounted within and extends in both directions beyond case 12. On the upper end of locking shaft 34 is fixedly secured by any suitable securing means a module restraining bar 37 which prevents the accidental insertion or removal of the electronic module 32 when the shaft 34 is in its locked position (shown in FIGS. 2 and 3). There is an elongated hole 36 located at one end of slip plate 18 through which the shaft 34 extends. A suitable retaining means such as retaining ring 38 secures the shaft 34 in place but allows for rotatable motion thereof. Within elongated hole 36 is located any suitable device such as cam 40 fixedly secured to shaft 34 and which is utilized to provide the translational movement of slip plate 18 within case 12. Another cam 42 is located at the bottom of shaft 34 and secured thereto by any suitable holding means such as setscrew 35. This cam is arranged so as to engage and operate a suitable energizing means 44 or motor when the locking shaft 34 is in the locked position.

Referring now to FIGS. 6 and 7 of the drawing, it is shown that the shaft 34 may have a variety of cams 40 and 42 located thereon. For example, in FIG. 6 the cams 40 and 42 are identical in structure or as shown in FIG. 7 one of the cams 40 may be an external type cam located on shaft 34 and the other cam 42' may be made of a flat surface 52.

MODE OF OPERATION

Referring now to FIGS. 1—4 of the drawing, the typical operation of the universal electrical connector 10 of this invention is basically as follows:

1. The locking shaft 34 is rotated by turning the restraining bar 37 in the clockwise direction and to a nonobstructing position. This enables cam 40 to engage the wall of hole 36 and translate the slip plate 18 so as to align the slip plate holes 50 with the socket sleeves 16.
2. The key plate 24, corresponding to the electronic module 32 to be tested, is then inserted in the slip plate recession 22 with the female and male portions 26 and 28, respectively, in engagement with each other.
3. A module 32 is inserted in the key plate window 30, with the pins 48 of the module 32 passing through the holes 50 of the slip plate 18 and into the holes of the socket sleeves 16.
4. The locking shaft 34 is rotated counterclockwise to translate the slip plate 18 along with the key plate 24 and the module 32 until the module pins 48 contact the walls of the socket sleeves 16. Simultaneously, the restraining bar 37 is brought to a position over the module 32 thus preventing its accidental removal and the cam 42 engages the energizing means 44 thereby enabling the power circuits in a test apparatus or in a computer to operate. It is clearly evident that because the cam 42 engages energizing means 44 only when the module 32 is properly in place there can be no accidental application of power to the electronic module 32. Furthermore, it is quite obvious that since both the internal diameters of the holes 50 and the socket sleeves 16 are greater than the diameter of the pins 48 on module 32, no force need be applied to the pins 48 of the module 32 during the insertion or removal processes. Thereby, no damage can occur to the pins 48 of module 32 during this insertion for removal process. It is only after the insertion has taken place that the pins 48, along with the slip plate 18, are moved in such a manner that the pins now make contact with the sides of the socket sleeves 16 and thereby complete a circuit.
5. After completion of the test of the module 32 or its use within a computer panel, the locking shaft 34 is again rotated in the clockwise direction back to the unlocked position. In the unlocked position cam 42 disengages the energizing means 44, restraining bar 37 is out of the obstructing position, and the holes 50 and sleeves 16 are aligned, thereby enabling the module 32 to be easily withdrawn. Any suitable type of module 32 can be inserted within the removable key plate window 30 as long as the window 30 of a suitable key plate 24 matches the electronic module 32 to be used.

High reliability is insured by the universal electrical connector 10 of this invention since the socket sleeves 16 are self-aligning due to the flare 44 and the fact that no damage can occur to either the module pins 48 or the connector sleeves 16 during the module insertion or withdrawal because of the zero-insertion-force required.

Although the invention has been described with reference to a particular embodiment it will be understood to those skilled in the art that the invention is capable of a variety of alternative embodiments within the spirit and scope of this invention.

We claim:

1. A universal electrical connector comprising a case, a plurality of socket sleeves mounted in said case, a slip plate moveably mounted on said case having a plurality of holes therein, said holes being substantially aligned with said socket sleeves, a locking shaft rotatably mounted on said case and operatively connected to said slip plate, said locking shaft having a restraining bar fixedly secured thereto and being positioned above said holes in said slip plate, whereby rotation of said locking shaft moves said slip plate and thereby said holes of said slip plate into and slightly out of alignment with said socket sleeves.

2. A universal electrical connector as defined in claim 1 wherein said slip plate has an elongated slot therein, said locking shaft protrudes through said slot, and a cam is mounted on said locking shaft and located within said slot whereby rotation of said locking shaft causes said cam to engage a wall of said slot thereby moving said slip plate.

3. A universal electrical connector as defined in claim 2 wherein said locking shaft has another cam mounted thereon, an energizing means is fixedly secured to said case and in operative relation with said other cam whereby said other cam actuates said energizing means when said holes of said slip plate are slightly out of alignment with said socket sleeves.

4. A universal electrical connector as defined in claim 2 wherein a pocket is formed in the bottom of said case, said socket sleeves being located within said pocket, and held in position by a resin.

5. A universal electrical connector as defined in claim 4 wherein said slip plate has a recess therein, a removable key plate is located within said recess, and said key plate has a window therein providing a means to properly locate an electronic module therein.

6. A universal electrical connector as defined in claim 5 wherein said slip plate has a female portion therein and said key plate has a male portion thereon whereby the key plate can fit within said recess of said slip plate in only one position.

7. A universal electrical connector as defined in claim 6 wherein said locking shaft has another cam mounted thereon, an energizing means is fixedly secured to said case and in operative relation with said other cam whereby said other cam actuates said energizing means when said holes of said slip plate are slightly out of alignment with said socket sleeves.

8. The combination of an electronic module having a plurality of pins thereon and a universal electrical connector comprising a case, a plurality of socket sleeves of predetermined diameter mounted in said case, a slip plate movably mounted on said case having a plurality of holes therein of a predetermined diameter, said holes being substantially aligned with said socket sleeves, said slip plate further having an elongated slot therein, a locking shaft is rotatably mounted on said case and protrudes through said slot, a cam is mounted on said locking shaft and located within said slot whereby rotation of said locking shaft causes said cam to engage a wall of said slot moving said slip plate and thereby the holes of said slip plate into and slightly out of alignment with said socket sleeves, said slip plate has a recess therein, a removable key plate is located within said recess, said key plate having a window therein, said electronic module being located within said window and having each of said pins inserted within each of said holes of said slip plate and said socket sleeves, and the internal diameter of each of said holes and socket sleeves being slightly greater than the diameter of each said pins whereby rotation of said locking shaft moves said slip plate holes slightly out of alignment with said socket sleeves and thereby enables said module pins to engage the walls of said socket sleeves.

9. A universal electrical connector as defined in claim 8 wherein said locking shaft has another cam mounted thereon, an energizing means is fixedly secured to said case and in operative relation with said other cam whereby said other cam actuates said energizing means when said holes of said slip plate are slightly out of alignment with said socket sleeves and engaging the walls of said socket sleeves.