Nov. 13, 1962

F. LYMAN, JR

3,064,232

ELECTRICAL CONNECTOR

Filed June 10, 1960

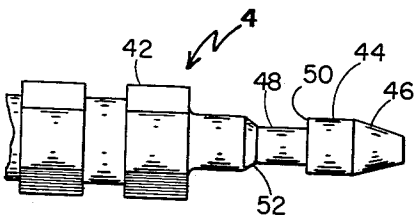


FIG. 2

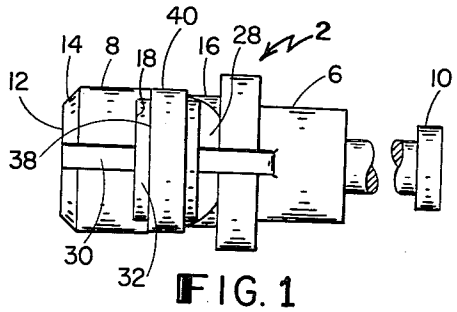


FIG. 1

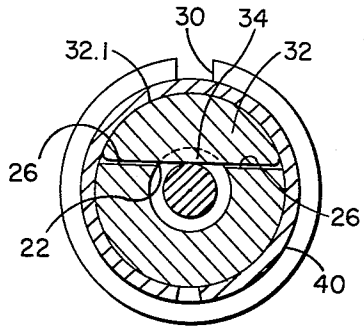


FIG. 4

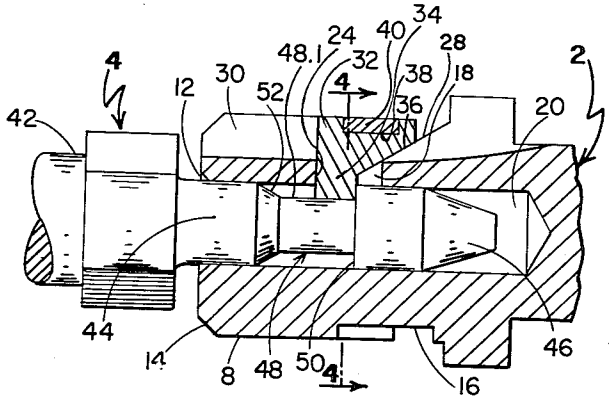


FIG. 3

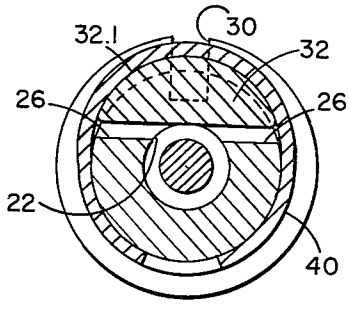


FIG. 6

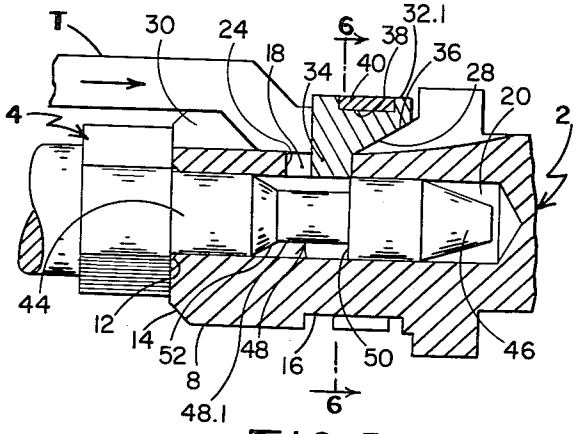


FIG. 5

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ELECTRICAL CONNECTOR

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The field of this invention is that of electrical connectors and more particularly, that of electrical connectors of the plug and jack type.

Objects of this invention are to provide an electrical connector of the above type in which the plug and jack units can be interconnected with great convenience; to provide such a connector in which the plug and jack units can be automatically locked together; to provide such a connector wherein the locked plug and jack units are firmly held together in excellent electrical contact; to provide such a connector which cannot be inadvertently disconnected after having been automatically locked; to provide such a connector in which the plug and jack units can be disconnected only by use of a special unlocking tool; to provide such a connector which is convenient and inexpensive to manufacture, assemble, install, and use; and to provide such a connector which is adapted to be made in very small sizes for use in electronic equipment.

The substance of the invention in its principal aspects can be briefly summarized as follows.

The connector comprises a jack unit which has a sleeve portion open at least at one end and terminal means, preferably oppositely of the sleeve, for connecting the jack unit in an electrical circuit. The sleeve has a notch between the two ends of the sleeve, which notch extends into the hollow inner space of the sleeve and which has a shoulder furthest from the open end of the sleeve and tapering away from the open end of the sleeve to intersect the surface of the sleeve near the other end. The sleeve is provided with an axial groove which does not cut into the hollow inner space of the sleeve but which extends from the open end of the sleeve into the sleeve notch. A key is fitted within the sleeve notch which has a portion that extends into the hollow inner space of the sleeve and a tapered portion which slidably engages the tapered shoulder of the sleeve notch. Pressure means, for example, a split-ring which is fitted around the sleeve and key, biases the key normally to extend into the hollow inner space of the sleeve.

The plug unit of the connector has terminal means for connecting the plug in an electrical circuit and a pin portion adapted to fit within the jack sleeve. The pin has tapered end and a circumferential groove spaced from its tapered end.

When the plug pin is inserted within the jack sleeve, the tapered end of the pin will wedge the key from within the hollow inner space of the sleeve against the bias of the pressure means, thereby permitting full insertion of the pin therein. Then, when the pin groove reaches the key of the sleeve notch, the pressure means will bias the key to reenter the inner space of the sleeve and the pin groove, thus locking the plug and jack units together so that they cannot be inadvertently separated regardless of their angular relation. The key will be biased to bear against the bottom of the pin groove, pressing the pin firmly against the inner surface of the sleeve, thereby providing good electrical contact between the plug and jack units of the connector.

The plug and jack units cannot be disconnected except by use of a disconnecting tool. When such a tool is inserted within the groove in the periphery of the sleeve, and pressed axially of the sleeve against the key, the key will be wedged from within the inner space of the sleeve, against the bias of the pressure means, by the tapered shoulder of the sleeve notch, thereby withdrawing the key from the pin groove and permitting easy separation of the plug and jack units.

These and other objects and aspects of the invention will appear from the following description of a preferred practical embodiment thereof illustrating its novel characteristics.

The description refers to a drawing in which:

FIG. 1 is a fragmentary side elevation view of the jack unit;

FIG. 2 is a fragmentary side elevation view of the plug unit;

FIG. 3 is a fragmentary section view on the axis of the connector showing the plug and jack units locked in interconnected relation;

FIG. 4 is a section view on line 4—4 of FIG. 3;

FIG. 5 is a fragmentary section view similar to FIG. 3 showing the plug and jack units in interconnetced relation with the units unlocked by means of a special tool; and

FIG. 6 is a section view on line 6—6 of FIG. 5.

In the drawing, numeral 2 indicates the jack unit, and 4 indicates the plug unit of the electrical connector according to this invention.

The jack unit 2 of the connector has a body portion 6 and a sleeve portion 8, and is provided with terminal means 10, located oppositely of the jack sleeve portion, by which the jack can be mounted on a terminal board or otherwise connected in an electrical circuit. The terminal means 10 is here shown to comprise a solder tip, but it should be understood that any conventional type of terminal means including a pin or jack of the present, or of conventional construction, could be used on the jack instead of the solder tip, within the scope of this invention.

The jack sleeve is open at one end, as at 12 (FIG. 3), and preferably is chamfered as at 14. The sleeve has a portion 16 of reduced diameter spaced from the open end of the sleeve for purposes to be described below. The sleeve has a peripheral notch 18, preferably of substantially chordal segmental configuration, which is spaced from the open end of the sleeve, which extends into the reduced diameter portion 16 of the sleeve periphery, and which extends into the hollow inner space 20 of the sleeve, as at 22. The notch forms a shoulder 24 adjacent the open end of the sleeve, which extends substantially perpendicular to the sleeve axis, and the flat surfaces 26—26 (FIG. 4) at either side of the point 22 at which the notch extends into the inner space of the sleeve. The notch also has a shoulder 28 which tapers away from the open end of the sleeve and from the sleeve axis to intersect the peripheral surface of the sleeve. An axial groove 30 in the periphery of the sleeve extends from the open end of the sleeve into the sleeve notch. The purpose of this groove will be explained below.

A key 32, preferably of substantially chordal segmental configuration corresponding to the sleeve notch 18 is fitted within the sleeve notch, this key having a portion 34 which extends into the inner space of the sleeve, and a tapered portion 36 which slidably engages the tapered shoulder 28 of the sleeve notch. The arcuate surface 32.1 (FIGS. 4, 5) of the key corresponds in diameter to the outer peripheral diameter of the sleeve and the key has a circumferential groove 38 located near the center of the key which is of a diameter corresponding to the reduced diameter portion 16 of the sleeve, as will be apparent from FIGS. 3 and 4.

A split-ring pressure member 40 of suitable resilient material is fitted around the reduced diameter portion of

the sleeve and around the key groove **38** for biasing the key normally to extend into the inner space of the sleeve. Fitting the key around the reduced diameter portions of the sleeve and key prevents such displacement of the ring from the key as might permit the key to escape from the sleeve notch.

The plug portion **4** of the connector has a body portion **42** and a cylindrical pin portion **44**, and is provided with terminal means (not shown), preferably located oppositely of the pin portion, by which the plug unit can be connected to a wire or otherwise connected in an electrical circuit as pointed out above with reference to the jack unit. Terminal means according to the present invention, or conventional terminal means, whether or not of the same type as is provided in the jack unit of the connector, can be used for the plug within the scope of this invention.

The pin portion of the plug is adapted to fit closely within the jack sleeve and is provided with a tapered end **46** and a circumferential groove **48**. The pin groove is spaced from the tapered end of the pin and forms a shoulder **50** at the side of the groove adjacent the tapered end of the pin which extends transversely from the pin axis. The opposite side of the groove forms a tapered clearance shoulder **52**.

The key **32** normally rests upon the flat surfaces **26—26** at either side of the notch in the jack sleeve and has a portion **34** which extends into the inner space of the empty sleeve. When the pin is inserted into the sleeve, the tapered end **46** of the pin will wedge the key from within the inner space of the sleeve against the bias of the split-ring spring. Then, when the pin groove **48** is aligned with the sleeve notch, the stressed split-ring will bias the key to reenter the inner space of the sleeve to fit within the pin groove and to engage the pin groove shoulder **50**, as shown in FIG. 3. The plug and jack units are thereby locked together preventing withdrawal of the plug pin from the jack sleeve.

As shown in FIG. 4, the key is biased against the bottom **48.1** of the pin groove and thereby presses the plug pin firmly against the inner surface of the sleeve, providing good electrical contact between the plug and jack units of the connector.

When separation of the plug and jack units is desired for breaking electrical connection therebetween, a tool T, preferably offset as shown in FIG. 5, is inserted within the axial groove **30** in the periphery of the jack sleeve and is pressed in the direction indicated by the arrow in FIG. 5 against the key **32**. The key will be thereby wedged from within the hollow inner space of the sleeve against the bias of the split-ring, on the tapered shoulder **28** of the sleeve notch, sliding the split-ring along the reduced diameter portion of the jack sleeve. Wedging the key from within the sleeve releases the plug pin shoulder **50** from engagement with the key and permits withdrawal of the plug pin from the sleeve. Release of pressure by the tool T permits the split-ring biasing means to bias the key to reenter the inner space of the sleeve, sliding the split-ring back toward the open end of the sleeve to the position shown in FIG. 1. It should be understood that although a special tool having the configuration of the tool T as illustrated is to be preferred, this connector could be unlocked by use of a screw driver or similar tool having a projection of a size adapted to fit within the groove **30**.

It can be seen that the jack unit of this invention does not have loosely-fitted parts such as might vibrate noisily within an electrical apparatus when the jack is not in use. However the jack is always ready to receive a plug and will automatically lock the plug therein in firm electrical contact. The plug and jack cannot thereafter be inadvertently separated since a tool is required for unlocking the plug and jack units.

It should be understood that although a particular embodiment of the connector provided by this invention has been shown for the purpose of illustration, this invention includes all modifications and equivalents which fall within the scope of the appended claims.

I claim:

1. An electrical connector comprising: a jack unit having a sleeve open at least at one end, said sleeve having a peripheral notch spaced from said open end and extending into the hollow inner space of the sleeve, said sleeve having an axial peripheral groove which extends into said notch, and said notch having a shoulder tapering away from the notch and from the sleeve axis oppositely of said groove to intersect the peripheral surface of the sleeve; key means fitted within said notch having a portion adapted to extend into the inner space of the sleeve and having a portion slidably engaging said tapered notch shoulder; a plug unit adapted to fit within said sleeve, said plug having a groove spaced from the tip of the plug and extending transversely of the plug axis; and pressure means for biasing said key means normally to extend into the inner space of the sleeve; whereby, when the plug is inserted into the sleeve, the key means will be biased into the plug groove for locking the plug and jack units together in electrical contact and whereby, when a tool is inserted within the sleeve groove and pressed against the key means, the key means will be wedged from within the plug groove by the tapered notch shoulder against the bias of the pressure means for permitting withdrawal of the plug unit from the jack sleeve.

2. An electrical connector comprising: a jack unit having a sleeve open at least at one end, said sleeve having a portion of reduced diameter spaced from the open end thereof, said sleeve having a peripheral notch in its reduced diameter portion which extends into the hollow inner space of the sleeve, said notch having a shoulder which tapers away from the open end of the sleeve and from the sleeve axis to intersect the peripheral surface of the sleeve, and said sleeve having an axial groove in its periphery which extends from the open end of the sleeve into the sleeve notch; a key fitted within the sleeve notch, said key having a portion adapted to extend into the hollow inner space of the sleeve and having a tapered portion which slidably engages the tapered shoulder of the sleeve notch, said key extending from the notch exteriorly of the sleeve to correspond to the larger diameter of the sleeve, and having a central portion of reduced diameter corresponding to the reduced diameter of the sleeve; split-ring means fitted over said reduced diameter portions of the sleeve and the key, respectively, for biasing the key normally to extend within the hollow inner space of the sleeve; and a plug unit having a cylindrical pin portion adapted to fit within the sleeve, said pin portion having a tapered end and having a groove spaced from said tapered end which extends substantially transversely of the pin axis; whereby, when the plug unit is inserted in the jack unit; the tapered end of the pin portion will wedge the key from within the sleeve, whereby when the pin groove is aligned with the sleeve notch, the key will be biased to re-enter the sleeve to fit within the pin groove for locking the plug and jack units together in electrical contact, and whereby when a tool is inserted in the sleeve slot and is pressed against the key, the key will be wedged from within the sleeve against the bias of the split-ring means by the tapered shoulder of the sleeve notch for permitting withdrawal of the plug unit from the jack unit.

3. An electrical connector comprising: a jack unit having terminal means for connecting the jack unit in an electrical circuit and having a sleeve which is open at least at one end, said sleeve having a portion of reduced diameter spaced from the open end thereof, said sleeve having a peripheral notch of substantially chordal segmental configuration in its reduced diameter portion which extends into the hollow inner space of the sleeve, said notch having a shoulder which tapers away from the open end of the sleeve and from the sleeve axis to intersect the peripheral surface of the sleeve, and said sleeve having an axial

slot in its periphery which extends from the open end of the sleeve into the sleeve notch; a key of substantially chordal segmental configuration, corresponding in diameter to the diameter of the sleeve, which is fitted within said sleeve notch, said key having a portion adapted to extend within the hollow inner space of the sleeve and having a tapered portion which slidably engages said tapered shoulder of the sleeve notch, said key having a circumferential groove in the center of its arcuate surface corresponding in diameter to the reduced diameter portion of the sleeve; a split-ring fitted around the reduced diameter portions of the sleeve and key for biasing the key normally to extend within the hollow inner space of the sleeve; and a plug unit having terminal means for connecting the plug in an electrical circuit and having a cylindrical pin portion adapted to fit within the sleeve, said

pin portion having a tapered end and a circumferential groove spaced from said tapered end forming a shoulder which extends substantially transversely from the sleeve axis adjacent the tapered end of the pin; whereby when a tool inserted in the sleeve slot is pressed against the key, the key will be wedged from within the sleeve against the bias of the split-ring by the tapered shoulder of the sleeve notch for permitting withdrawal of the plug unit from the jack unit.

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