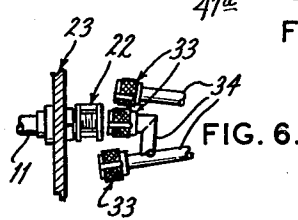
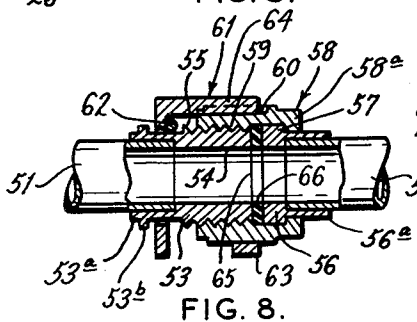
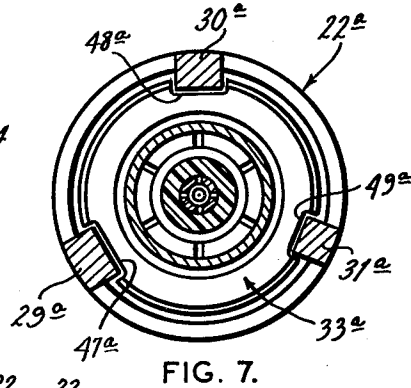
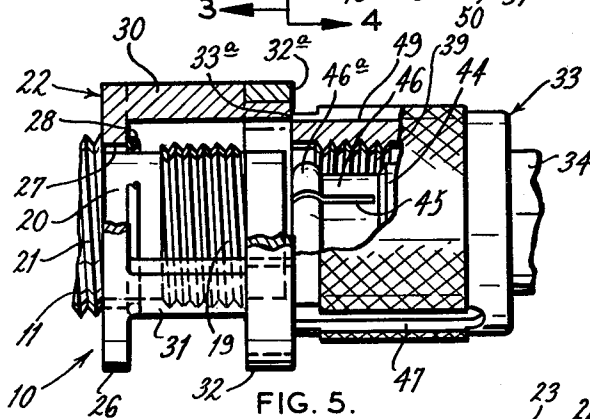
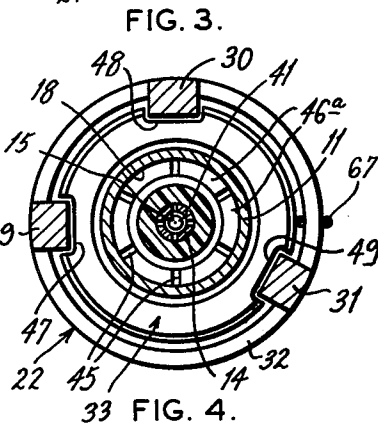
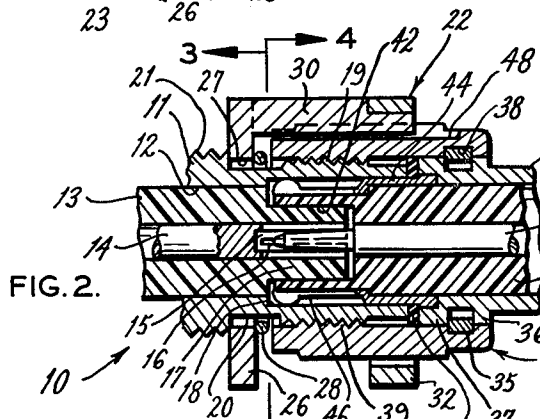
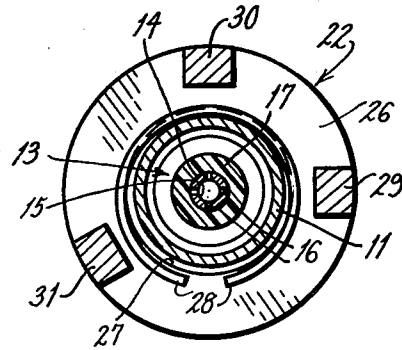
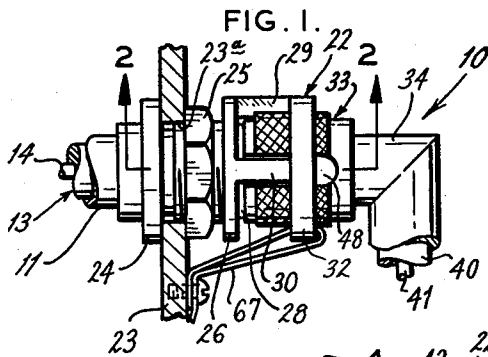


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KEYED CONNECTOR FOR PLUGS AND SOCKETS HAVING
NONINTERCHANGEABLE COUPLING MEANS
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KEYED CONNECTOR FOR PLUGS AND SOCKETS HAVING NONINTERCHANGEABLE COUPLING MEANS

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The invention described herein was made in the performance of work under a NASA contract and is subject to the provisions of the National Aeronautics and Space Act of 1958, Public Law 85-568 (72 Stat. 426; 42 U.S.C. 2451), as amended.

This invention is directed to improvements in devices for positively preventing wrong connecting of plugs and sockets, and is particularly related to keyed type connectors which permit the joining together of plugs and receptacles after it has been established that the plugs and receptacles are correctly selected.

In the joining together of plugs and sockets or receptacles, whether for electrical, hydraulic or pneumatic lines, it is often too easy for the wrong lines to be mated. Part of this problem is due to the fact that keying elements in use at the present time are generally limited to alignment functions and cannot prevent joining of the two ends of lines to be mated. For example, in the electrical field there are military type multiple-contact connectors where the contacts are pre-located with relation to the key. These type are not suitable with single-contact coaxial connectors where the connector body must be concentric with the contact. Moreover, the "polarized" coaxial connectors are limited to connections where there are just two coaxial connectors to be considered.

The present invention has as one of its objects the provision in a connector of means to positively prevent the joining together of the ends of lines which are not intended to be connected, and to prevent wrong connections from being initiated.

It is an object of this invention to provide a connector device which has a combination of cooperating parts that may be varied to permit the correct mating of plugs and sockets in multiple groups where the mismating could easily occur but for this improvement.

Other objects and advantages of this invention are to prevent mis-mating of adjacent similar connectors, to provide easy connections in blind areas and improve the safety of making connections properly by preventing the lines from uniting until the connector has been properly keyed.

The present invention, in a preferred form, may include two ends of a line to be matched and connected, one end having a plug and the other end a socket, the plug and socket being overlapped and relatively axially movable into connection, a key member mounted on one end and a key received disposed on the other end, and means in the plug and socket to complete the desired connection after the key and key receiver have been mated. The invention also includes the assembly, parts thereof and such components or equivalents, as are hereinafter described in connection with the accompanying drawings, wherein:

FIG. 1 is an assembled view of the improved keyed connector;

FIG. 2 is an enlarged longitudinal sectional view of the assembly taken at line 2—2 in FIG. 1;

FIG. 3 is a transverse view seen at line 3—3 in FIG. 2;

FIG. 4 is another transverse view taken at line 4—4 in FIG. 2;

FIG. 5 is a view of the connector assembly, partly

broken away and partly in section, to show the mismating of the key and key receiver portions of the same;

FIG. 6 is a fragmentary view of a panel carrying at least one plug and key to be mated with one of a plurality of sockets formed with key receiver means;

FIG. 7 is a view similar to FIG. 4, but illustrating a variation from the key and key receiver portions shown in FIG. 4; and

FIG. 8 is a fragmentary sectional view of a modification of the assembly of FIG. 2 adapted for joining conduits.

In the views of FIGS. 1, 2 and 3, the connector assembly 10 comprises a plug body 11 having an internal bore 12 to receive an electrical line 13 in which the current lead 14 is embedded. The lead 14 has its end portion counterbored at 15 and lengthwise slits 16 are formed to give the end 15 a certain degree of circumferential expansion capability. Such end 15 is protected by a reduced diameter end 17 on the insulation for the line 13. The end of line 13 is inserted in the body 11 with the end 17 projecting into the space in an internal counterbore 18. The counterbore 18 is in the outer open end of the body on which external threads 19 are provided. Threads 19 are adjacent a recessed annular groove 20 and spaced from other threads 21 so that a key member 22 may be loosely engaged therein as will be described presently.

In FIG. 1, the plug body 11 is shown mounted in a panel or wall 23 by providing an enlarged shouldered abutment 24 on the body 11 which engages the margins of the aperture 23a opposite a nut 25 engaged on the threads 21. The mounting provisions are omitted in FIG. 2.

As may be seen in FIGS. 1, 2, 3 and 4, the key member 22 includes a ring 26 having a bore 27 which is large enough to pass over the threads 19 on the plug body 11 and fit loosely in the groove 20 between threads 19 and 21. The ring 26 is held in the groove by a removable split lock wire or spring means 28. The body ring 26 carries a plurality (three being shown) of key fingers 29, 30 and 31 which are straight elongated elements in circumferential spaced relation according to a desired code. The ends of the key fingers are held in proper alignment by a second ring 32 fitted over the outer sides of the fingers. This key member is in the form of an open cage having axially spaced ring elements and circumferentially spaced key fingers extending between such rings. Obviously the number and spacing of the key fingers, as well as the relative size or shape of each, may be selected to provide a variety of different key members 22 for a group of adjacent plug bodies 11. Once the key member is locked on a body 11 it is free to be turned in the groove 20, but cannot escape axially over threads 19 until the means 28 is removed.

Referring again to FIGS. 1, 2 and 4, the assembly also includes a socket 33 which is captured on the end of the line 34 by a lock ring 35 seated in a groove between spaced ring lands 36 and 37 on the line 34 and an annular recess 38 in the bore of the socket 33. Thus, the socket is non-axially movable but may rotate upon the line 34, and threads 39 in the bore engage with threads 19 on the plug body 11.

The line 34 encases insulation 40 about a current lead 41, except that the end of the insulation is formed with an axial recess 42 which exposes the lead 41 for connection with lead 14 by a push fit in the counterbore 15. The recess 42 receives the end 17 on the insulation for line 13, and the outer side of the insulation surrounding such recess 42 is mounted in a spring member 44 having a plurality of axially directed slots 45 which divide the member into spring fingers 46 with enlarged ends 46a. This construction of member 44 provides structural support for the insulation wall surrounding the recess 42 and also es-

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establishes a push fit of the member 44 in the bore 18 of the plug body 11.

The outer side or surface of the socket 33 is provided with circumferentially spaced grooves or slots 47, 48 and 49 which are matched with the fingers 29, 30 and 31, respectively, on the key member 22. This matching relationship of fingers to slots is important to be able to fit the socket 33 into the key member 22 and have the plug body 11 fit with the socket. Mis-matching of the key member 22 and socket 33 will, of course, prevent the parts being assembled even to the extent of preventing the end of lead 41 touching the lead 14 as the end 33a of the socket 33 will not pass the edge 32a of the ring 32 when the parts are mis-matched.

FIG. 5 illustrates a mis-matched condition of key member 22 and socket 33 which may be due to non-alignment of the key fingers 30 and 31 with the key receiver grooves 48 and 49 formed in the socket 33. This condition is overcome by rotating one part relative to the other until the proper key fingers are aligned with the proper finger receiving grooves. Thus, in FIG. 5 the key member 22 is shown rotated from the position of FIG. 2 so that key 30 is on top and key receiver groove 49 is aligned therewith. The key 31 is then out of registry with receiver groove 47 which is due to the fact of non-symmetrical spacing of the grooves. By proper rotation of the key member 22 relative to socket 33 the proper key fingers and receiver grooves will align so that axial engagement can be effected, as in FIG. 2. Upon threaded assembly the electric lines 14 and 41 are mated and the junction is sealed by the seal element 50.

In FIG. 6 there has been illustrated at least one plug body 11 mounted in panel 23 with the loosely mounted key member 22 thereon. A plurality or bundle of lines 34, each with its socket 33, are adjacent the plug body 11 as might be found in a typical case. According to the principles of this invention one only of the sockets 33 will mate with the key member 22 as previously described. The assembly of the proper line 34 with plug body 11 is easily effected by aligning each socket 33 with the plug and rotating the key member 22 to try matching the key fingers with the receiver grooves in the sockets. The proper socket 33 can be quickly selected in this manner. It is to be noted that the lines 34 do not require turning or twisting (which is undesirable for electric lines and even conduits) as the sockets 33 are free to be rotated relative to the respective lines 34, as is the key member 22. Thus, there is eliminated kinking of electrical lines and a neat connection will result.

A modification within the purview of this invention is illustrated in FIG. 7. In this view a key member 22a is provided with circumferentially spaced key fingers 29a, 30a and 31a, each of a different size. The spacing of these key fingers is non-symmetrical. There is also shown the end of a socket body 33a in which key receiving grooves 47a, 48a and 49a are formed to match the respective key fingers 29a, 30a and 31a before described. Other parts and elements shown in FIG. 7 are similar to those shown in FIG. 4 and these parts are not pointed out so as not to obscure the parts which are modified.

After comparing the disclosures of FIGS. 4 and 7 it will be readily apparent that an infinite variety of keying combinations may be provided merely by varying the spacing of the key fingers without change of size, by varying the size of the key fingers without change of spacing, by varying the shape of one or more of the key fingers, and by any combination of these variations. It is also possible to vary the number of key fingers. In whatever manner desired, the coding of the key member will require a similar coding of the socket member so that one and only one of a pair of plugs and sockets can be connected.

In FIG. 8, the principles of this improvement are applied to mating a line 51, such as a conduit or tube with another line 52, such as a conduit or tube. As shown, the line 51 is provided with a plug body 53 which has

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its sleeve 53a welded, brazed or otherwise connected to the tube end. The plug has an internal bore 54 as a continuation of the bore in line 51, and external threads 55. The mating line 52 carries an end piece 56 attached by its sleeve 56a as above described. The end piece 56 forms an abutment for a socket 58 formed with internal threads 59 and a plurality of external axially directed grooves (one being indicated at 60) as disclosed in FIG. 4 or 7. A key member 61 of the character heretofore disclosed at 22 in FIG. 2 is loosely carried over the plug body 53 and is loosely held in position on the plug by the locking ring 62, also disclosed in FIGS. 2 and 3, and a shoulder 53b on the sleeve 53a.

The assembly of the parts of FIG. 8 is carried out by positioning the key member 61 over the plug (as shown) so that the end ring element 63 thereof which supports the key elements 64 extends just beyond the end face 65 of the plug. The socket 58 is brought up to the key member 61 and if, after relatively rotating the key member 61 and socket 58, the grooves 60 and key elements 64 properly match in size and circumferential spacing, the socket 58 can be moved axially over and threadedly engaged with the plug 53 and screwed up until the annular flange 58a engages the shoulder 57 on the end piece 56.

This engagement between flange 58a and shoulder 57 draws the end piece toward the end face 65 of the plug and against a suitable seal 66 located therebetween.

The foregoing description has set forth the principles of this improvement in connection with matching preferred electrical line or conduit junctions, and a properly matched union is effected by the mating of the key member and socket portions of the structure. It is noted that the electric lines 14 and 41 and the line conduits 51 and 52 are keyed into each other in coaxial relation. The present assembly is a simple and economical arrangement for preventing the mating of wrong plugs and sockets, and in the case of electrical lines no electrical continuity is made until the proper key member and socket have been found. In FIG. 1, after the assembly has been effected, a lock wire 67 may be installed between the ring 32 and the wall 23.

In the several views of FIGS. 2, 5 and 8, the plug and the socket members are shown connected by means of threads so that axial drawing together of these members results. Other equivalent provisions may be employed, such as lugs and cam-shaped slots, or the quick connect-disconnect bayonet type means. Since these equivalent means are known, it is unnecessary to illustrate the same.

From the foregoing description it should now be understood that plugs and sockets of standard well-known types can be used for coaxial connections, and mis-matching of wrong parts can be very simply provided for by the key member and key receiving grooves. Thus, very little modification of a standard part is necessary, but the important advantages of preventing joining of wrong lines is made available in an inexpensive and novel manner. By this invention, it is impossible to connect two lines in a wrong way, or even to have the two lines momentarily touch (if electric lines) until the right plug and socket are located. Other advantages, of course, are present, and it is desired to include all variations and equivalents of the disclosed invention in the scope of the appended claims.

What is claimed is:

1. In a keyed connector assembly for mating the end of a first line with the end of one of a plurality of second lines, the improvement which comprises a plug carried on the end of the first line with an internal bore exposing the end of the first line therein and said internal bore extending axially beyond the end of the first line, a key member mounted for relative rotation and against axial movement on said plug, said key member having generally axially directed and laterally spaced key elements extending over said plug, a socket carried on the end of a second line for relative rotation and against axial move-

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ment thereon with an internal bore exposing the end of the second line therein and said internal bore of said socket extending axially beyond the end of the second line and being sized to receive said plug therein, said socket having external key element receiving grooves generally axially directed and arranged in laterally spaced relation matching the spacing of said key elements, said socket and key member being relatively rotatable to match said key elements and grooves for interfitting sliding connection and being rotatable together relative to said second line and plug and without rotation of said plug and second line, and means on said plug and socket adapted to relatively axially move the same into assembly and connect said first and second lines.

2. In a keyed connector assembly for mating the ends of a pair of lines and preventing mating of other lines, the improvement comprising a plug on a first line formed with an axial bore in one end for exposing the end of the first line therein and having external threads thereon adjacent said one end, a rotary key member carried by said plug against axial movement thereon and provided with a plurality of laterally spaced key elements extending over said external threads in spaced relation, said key elements having ends arranged in a common plane, and a socket mounted for relative rotation on and against axial movement on a second line and formed with an axial bore in one end for exposing the end of the second line therein and having internal threads adjacent said one end, said socket having a plurality of key element receiving grooves arranged in spaced relation matching the spaced relation of said key elements so that said key member and said socket may be mated and rotate together relative to said plug and second line and without rotation of said plug and second line, said one end of said socket being sized to abut the said ends of said key elements at the common plane and prevent engagement of said plug and socket until said key elements and recesses match and fit together whereby said exposed ends of said first and second lines are mated in said assembly.

3. In a keyed connector assembly for mating a plug and a socket, the improvement comprising a plug body for a first line, a socket body for a second line, one of said bodies comprising a line connecting means for mounting the same on its related line for relative rotation and against axial movement thereon, said plug body and socket body having complementary connecting means for securing the same together in overlapped relationship axially to establish continuity of the line, and key and groove matching means for said assembly including key elements and matching groove providing elements, a mem-

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ber supported by the other of said bodies for relative rotation and against axial movement thereon, said member having one of said elements thereon, and the one of said bodies having the other of said elements thereon so that said member and said one body may be mated and rotate together relative to said other body and the line related to the one body, and without rotation of said other body and line related to said one body.

4. The improved keyed connector assembly set forth in claim 3 wherein said key elements are non-symmetrically spaced and said groove providing elements are similarly non-symmetrically spaced, whereby said member and the one of said bodies mate in one position only.

5. The improved keyed connector assembly set forth in claim 3 wherein said key elements are of different sizes and said groove providing elements are similarly sized, whereby said member and the one of said bodies mate in one position only.

6. In a keyed connector assembly for mating a plug and a socket, the improvement comprising a plug body for a first line, a socket body for a second line, one of said bodies comprising a line connecting means for mounting the same on its related line for relative rotation and against axial movement thereon, said plug body and socket body having threads thereon for axially threaded coupling thereof to establish continuity of the lines, and a key member rotatably supported by the other of said bodies for relative rotation and against axial movement thereon, said key member having spaced key elements thereon and the one of said bodies having spaced key element receiving grooves matching the spacing of said key elements so that said member and said one body may be mated and rotate together relative to said other body and the line related to the one body, and without rotation of said other body and line related to said one body.

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