April 21, 1953 C. H. JUDISCH 2,636,070

SELF-LOCKING ELECTRICAL CONNECTOR

Filed Sept. 27, 1949

Fig. 1.

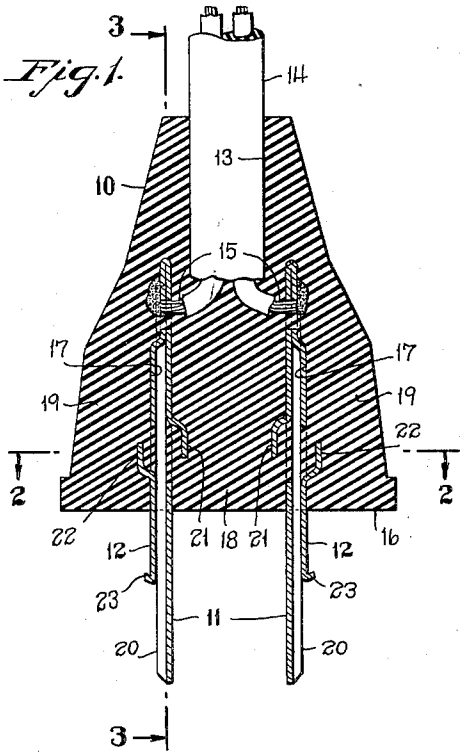


Fig. 2.

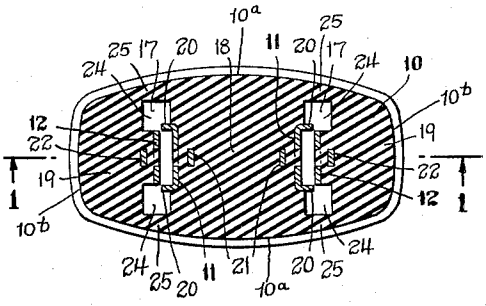


Fig. 5.

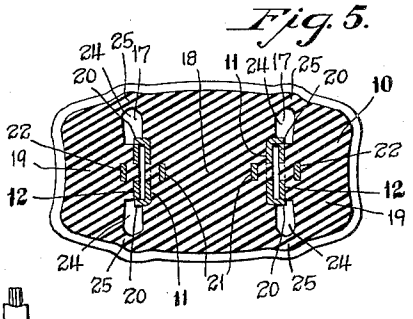


Fig. 3.

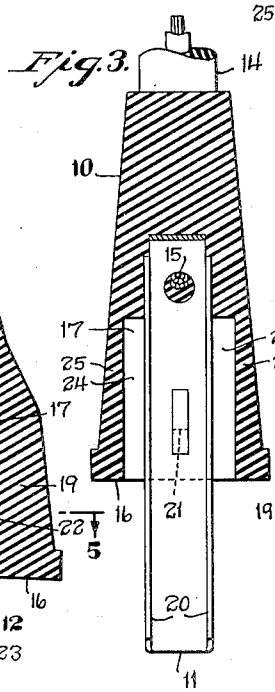


Fig. 4.

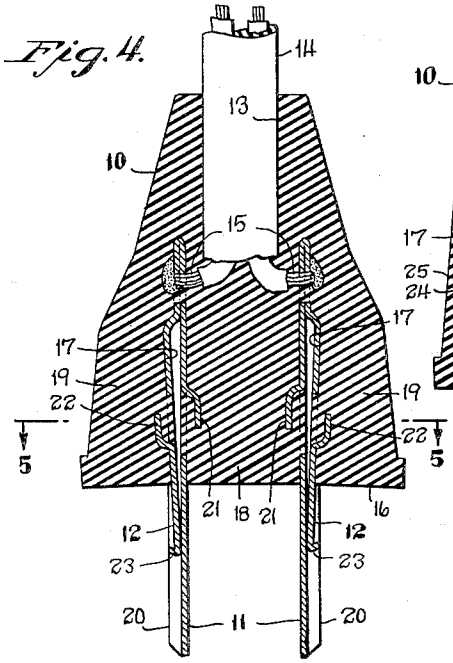
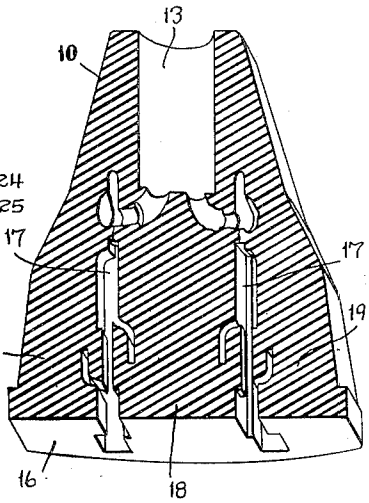


Fig. 6.



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SELF-LOCKING ELECTRICAL CONNECTOR

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Application September 27, 1949, Serial No. 118,025

6 Claims. (Cl. 173—361)

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The present invention relates to improvements in electrical connectors and relates more particularly to improvements in self-locking electrical connectors which are designed and adapted to lock themselves in connected relationship with respect to a receptacle or other electrical fitting so as to avoid accidental disconnection in the event that lengthwise strain is placed upon the wires or cable to which the electrical connector is attached:

As will be apparent from the following, considered in conjunction with the accompanying drawings, the present invention contemplates a unique and highly effective self-locking electrical connector having a body formed of rubber or other suitable resilient material and having projecting from the said body a pair of contact-prongs and a pair of complemental locking arms movable toward the respective contact prongs into unlocking position by laterally compressing the said resilient body.

It is not alleged that the present invention is the first wherein it is proposed to provide a self-locking electrical connector having a resilient body which is laterally yieldable. However, as far as I am aware, all prior self-locking electrical connectors having transversely-yielding resilient bodies have endeavored to devolve the locking function upon the contact prongs themselves, in which construction the lateral spacing of the contact blade has necessarily to be altered in order to effect the locking and unlocking. Such prior construction and arrangement of parts has been open to the very serious objections that not only is it unreliable but exceedingly awkward in use, in view of the fact that the apertures in a companion receptacle are at fixed spacings and the shifting of the contact prongs of the self-locking connector has made it difficult to interfit the latter with a plug-receptacle or the like.

As will also be apparent from the following, the self-locking electrical connectors of the present invention do not require the alteration of the lateral spacing between the contact prongs, and while this latter feature in itself is not original with the present invention, the combination of such feature with the other features herein set forth, has resulted in a unique structure possessing marked advantages over the prior art.

One of the main objects of the present invention is to provide a superior self-locking electrical connector characterized by ease and facility of use, together with reliability of operation.

Another object of the present invention is to provide an electrical connector of the character

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referred to which does not require the lateral movement of the contact prongs or members in order to effect the locking and unlocking actions.

A further object of the present invention is to provide a superior self-locking electrical connector which may have its metallic parts together with wires or cables leading therefrom, encased in a resilient body by a simple molding operation to thus lower cost of manufacture and provide a connector which will not readily come apart.

Other objects and advantages will appear to those skilled in the art from the following, considered in conjunction with the accompanying drawings.

In the accompanying drawings, in which certain modes of carrying out the present invention are shown for illustrative purposes:

Fig. 1 is a longitudinal sectional view taken on the line 1—1 of Fig. 2 and showing the parts in the positions which they assume when the locking arms are in position to interlock the electrical connector with a plug receptacle or the like;

Fig. 2 is a transverse sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a longitudinal sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a longitudinal sectional view similar to Fig. 1 but showing the locking arms retracted;

Fig. 5 is a transverse sectional view similar to Fig. 1 but taken on the line 5—5 of Fig. 4; and

Fig. 6 is a sectional perspective view of the body taken on the central flatwise plane thereof.

The particular self-locking electrical connector herein chosen for purposes of illustrating a preferred embodiment of the present invention, is in the form of a double-pronged plug unit of the type adapted to be thrust into and pulled out of connection with an electrical supply receptacle or outlet, which plug unit comprises a resilient body generally designated by the reference character 10, two corresponding or like contact prongs or members, each generally designated by the reference character 11, and two corresponding flexible locking arms or members, each generally designated by the reference character 12. As shown, the plug body is generally oblong in cross-section, with a pair of opposed relatively broad lateral faces 10a and a pair of opposed narrower lateral faces 10b substantially perpendicular thereto.

The body 10 may be formed of any suitable resilient insulating material such, for instance, as natural rubber compounds, synthetic rubber compounds, compounds of synthetic rubber and

natural rubber or synthetic resins. Some of the resilient insulating materials suitable for the present purposes are:

(1) Vulcanized copolymers of styrene and butadiene,

(2) Vulcanized copolymers of polyisobutylene and isoprene or butadiene,

(3) Vulcanized polychloroprene,

(4) Vulcanized copolymers of butadiene and acrylonitrile,

(5) Vulcanized organic polysulfide,

(6) Plasticized vinyl chloride polymers, and

(7) Plasticized vinyl chloride-vinyl acetate copolymers.

Extending axially in the inner or cord end of the body 10 is a passage 13 into which is fitted the end portion of a multiple-conductor cable or cord 14 having, in the present instance, two sets of individually insulated conductors 15—15 each preferably formed of a group of fine strands of copper or the like.

Formed in the resilient body 10 and opening through its outer or prong end 16, is a pair of like prong-anchoring recesses or cavities 17—17 which extend longitudinally in the said body in substantial parallelism with each other and in spaced-apart relation on opposite sides of the plug axis. Each of the said recesses is of slot-like form in cross section with its major cross-sectional transverse dimension extending in a direction substantially perpendicular with respect to a line drawn between the two recesses. The two said laterally spaced apart recesses 17—17 serve, in effect, to divide the one-piece resilient body 10 into three longitudinally extending sections or arms which are aligned, in normally spaced-apart relation, in the direction of the major cross-sectional dimension of the plug body, namely, a central "spacing-arm" or section 18 extending substantially in an axial direction away from the cable 14, parallel to and situated between those portions of the contact prongs or blades which are within the plug body 10; together with two outer flexible "releasing arms" or end sections 19—19 which are movable toward and away from each other and toward and away from the spacing arm 18 in a manner that will hereinafter appear. As compared to the flexible outer lock-controlling or releasing arms 19, the central prong-spacing arm is seen from the drawings to be relatively massive and unyielding.

Respectively located in the recesses 17—17 in the body 10 are the inner portions of the contact prongs 11—11 before referred to and which contact prongs project at their outer ends from and beyond the outer end 16 of the said body 10. Each of the said contact prongs may be conveniently formed up of spring brass or other suitable resilient metal, and in the instance shown is channel-like in cross-section, being formed with parallel side flanges 20—20 which are spaced from each other a distance sufficient to freely accommodate between them the companion or associated locking-arm 12. The said flexible locking arm is preferably pretensioned or biased so as to normally tend to stand in spaced relationship outwardly from its companion contact blade 11 as is especially well shown in Figs. 1 and 2.

Preferably and as shown, each contact prong 11 and its companion locking arm 12 are integrally united with each other at their respective inner or upper ends. Adjacent its junction with the companion contact prong 11, each locking arm 12 is preferably flattened tightly against the adjacent face of the said contact prong as shown, and in this area of contact, both the contact prong 11 and its companion locking arm 12 are jointly pierced transversely to provide an aperture through which the bared end of the adjacent one of the conductors 15 may be passed and soldered or otherwise rigidly connected to the unit comprising the two members 11 and 12.

As thus constructed and arranged, each contact prong 11 is mounted against the inner wall of the particular recess 17 in which it is located and is preferably firmly coupled to the said wall in any suitable manner such, for instance, as by being provided with an offsetting coupling finger 21 embedded in the resilient material from which the body 10 is formed. Each locking arm 12 is located against the outer wall of the particular recess 17 in which it is mounted and is preferably firmly coupled to such wall in any suitable manner such, for instance, as by striking therefrom a coupling finger 22 which is embedded in the resilient material from which the body 10 is made. At its lower end, each resilient locking arm 12 has detent or latching provision, said end being in this instance bent outwardly away from the companion contact prong 11 to provide a hook-like locking finger 23.

One of the features of a preferred embodiment of the present invention is the secure attachment of a given contact prong 11 to the inner wall of the particular recess 17 in which it is mounted and the attachment of the companion locking arm 12 to the outer wall of the said recess, whereby the tension of the resilient body 10 will serve to yieldingly hold a given locking arm 12 away from its companion contact prong 11, as is shown in Figs. 1 and 2. In addition to or in lieu of the attachment provided by the coupling fingers 21 and 22, the contact prongs 11 and the locking arms 12 may be secured to the respective walls of a given recess 17 by being suitably adhered to the material from which the body 10 is formed, in a manner well known in the art.

Suitable cements for effecting the adhering just above referred to are numerous, but the following may be mentioned by way of example:

(1) Cements made from solutions or dispersions of rubber conversion products such as are produced by the action of sulfuric acid or benzene-sulfonic acid on natural crude rubber,

(2) Alkyd resin cements,

(3) Polychloroprene cements, and

(4) Cements made of natural or synthetic rubber compositions containing vulcanizing agents.

It will be noted by reference to Figs. 2 and 3, in particular, that each longitudinal recess 17 has its major transverse dimension in a direction substantially perpendicular to a line drawn between the two said recesses, and this major transverse dimension is greater than the similar transverse dimension of both the contact prong 11 and companion locking arms 112 mounted therein. This relationship, in effect, causes the respective opposite edges of each of the said recesses to constitute longitudinal clearance channels 24—24. As thus proportioned, each releasing arm 19 is integrally connected to the central spacing arm of the body 10 by means of relatively thin flexible and compressible connecting webs 25—25.

Preferably, the body 10 is injection-molded in one piece around the elements 11, 12, 14 and 15, during which molding operation suitable removable fillers (i. e. core material) may be placed

between a given contact prong 11 and its complemental locking arm 12 to exclude the resilient material from therebetween, whereby to maintain them normally spaced apart to the extent indicated in Figs. 1 and 2, and to laterally extend the cross-sectional dimensions of the recesses 17 to form the clearance channels 24 and the flexible connecting webs 25.

The self-locking electrical connector above described is adapted to have its contact prongs 11—11 inserted together with the companion locking arms 12—12) through the usual slots or apertures in another electrical connector of any suitable character and commonly known as a "plug receptacle." Such plug receptacles are frequently formed interiorly with abutments with which the respective locking fingers 23—23 may engage to releasably couple or interlock the connector of the present invention with such plug receptacle, all in a manner well understood in the art.

To effect the insertion of the contact prong 11—11 and the companion locking arms 12—12 into the usual slots or apertures in a plug receptacle or the like, the body 10 may be squeezed by finger pressure applied simultaneously to the respective outer faces of the flexible releasing arms 19—19 of the said body. The described squeezing will cause the said releasing arms 19—19 to flex inwardly toward each other, thereby, in turn, inwardly flexing the locking arms 12—12 toward their respective contact prongs 11—11 into substantially the positions in which the parts are shown in Figs. 4 and 5. It will be noted that when the body 10 is squeezed as just described, the locking fingers 23—23 of the respective locking arms 12—12 will be retired close to their respective contact prongs 11—11, as is especially well indicated in Fig. 4, without materially altering the predetermined spacing between the said contact prongs 11—11.

Upon the squeezing pressure above referred to being released, the locking arms 12—12 will be restored to substantially the positions in which they are shown in Figs. 1 and 2, under the combined urge of the locking arms themselves and of the resilient material of the body 10, so that the locking fingers 23—23 will be in position to engage with any suitable abutments within a plug receptacle to interlock the device of the present invention with the said plug receptacle.

Where, as is often the case, the plug receptacle is provided with suitably formed guide surfaces sloped to the prong receiving apertures, entry of the prong-and-locking-arm units of the present novel plug connector construction into said apertures may obviously be effected by a simple thrusting movement, without applying the described squeezing pressure to the end sections 19 of the plug connector.

To effect the disconnection of the electrical connector of the present invention from a plug receptacle or the like, the squeezing action above referred to may be repeated and the entire connector withdrawn from the plug receptacle before the squeezing pressure referred to is relaxed.

During the squeezing of the body 10, as above described, the locking arms 12—12 move inwardly as described, without causing the material displacement of the contact prongs 11—11 toward each other, which thus remain substantially in their predetermined spaced-apart relationships, whereby they may be readily entered into and removed from a plug receptacle or the like.

During the described squeezing of the body 10 to effect the retirement of the locking arms 12—12, the connecting webs 25 of the body 10 provide, in conjunction with the clearance channels 24, a flexible action which permits the ready retirement of the said locking arms even by relatively-weak finger pressure, without appreciably disturbing the spacings of the contact prongs 11—11.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. A self-locking electrical connector plug comprising a plug body of resilient insulating material having a cord end and a prong end and a pair of opposed relatively broad lateral faces, a pair of contact prongs anchored within said body and projecting from said prong end in substantially fixed parallel relation to each other, the inner portions of the prongs being disposed in spaced parallel slots formed within said body and dividing it longitudinally at this locality into a central prong supporting and spacing section and two end sections, each of said slots being substantially wider than the thickness of the prong disposed therein and extending beyond both edges of said prong transversely of said body toward the broad lateral faces thereof, whereby to give said body maximum flexibility along the slot ends, said contact prongs being firmly secured within their respective slots to said central supporting and spacing section; a pair of locking arms each firmly secured within one of said slots to the adjacent end body section in spaced relation to the contact prong secured to said section, each said arm projecting outwardly from the open end of the slot and having detent provision for locking engagement with cooperating detent provision in a plug receptacle into which the plug is adapted to be thrust, said locking arms being movable inwardly to clear the receptacle detent provision by compressing said end sections toward said central section against the resiliency of said body material; and means connecting lead wires to the inner ends of the prongs.

2. A self-locking electrical connector as defined in claim 1, wherein each of said contact prongs is provided with side flanges adapted and arranged to permit entry between them of the respective locking arm associated with such prong.

3. A self-locking electrical connector as defined in claim 2, wherein said contact prongs and locking arms are formed of suitable resilient metal, and the locking arms are so biased that each normally tends to maintain the spaced relationship between it and the contact prong with which it is associated.

4. A self-locking electrical connector as defined in claim 3, wherein each said contact prong and its associated locking arm are united with each other at their ends located within the plug body, and to those junctions are secured the conductor terminals of a multiple conductor cord of which the end portion enters said plug body.

5. A self-locking electrical connector as defined in claim 4, wherein said plug body is composed of resilient insulating material molded in

one piece about the other elements specified in said claim.

6. A self-locking electrical conductor as defined in claim 5, wherein said cavities, in which are located the units each comprising a contact prong and an associated locking arm, extend laterally beyond both edges of both said units to such a distance as to provide that the resilient connection of each lock-controlling section of the plug body is constituted by relatively thin, flexible and compressible webs of said insulating material.

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