

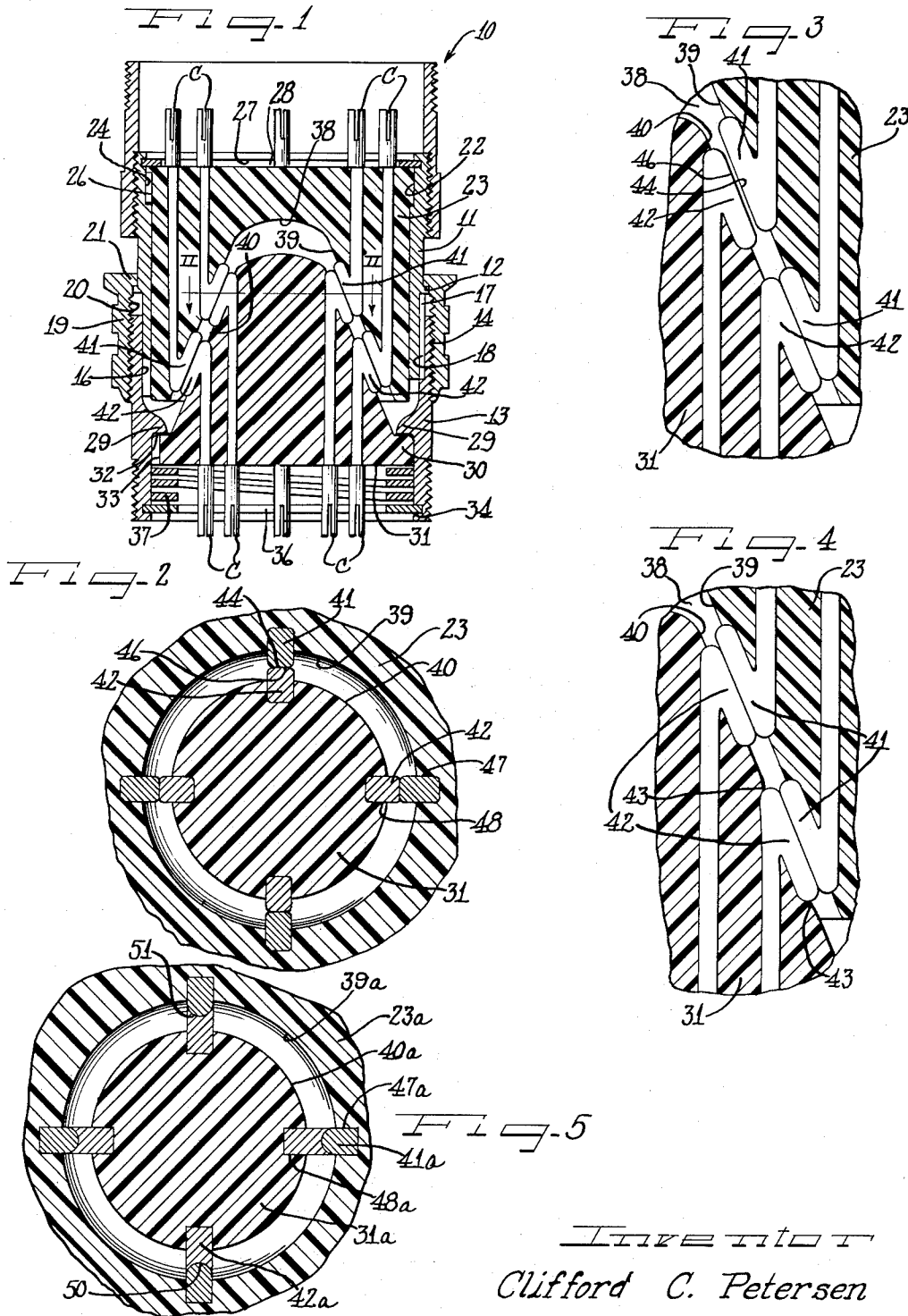
June 5, 1956

C. C. PETERSEN

2,749,526

MULTI-CONTACT CONNECTOR

Filed Feb. 19, 1953



Inventor
Clifford C. Petersen

Hill, Sherman, Meroni, Cross & Simpson

1

2,749,526

MULTI-CONTACT CONNECTOR

Clifford C. Petersen, Chicago, Ill., assignor to The Pyle-National Company, Chicago, Ill., a corporation of New Jersey

Application February 19, 1953, Serial No. 337,714

12 Claims. (Cl. 339—61)

This invention relates generally to an electric plug and socket and more particularly to a connector comprising elastic plug and socket members having complementary conically shaped mating telescoping surfaces intersected by cooperating contact terminals yieldable into full contact engagement with one another.

In the development of power, signal and control circuits, plug and socket connectors have been provided which require the utilization of a large number of contact terminals. If an ordinary pin and socket type terminal arrangement is utilized, the provision of a large number of terminals in a single connector fitting presents many difficulties. For example, a multi-contact connector of the pin and socket type is difficult to align properly for assembly and disassembly and is also particularly difficult to operate insofar as the actual physical separation and joining forces are concerned.

In accordance with the principles of the present invention, a connector is provided which comprises elastic plug and socket members having complementary conically shaped mating telescoping surfaces. Because of the greatly increased area provided by the conical configuration of the mating surfaces, a large number of contact terminals having confronting abutting contact surfaces may be provided. Since at least one of the plug and socket members is elastic, the corresponding contact terminals carried by such member are resiliently and elastically supported. Mating of the plug and socket members permits radial and longitudinal displacement of any misaligned contact terminals, thereby facilitating full contact engagement of all of the terminals.

It is an object of the present invention, therefore, to provide a multi-contact connector which overcomes the deficiencies of the prior art.

Yet another object of the present invention is to provide a multi-contact connector which may be easily separated, but which may be firmly assembled.

A further object of the present invention is to provide a plug and socket connector having cooperating contact terminals yieldable into full contact engagement with one another.

A further object of the present invention is to provide a plug and socket structure having relatively telescoping surfaces intersected by cooperating contact terminals which are yieldable radially and longitudinally into full contact-engagement with one another.

Yet another object of the present invention is to provide a connector affording positive increased contact pressure by means of a wedging action.

Many other advantages, features and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and the annexed sheet of drawings in which a preferred structural embodiment of an electric plug and socket connector structure is shown incorporating the principles of the present invention.

On the drawings:

Figure 1 is a cross-sectional view with parts shown in

2

elevation of a connector provided in accordance with the principles of the present invention;

Figure 2 is a fragmentary cross-sectional view taken generally on line II—II of Figure 1;

Figure 3 is a fragmentary cross-sectional view of parts shown in elevation depicting a plug and socket member arrangement according to the present invention wherein one of the contacts is misaligned and the plug member is being moved towards mating relationship with the socket member;

Figure 4 is a view similar to Figure 3, but showing how full contact engagement is achieved in accordance with the principles of the present invention despite misalignment of individual contact terminals; and

Figure 5 is a fragmentary cross-sectional view similar to the view shown in Figure 2, but showing contact terminals having an engagement surface of a modified configuration.

As shown on the drawings:

The connector of the present invention comprises an electric plug and socket fitting indicated generally at 10 and comprising a socket housing 11 which is of generally cylindrical configuration and which includes a medial annular rib 12 formed on the peripheral surface thereof.

A plug housing 13 is provided which is also of generally cylindrical configuration and which includes a threaded portion 14 adjacent one end thereof.

The plug housing 13 has a bore 16 which receives the socket housing 11. A key 17 is provided on the socket housing 11 and a key slot 18 is provided on the plug housing 13 to intermatingly function as a polarizing means for the plug and socket fitting 10.

An annular ring shaped collar member 19 is internally threaded as at 20 and includes a radially inwardly extending flange 21 seating behind the annular shoulder 12 and engaging therewith to draw the socket housing 11 and the plug housing 13 into coaxial aligned assembly when the collar 19 is threaded onto the plug housing 13. The collar 19 not only effects the axial advance of the plug and socket housings 11 13 with respect to one another, but also locks the plug and socket housings 11 and 13 in firm assembly with one another.

The socket housing 11 is counterbored as at 22 and receives a terminal block 23 made of an electrically non-conductive material. An axially extending rib 24 may be provided in the counterbore 22 and cooperates with a slot 26 formed in the terminal block 23 to prevent relative rotation between the terminal block 23 and the socket housing 11. An annular groove 27 is formed in the socket housing 11 and receives a snap ring 28 to retain the terminal block 23 in assembly with the socket housing 11.

The plug housing 13 is provided with radially inwardly extending shoulder means 29 which engage the flange 30 of a terminal block 31, also made of a suitable electrically non-conductive material.

A key 32 extends axially away from the shoulder means 29 in the plug housing 13 and cooperates with a slot 33 formed in the terminal block 31 to prevent relative rotation between the plug housing 13 and the terminal block 31.

Adjacent the end of the plug housing is provided an annular groove 34 receiving a snap ring 36 bottoming a coil spring 37 which engages one end of the terminal block and exerts a continuous biasing force on the terminal block 31 to retain same in assembly with the plug housing 13.

Each of the terminal blocks 23 and 31 is provided with current continuing means taking the form of a plurality of conductors indicated generally by the reference character C. In the structural embodiment herein described by way of illustrative example, there are eight conductors C in each of the terminal blocks 23 and 31, however, it

3

will be understood that the principles of the present invention are equally applicable to any plug and socket connector without regard to the numerical quantity of current continuing means.

The terminal blocks 23 and 31 are provided with complementary conically shaped telescoping surfaces which are intersected by the conductors C, each of the conductors C having a contact terminal formed on the end thereof which protrudes outwardly of the corresponding surface of the terminal blocks.

In this preferred embodiment, the terminal block 23 is provided with a recess 38 which is generally conical in configuration and which provides a conically shaped contact terminal surface 39. The terminal block 31 is also conical in configuration and is received within the recess 38, a conical contact terminal surface 40 being provided which is complementary to the contact terminal surface 39.

According to the principles of the present invention, the terminal blocks 23 and 31 comprise members made of elastic material so that the cooperating contact terminals will be supported for yielding movement in both radial and longitudinal direction. For purposes of identification, each of the contact terminals provided at the contact terminal surface 39 is indicated by the reference numeral 41 and each of the contact terminals provided at the contact terminal surface 40 is indicated by the reference numeral 42.

If desired, one of the terminal blocks 23 or 31 can be of a comparatively hard dielectric while the other terminal block is made of an elastic dielectric such as rubber, although the invention is not limited to the inclusion of an elastic block.

In the embodiment shown by way of illustrative example and to demonstrate the principles of the present invention with particular clarity, it is assumed that the terminal block 23 is made of a hard dielectric while the terminal block 31 is made of an elastic dielectric material. It is further assumed for purposes of illustration that the contact terminals 42 carried by the elastic terminal block 31 are misaligned with respect to the contact terminals 41 carried by the terminal block 23. Thus, as shown in Figure 3, the terminal block 31 is shown inserted into the recess 38 so that the contact terminal surface 39 and the contact terminal surface 40 are in relatively telescoped relation; however, the lowermost contact terminals 41 and 42 are engaged in Figure 3, but the uppermost of the contact terminals 41 and 42 are not yet engaged.

By tightening the collar 19 to draw the plug housing 13 and the socket housing 11 together, the contact terminals 42 and the contact terminals 41 will be drawn together into full contact engagement with one another as shown in Figure 4. As will be noted upon referring to Figure 4, the lowermost contact terminal 42 is actually displaced into the elastic material of the elastic terminal block 31, the deformation of the elastic material being clearly indicated at 43 on Fig. 4. The telescoping conical surfaces provide a wedging action which increases contact pressure. This wedging occurs with any relatively telescoping surfaces having a discrete inclination between 0° and 90°.

The additional movement afforded by the structural arrangement provided permits the uppermost contact terminals 42 and 41 to come into full engagement with one another.

Another advantageous feature of the present invention resides in the utilization of contact terminals 41 and 42 having engagement surfaces of a configuration to mate each respective cooperating pair of contact terminals 41 and 42. In other words, each of the contact terminals 41 and 42 has a contact surface indicated at 44 and 46, respectively, (Fig. 3) having appreciable extent in a longitudinal direction relative to the axis of the plug and socket fitting 10 and lying generally parallel to the contact terminal surface 39 and the contact terminal surface 40, respectively.

4

Referring to Figures 2 and 5, additional details of construction in regard the terminal blocks 23 and 31 and the contact terminals 41 and 42 may be understood.

It will be noted that the contact terminal surface 39 has a plurality of circumferentially spaced recesses 47, each receiving one of the contact terminals 41 while the contact terminal surface 40 is provided with a plurality of circumferentially spaced recesses 48, each receiving one of the contact terminals 42.

In the embodiment of Figure 2, engagement surfaces 44 and 46 of the contact terminals 41 and 42, respectively, lie on a conical plane which is in parallel spaced relation to the contact terminal surface 39 and the contact terminal surface 40.

One convenient form of fabricating the connector 10 is to integrally imbed the conductors C and the contact terminals 40 and 41 in the terminal blocks 23 and 31 during the formation of the terminal blocks 23 and 31 as plastic moldings. Thereafter, as a machining operation, the contact terminal surfaces 44 and 46 can be machined down to a uniform spacing dimension from the respective contact terminal surfaces 39 and 40.

It should be further noted that the relative movement occurring between the lowermost terminals 41 and 42 after these terminals have engaged one another as shown in Figure 3 and which occurs when the terminal block 31 and the terminal block 23 are drawn axially together to the position of Figure 4, the contact terminal surfaces 44 and 46 will enjoy good wiping contact, thereby promoting an efficient electrical coupling joint.

In the embodiment of Figure 5, the contact terminals are provided with engagement surfaces of a configuration to mate each respective cooperating pair of contact terminals on the respective plug and socket members. Thus, as shown in Figure 5, the terminal block 23a is provided with a plurality of circumferentially spaced recesses 47a, each receiving a contact terminal 41a and the terminal block 31a is provided with a plurality of circumferentially spaced recesses 48a, each receiving a contact terminal 42a.

Each of the contact terminals 42a is provided with a concave engagement surface indicated at 50. Each of the contact terminals 41a is provided with a convex engagement surface indicated at 51. The engagement surfaces 50 and 51, respectively, have appreciable longitudinal extent and lie in a curved plane which extends generally parallel to the contact terminal surfaces 39a and 40a so that should a misalignment occur between the contact terminals 41a and 42a, relative movement between the contact terminals 41a and 42a may occur after any given pair or pairs of contact terminals 41a and 42a are in initial engagement with one another.

Although various minor structural modifications might be suggested to the preferred embodiments herein described by way of illustrative example only, it should be appreciated that many changes could be effected to exemplary structure herein described without departing from the spirit of the present invention and, accordingly, it should be understood that I wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

1. A connector comprising elastic plug and socket members having relatively telescoping confronting surfaces intersected by a plurality of pairs of telescopically cooperating contact terminals elastically supported by said members and being yieldable radially and longitudinally into full contact engagement with one another, said contact terminals having engagement surfaces of a configuration to mate each respective cooperating pair of contact terminals on the respective plug and socket members.

2. A connector comprising elastic plug and socket members having complementary confronting conically

5

shaped mating telescoping surfaces intersected by a plurality of pairs of telescopically cooperating terminals elastically supported by said members and being yieldable into full contact engagement with one another, said contact terminals having engagement surfaces of a configuration to mate each respective cooperating pair of contact terminals on the respective plug and socket members.

3. A connector comprising elastic plug and socket members having complementary conically shaped concentrically disposed confronting inner and outer surfaces having at least a pair of projecting telescopically cooperating contact terminals elastically carried by said members and yieldable into full contact engagement with one another, said plug and socket members being axially separable and coupling means between said plug and socket members drawing said plug and socket members into coaxial assembly and concurrently urging said contact terminals into yielding engagement with one another.

4. A connector comprising a socket member having a generally cylindrical socket housing including a keyway formed therein, a terminal block in said socket housing having a key received in said keyway, an annular peripheral shoulder on said socket housing, a plug member comprising a generally cylindrical plug housing having a keyway formed therein, a terminal block in said housing having a key received in said keyway, a threaded peripheral portion on said plug housing, a locking collar having a flange abutting said annular shoulder on said socket housing and having a threaded portion engaging said plug housing to draw said plug and socket housings together coaxially, said terminal blocks having conically shaped telescoping surfaces and each presenting confronting mating contact terminals to engage one another, the contact terminals on at least one of said terminal blocks being yieldably supported to facilitate full contact engagement between all of the mating terminals when the plug and socket members are mated.

5. A connector comprising, a socket member having a cylindrical housing, a terminal block in said socket housing having a plurality of axially extending conductors therein, a plug member having a cylindrical housing, a terminal block in said plug housing having a corresponding plurality of axially extending conductors therein, said terminal blocks having conically shaped concentrically disposed inner and outer confronting surfaces, a contact terminal for each of said conductors and each having a contact surface spaced outwardly of the respective telescoping surface, at least one of said terminal blocks being made of elastic material to yieldably carry the corresponding contact terminals, and coupling means between the housing members drawing the contact terminals into telescoped full mated contact surface engagement with one another.

6. A connector comprising, a plug member made of electrically non-conductive material and being generally conical in configuration, a socket member being made of electrically non-conductive material and being recessed to receive said plug in mating assembly, at least one of said members being appreciably elastic and both of said members providing confronting conical mating surfaces which are telescopically related when said plug member is assembled with said socket member, conductor means in each of said plug and socket members including contact members supported in and protruding from the respective mating surfaces, and means locking said plug and socket members in mated assembly, the contact members in said one of said plug and socket members being

6

telescopically mounted and elastically yieldable upon engagement with the contact members in the other of said plug and socket members to accommodate misalignment and to promote full contact engagement therebetween.

7. A connector comprising, a socket member having a generally cylindrical socket housing including a keyway formed therein, a terminal block in said socket housing having a key received in said keyway, an annular peripheral shoulder on said socket housing, a plug member comprising a generally cylindrical plug housing having a keyway formed therein, a terminal block slidably mounted in said plug housing and having a key received in said keyway, a spring between said terminal block and said plug housing continuously biasing the terminal block toward one end of the plug housing, a threaded peripheral portion on said one end of said plug housing, a locking collar having a flange abutting said annular shoulder on said socket housing and having a threaded portion engaging said plug housing to draw said plug and socket housing together coaxially, said terminal blocks being conically shaped to provide mating telescoping surfaces, each of said terminal blocks presenting confronting mating contact terminals at telescoping surfaces to engage one another, the contact terminals on at least one of said terminal blocks being yieldably supported to facilitate full contact engagement between all of the mating terminals when the plug and socket members are mated.

8. A multi-contact connector comprising separable plug and socket members, at least one member being made of elastic material and each having relatively telescoping surfaces inclined complementally at a discrete angle between 0° and 90° and cooperating contact terminals projecting from said surfaces providing relatively telescoping surfaces inclined at the same angle, means to draw said plug and socket members together axially to elastically wedge respective pairs of said contacts together with increased contact pressure and polarizing means between said plug and socket members to insure proper mating of said respective pairs of contact terminals.

9. A connector comprising elastic plug and socket members, complementary inner and outer conically-shaped concentrically disposed radially yieldable confronting surfaces on said members, said confronting surfaces having at least one pair of projecting contact terminals elastically supported by said plug and socket members and being yieldable into full contact engagement with one another.

10. A connector as defined in claim 9, said contact terminals having an engagement surface complementary in configuration to the corresponding conically-shaped inner and outer surfaces of said plug and socket members.

11. A connector as defined in claim 9, said contact terminals having complementary concave and convex engagement surfaces.

12. A connector as defined in claim 1 and coupling means advancing said plug and socket members into coaxial assembly and drawing said contact terminals into yielding engagement with one another.

References Cited in the file of this patent

UNITED STATES PATENTS

1,934,799	Gunby	Nov. 14, 1933
2,236,167	David	Mar. 25, 1941
2,275,762	Horton	Mar. 10, 1942
2,499,825	Havlicek	Mar. 7, 1950
2,645,759	Solari	July 14, 1953