Feb. 23, 1965 R. WITTE ETAL 3,170,753

ELECTRICAL CONNECTOR

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Fig.2

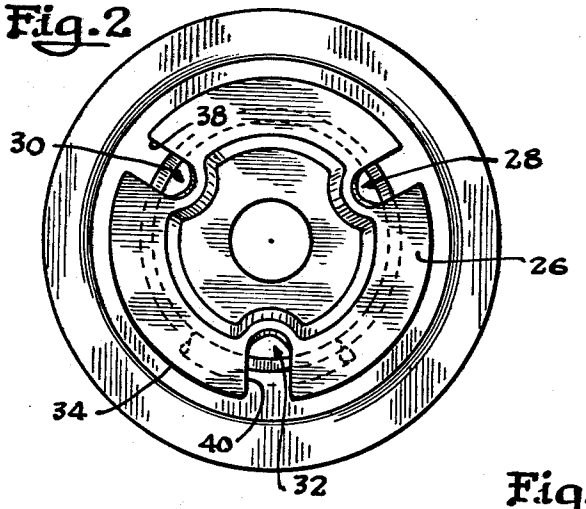
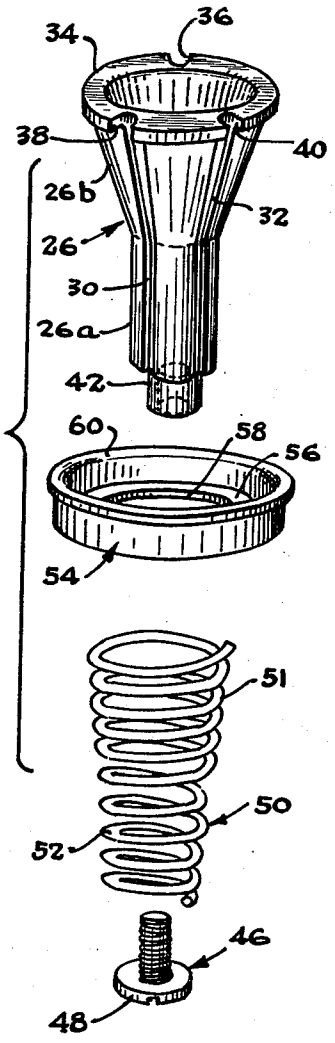


Fig.3



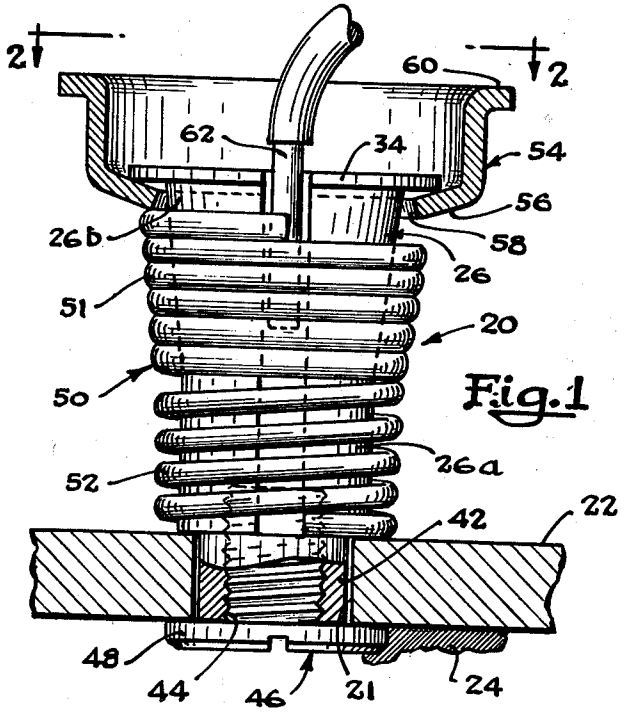


Fig.1

Inventors

Roy Witte

William H. McKee

By John Todd

Attorney

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ELECTRICAL CONNECTOR

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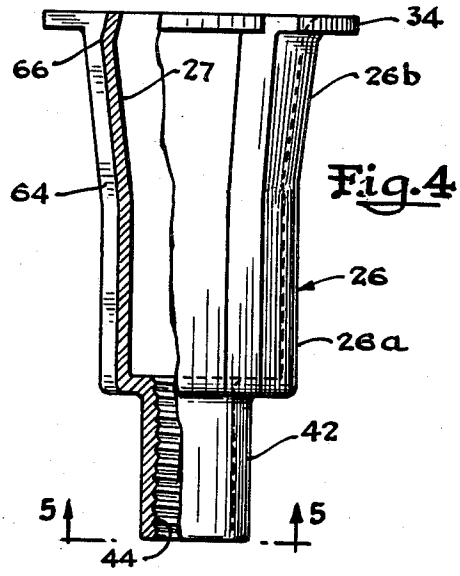

Fig.4

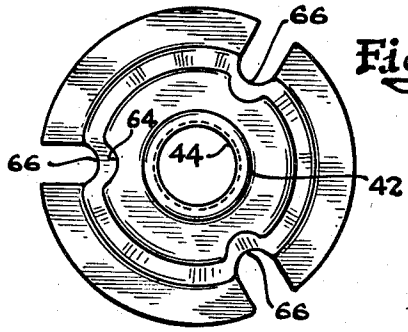

Fig.5

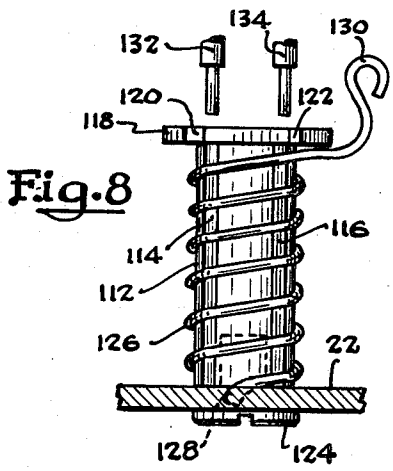

Fig.8

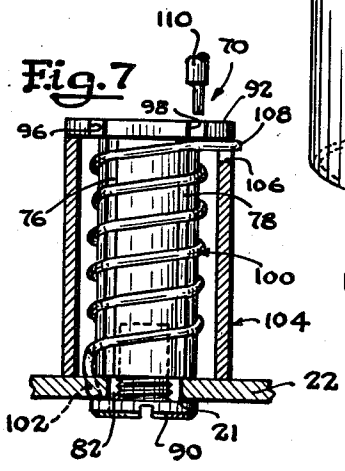

Fig.7

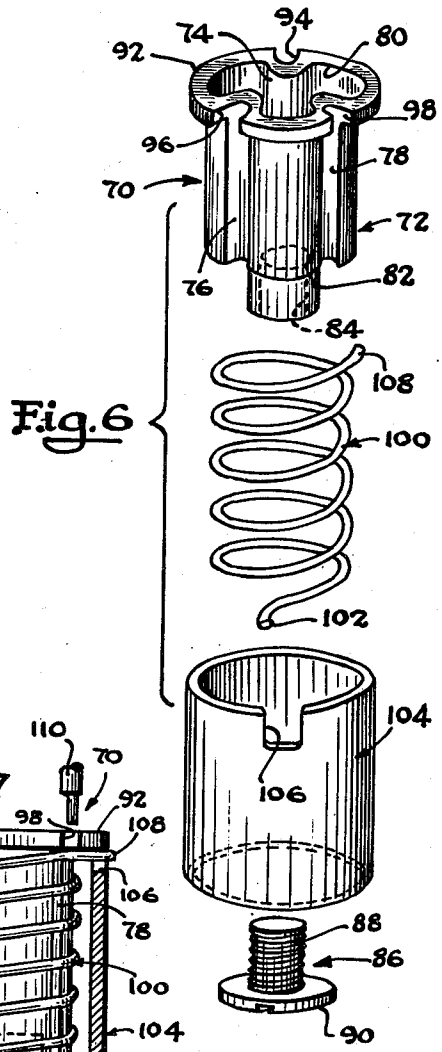

Fig.6

Inventors
ROY WITTE
WILLIAM H. McKEE
By John Todd
Attorney

Feb. 23, 1965 R. WITTE ETAL 3,170,753

ELECTRICAL CONNECTOR

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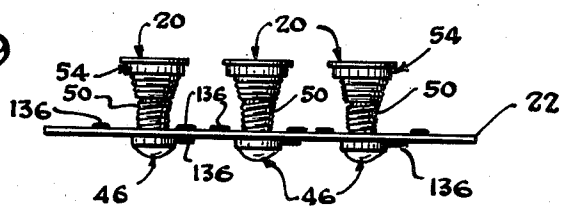
Fig.9



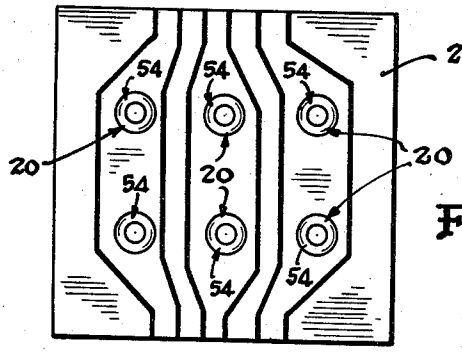
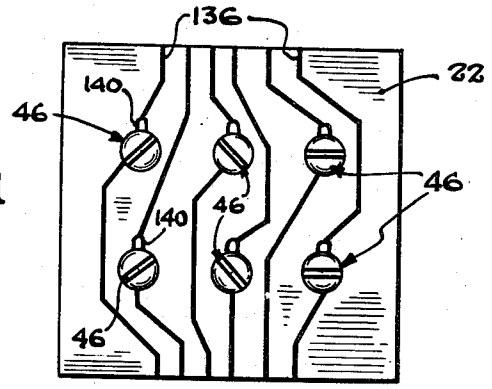


Fig.10

Fig.11



Inventors
ROY WITTE
WILLIAM H. McKEE
By John Todd
Attorney

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3,170,753
ELECTRICAL CONNECTOR

Roy Witte, 1942 De Cook Ave., Park Ridge, Ill., and William H. McKee, 2436 E. Evergreen St., West Covina, Calif.

Filed July 19, 1962, Ser. No. 210,912
2 Claims. (Cl. 339—256)

The present invention relates to an electrical connector and more particularly it relates to an improved connector adapted to receive and clamp electrical leads therein upon insertion of the lead within the connector.

Varied electrical connectors are available to electrically interconnect an electrical lead to an apparatus from the simple screw-in connector to a sophisticated clamping or plug device.

In accordance with the present invention a simple and inexpensive electrical connector is provided. The connector contemplates a spring retaining member in cooperation with an electrical lead receiving component. The spring member is adapted to be received in telescoped relation about the lead receiving component. The spring is "unwound" to spread the coils and receive the electrical lead between the spring and the component. After the lead is inserted, the spring is released. Upon relaxation the spring defines a clamping relation between the spring, electrical lead and the component.

It is therefore a general object of the present invention to provide an improved electrical connector that will provide interconnection to an electrical lead without the use of screwdrivers, pliers or the like.

A further object of the present invention resides in the provision of an improved electrical connector wherein the interconnection between the connector and the lead is realized by depressing a spring member, inserting the lead and releasing the spring member.

An additional object of the present invention resides in the provision of an improved electrical connector wherein the interconnection between the connector and the lead is realized by unwinding the coiled spring, inserting the lead and releasing the spring.

A further object of the present invention is to provide an improved electrical connector that is inexpensive to manufacture, easy to install and simple to use.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, together with further objects and advantages thereof, will best be understood by reference to the following description taken in connection with the accompanying drawings, in which:

FIGURE 1 is a side elevation, partly in cross section of one form of the connector of the present invention;

FIGURE 2 is a top view of the connector illustrated in FIGURE 1;

FIGURE 3 is an exploded view of the electrical connector of FIGURE 1 illustrating the individual components in greater detail;

FIGURE 4 is a side elevation, partly in cross section, of one component of a modified form of the electrical connector of the present invention;

FIGURE 5 is a top view of the component illustrated in FIGURE 4;

FIGURE 6 is an exploded view of another form of the present invention;

FIGURE 7 is a side elevation of the connector illustrated in FIGURE 6, partly in cross section;

FIGURE 8 is a side elevation of still another form of connector in accord with the present invention;

FIGURE 9 is a side elevation of the connectors of the present invention as mounted on a printed circuit board;

FIGURE 10 is a top plan view of the board and connector assembly illustrated in FIGURE 9; and

FIGURE 11 is a bottom view of the assembly of FIGURE 9 illustrating the interconnection of the printed circuitry to the electrical connectors.

Referring more particularly now to FIGURE 1, the electrical connector is indicated generally at **20**. The electrical connector **20** of the present invention is adapted to be mounted in a suitable base **22**, which may be a conventional chassis for an electronic assembly or may be a printed circuit board or the like. As indicated at **24** an electrical lead extends along one face of the base **22** and intersects the electrical connector to define an electrical interconnection therewith.

The connector **20** includes an electrical lead receiving member **26** which defines a cylindrical body **26***a* at the lower portion thereof and an outwardly flaring cylindrical section **26***b* at the upper portion thereof, in the embodiment illustrated in FIGURES 1, 2 and 3. The lead receiving member **26** is characterized by a plurality of grooves **28**, **30** and **32** therein extending for substantially the entire length of the body.

The upper terminal of the outwardly flaring body portion **26***b* of the lead receiving member **26** defines a flange **34** which extends outwardly from the body portion **26***b* substantially normal thereto. The flange **34** defines a plurality of recesses **36**, **38** and **40** at spaced intervals about the periphery thereof in mating, aligned relation to the grooves **28**, **30** and **32**, respectively in the lead receiving member **26**.

A boss **42** integral with and extending downwardly from the lower cylindrical body portion **26***a* of the lead receiving member **26** is adapted to be received within the opening **21** of the base **22**. The boss **42** is internally threaded with the threaded opening **44** extending through said boss **44** and into the open area of the lead receiving member, the lead receiving member being hollow and of tube-like overall configuration. A screw **46** is adapted to be threadedly received within the threaded opening **44** of the boss **42** and to fasten the lead receiving member **26** to the base **22**, the head **48** of the bolt **46** being adapted to overlap the margins of the opening **21** of the base **22** to define an interference therewith against which the screw **46** is tightened.

A coiled spring member **50** is received in telescoped relation about the electrical lead receiving member **26**. As indicated in FIGURE 1 the spring **50** is characterized by two sections—the upper portion **51** of the spring **50** is tightly coiled to thereby offer a relatively high resistance to deflection thereof while the lower portion **52** is relatively loosely coiled to permit relatively easy deflection thereof from the static position of the spring.

A sleeve or collar **54** is adapted to be received in telescoped relation about the lead receiving member **26** of the connector **20**. The sleeve **54** has an inwardly directed flange **56** at the lower terminal thereof having a central opening **58** defined therethrough, the central opening **58** being of slightly greater diameter than the largest diameter of the outwardly flaring upper body portion **26***b* of the lead receiving member **26**, but of smaller diameter than the greatest diameter of the flange **34**. It is readily seen, therefore, that the sleeve **54** is vertically movably positioned in telescoped relation upon the member **26** but that the upper limit of movement of the sleeve is defined by the flange **34**. The sleeve **54** is restricted in its downward movement by the spring **50**. The central opening **58** of the spring **54** is smaller than the maximum diameter defined by the coils of the spring **50** and thus the sleeve **54** is positioned between the flange **34** on the upper side and the spring **50** therebelow. The central opening **58** of the spring is of greater diameter

than the minimum diameter defined by the inner periphery of the coil springs so as to not interfere with the electrical leads to be inserted within the lead receiving member of the connector 20. The upper terminal of the sleeve 54 is folded to define the upper flange portion 60.

The assembly of the electrical connector of FIGURE 1 is illustrated more clearly in the exploded view of FIGURE 3. As indicated, the sleeve 54 is first inserted in telescoped relation over the electrical lead receiving member 26 from the bottom thereof. The spring 50 is next inserted over the member 26 and urged upwardly thereon until contacting the sleeve 54. The boss 42 of the member 26 is then inserted into the chassis opening and the screw then inserted from the bottom side of the chassis into the threaded opening 44 of the boss 42 and tightened against the chassis.

The electrical leads are inserted into the connector 20 and electrically connected thereto in one continuous motion. To insert an electrical lead into the connector the sleeve 54 is urged downwardly to compress the spring 54 and force it downwardly with respect to the member 26. In view of the spring characteristic the lower portion of the spring 50 is easily deflected thus making the depression of the collar 54 relatively easy. The collar 54, and spring 50, are held in this depressed state while the exposed lead, 62, FIGURE 1, is inserted into one of the grooves, 28, 30 or 32, of the member 26. When the exposed portion of the lead 62 is positioned within the recess, the collar and spring are released. The spring moves the collar and itself upwardly to return to the static position defined by the spring. In so returning the inner periphery of the spring coils engage the periphery of the electrical lead 62 and serve to clamp the lead within the groove of the electrical lead receiving member 26. The diameter defined by the inner periphery of the coils of the spring 50 is just slightly greater than the largest diameter defined by the outwardly flaring portion of the member 26 of the connector so that if the electrical lead projects from the recess even a slight amount it will be clampingly engaged between the inner periphery of the spring coils and the base of the groove within the electrical lead receiving member 26. The connector of the present invention will accommodate a variety of lead diameters in view of the tapering characteristic of the upper body portion of the member 26. It can readily be seen that the spring 50 will move upwardly upon the member 26 a sufficient distance only to engage the outer periphery of the electrical lead between the inner periphery of the spring coils and the base of the groove within the member 26. The lower the position of the spring at the time of engagement, the greater the compressive force defined to retain the lead within the clamp defined between the spring and the groove, in view of the larger amount of stored energy within the trapped compressed spring member. The clamping force of the spring with respect to the lead and the base of the groove in the member 26 in a function of the spring characteristics, and can readily be varied by selection of material from which the spring is manufactured. Normally the choice will not be too significant and any spring with sufficient resiliency will suffice.

To remove the lead from the connector 20 the collar 54, and thereby the spring 50, is depressed to relieve the clamping engagement defined between the spring and the groove in the member 26. Once the clamping engagement is removed, the lead may readily be removed from the connector.

The embodiment of FIGURES 4 and 5 is illustrative of one modification of the electrical lead receiving member of the connector 20 of the present invention. Similar parts are numbered identically to those of FIGURE 1 to facilitate understanding thereof. The modification of FIGURES 4 and 5 may be formed by stamping or other forming means from a hollow tube-like starting form. As indicated, the lead receiving member 26 is defined by a tube-like wall portion having a central opening 27 extending therethrough to intersect the threaded opening 44 in the boss 42. The recess 64 is formed in the wall of the member 26, said recess being of sufficient depth to receive a number of varying sizes of electrical leads therein such that the leads will project at least a slight amount above the outer cylindrical surface of the lead receiving member 26 so as to permit engagement of the lead by the spring to be received about the member 26. A ridge 66 is defined across the base of the recess 64 adjacent the upper terminal of the recess and approximately at the lower face of the flange 34. The ridge 66 defines an additional clamping point to facilitate retention of the electrical lead within the clamping means defined between the spring and the recess, as noted in the discussion of the embodiment of FIGURES 1, 2 and 3. The ridge 66 will further intimately engage the electrical conductor to provide a further sharp point of electrical contact. It should be observed, however, that the more favorable electrical contact is defined along a substantial portion of the extent of the lead within the connector 20. The lead, as indicated, extends into intimate contact with the recess in the member 26 and the spring 50 of the connector, both of which, preferably, are of electrically conductive material, although it will be sufficient to good electrical connection if just the member 26 is of conductive material. The conductive path, therefore, is defined along the entire extent of the lead disposed within the recess in the connector and electrical conduction takes place along the entire interface. This broad plane of conductive interconnection facilitates the efficiency of contact and the effectiveness of the connector in establishing and maintaining electrical contact between the connector, and the auxiliary circuitry connected thereto.

As noted hereinabove, in connection with the discussion of the embodiment of FIGURES 1, 2 and 3, the lead receiving member 26 may be provided with a plurality of recesses to facilitate greater efficiency in use of the connector.

FIGURES 6 and 7 are illustrative of still another embodiment of the connector of the present invention, the preferred embodiment having been illustrated in FIGURE 1. As indicated in FIGURES 6 and 7, the connector 70 includes an electrical lead receiving member 72. The member 72 is provided with a plurality of electrical lead receiving grooves 74, 76 and 78 therein extending for substantially the full length of the member 72. A central opening 80 is defined in the member 72, said member preferably being formed of a tube-like starting form. A boss 82 extends from the lower terminal of the member 72, said boss being integral with said member. The boss 82 defines a threaded opening 84 therethrough intercepting the opening 80 of the main body portion of the member 72. A screw 86 having a threaded portion 88 and an enlarged head portion 90 is adapted to be threadably received within the threaded opening 84 of the boss 82, the mounting of the member 72 being in the same fashion as that described in connection with the description of the assembly of the embodiment of FIGURE 1.

A flange 92 is defined at the upper terminal of the member 72 which flange defines a plurality of recesses 94, 96 and 98 therein in mating aligned relation with the flanges in the main body portion of the member 72.

A spring 100 is adapted to be received in telescoped relation about the member 72. One end of the spring 100 is bent downwardly as indicated at 102, FIGURE 6, said end 102 being adapted to be received in an opening in the base 22, as indicated in FIGURE 7. The inside diameter of the coils of the spring 100 should be such that the spring will lie in intimate relation to the periphery of the main body of the member 72 when the spring is in the relaxed position. In this manner the spring will always serve to clampingly engage the electrical leads to be inserted in the recesses of the member 72.

A sleeve 104 is adapted to be received in telescoped

relation about the member **72** and the spring **100** when in assembled relation therewith. The sleeve **104** defines a tube-like cylindrical body, as indicated in FIGURE 6. A recess **106** is provided at the upper portion of the sleeve **104**, said recess adapted to receive the opposite end **108** of the spring **100**.

The connector modification illustrated in FIGURES 6 and 7 is assembled by first inserting the spring **100** in telescoped relation about the member **72**. The sleeve **104** is then inserted in telescoped relation over the spring **100** and the member **72**, spring **100** and sleeve **104** placed upon the chassis or base **22** (FIGURE 7). The boss **82** of the member **72** is adapted to be received within the opening **21** of the base **22**. A screw **86** is adapted to be threadably received within the threaded opening **84** of the boss **82** to affix the assembly to the base **22**, the head **90** of the screw **86** being drawn up to tight relation with the lower face of the base **22** to define the secured relationship.

An electrical lead **110** may be inserted into a recess in the electrical connector of FIGURES 6 and 7 by rotating the sleeve **104** in a direction counter to the direction in which the spring **100** is coiled. In view of the fact that one end of the spring is confined within the recess **106** of the sleeve **104** and the other end **102** within an opening in the base **22**, the spring **100** is non-rotatably mounted with respect to the base. Upon rotation of the sleeve **104** in the direction noted, the coils of the spring **100** will begin to unwind to thereby define a greater inside diameter between the coils of the spring **100**. Rotation of the sleeve **104** is continued until a sufficient clearance between the inside of the coils of the spring **100** and the base of the groove in the member **72** is provided for insertion of the electrical lead **110** into the recess. After the lead is in the groove, the sleeve **104** is released. The spring **100** will serve to urge the sleeve **104** and itself towards the static spring position wherein the inner periphery of the coils of the spring will engage the portion of the electrical lead projecting beyond the periphery of the member **72** to clampingly engage the lead within the groove. It can readily be seen that the connector of the present invention may be adapted to receive one or any number of leads within the grooves of the member **72**, one groove being provided for each lead. The universality of use makes it especially attractive for installations where modification of the circuitry is necessary from time to time. An additional feature of considerable attraction is the ease with which the leads may be inserted and removed from the connector and the rugged character of the connector.

A still further modification of the connector of the present invention is shown in FIGURE 8 wherein an electrical lead receiving member **112** defines grooves **114** and **116** in the outer wall thereof. A flange **118** is provided at the upper terminal of the member **112**, said flange having grooves **120** and **122** in mating aligned relation with the grooves **114** and **116**, respectively, in the body of the member **112**. The member **112** defines a central opening extending therethrough, said opening defining a threaded portion at the lower terminal thereof. A screw **124** is adapted to be threadably received within the threaded portion of the member **112** to affix said member to the base **22**, as indicated in FIGURE 8.

A spring **126** is received in telescoped relation about the member **112**, the inner portion of each of the coils of the spring being in intimately wrapped relation to the outer periphery of the member **112**. One end **128** of the spring **126** is bent downwardly and is adapted to be received within an opening of the base **22**. The opposite end **130** of the spring **126** extends outwardly and upwardly to define a convenient finger grasping portion.

The electrical leads **132** and **134** may be inserted into the grooves in the member **112** by urging the end **130** of the spring **126** in an angular direction counter to the direction of winding of the coils of the spring **126**. This action will serve to open the coils of the spring to a greater diameter and move them away from the outer periphery to the member **112** to define an enlarged space between the inner periphery of the spring coils and the base of each of the recesses **114** and **116** in the member **112**. The leads are inserted into the grooves when the opening defined between the bases thereof and the spring is sufficiently large. After the leads are inserted, the portion **130** of the spring **126** is released and the spring permitted to return toward its relaxed position. It should be observed that the spring will not return completely to its relaxed position but will come to rest at a point of tension short of its normal static position. This point will be defined by the position of clamping engagement with the outer portion of the leads within the grooves and will define the means for retaining the leads within the electrical connector.

The preferred embodiment of the connector **20** of the present invention is illustrated in assembled relation on a printed circuit board in FIGURES 9, 10 and 11. As indicated the board **22** is provided with a plurality of electrical leads **136** thereon. The top portion of the board (FIGURE 10) is illustrative of the leads in spanning relation to the board **22**. The side elevation view of FIGURE 9 illustrates the connectors **20** and base **22** in assembled relation. As indicated, the screws **46** affix each of the connectors **20** to the base **22** in rigid inter-relation therewith. As indicated in FIGURE 11, the leads on the bottom face of the base **22** are connected to the base of the connector **20** to define electrical interconnection with each of said connectors **20**. A solder lug **140** may be provided on each of the base portions of the connector **20** to facilitate connection of the leads **136** thereto.

While we have shown and described a specific embodiment of the present invention it will, of course, be understood that other modifications and alternative constructions may be used without departing from the true spirit and scope of this invention. We therefore intend by the appended claims to cover all such modifications and alternative constructions as fall within their true spirit and scope.

What we claim as new and desire to secure by Letters Patent of the United States is:

1. An electrical connector adapted to receive an electrical lead therein, said connector comprising:

a base;

a generally tubular electrical lead receiving member affixed to said base and having a plurality of grooves defined in the outer periphery thereof, said grooves extending along substantially the entire length of said electrical lead receiving member;

a coiled spring received about said tubular electrical lead receiving member in telescoped relation thereabout, one end of said spring being rigidly affixed to the base, said spring in relaxed position defining a restrictive passage between the inner periphery of the spring coils and the base of the grooves defined in the electrical lead receiving member to thereby provide retention means for the electrical leads to be received therebetween; and

a sleeve received in telescoped relation about the coiled spring, said sleeve being freely rotatable with respect to the lead receiving member, said sleeve defining a recess adjacent the upper terminal thereof, said recess being adapted to receive the free end of the coiled spring therein whereby upon application of an external force to rotate said sleeve counter to the winding direction of the coiled spring the coils of said spring will be opened and the space between the inner periphery of said coils and the base of the groove will be enlarged to facilitate insertion of electrical leads therein, said spring being effective to return said sleeve and itself to relaxed position upon removal of the external force and thereby to clamp

the electrical lead between the base of the groove in the lead receiving member and the inner periphery of the coils of said spring.

2. An electrical connector adapted to receive an electrical lead therein, said connector comprising:

an electrical lead receiving member having a tubular body portion, said body portion having a laterally extending flange element at one end, said body portion having a groove extending along a portion of the length thereof and said flange element having a recess in alignment with said groove of said body portion, and said body portion tapering from said flange element toward its end away from said flange element;

a sleeve member having an inwardly directed flange element encircling said body portion and having an opening through which said body portion extends of greater diameter than said body portion but of less diameter than said body flange element;

a coil spring received about said body portion in telescopic relation thereto, the maximum diameter of said coil spring at its upper end being greater than the diameter of the opening of said sleeve flange element whereby said coil spring is in abutting relation to said sleeve flange element; and

said sleeve member being effective upon the application of an external force thereto to compress said coil spring to permit insertion of said electrical lead into the area between the base of said groove and said coil spring, the depth of said groove being less than the diameter of said lead whereby said coil spring upon the withdrawal of external force on said sleeve expands toward relaxed position to engage under tension said electrical lead disposed within said groove of said body portion.

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