June 18, 1957 R. S. CARTER ET AL 2,796,591

ELECTRICAL CONNECTOR

Filed Aug. 30, 1955

FIG. 1.

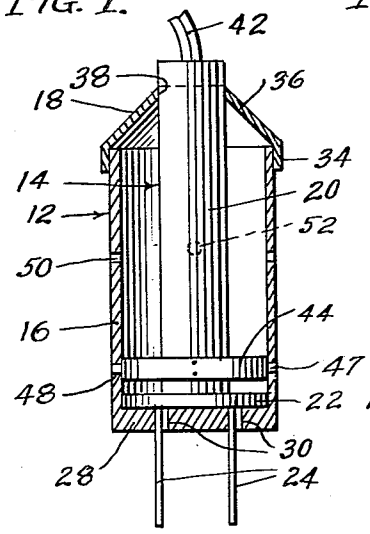


FIG. 2.

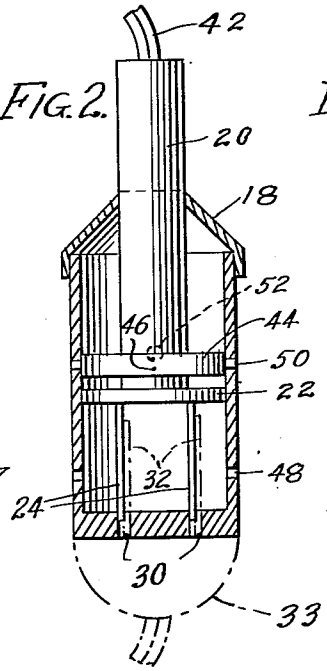


FIG. 3.

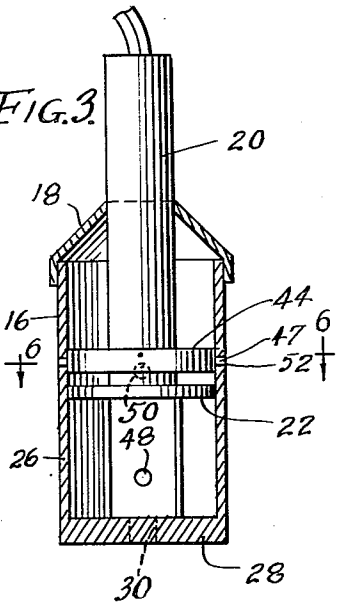


FIG. 4.

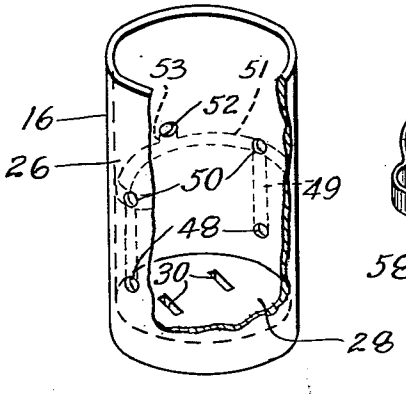


FIG. 5.

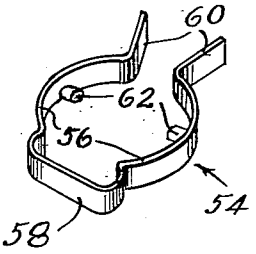
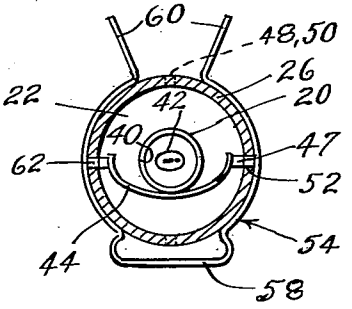


FIG. 6.



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ELECTRICAL CONNECTOR

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11 Claims. (Cl. 339—31)

The present invention relates to electrical connectors or "plugs." The device of the invention is one part of an electrical connector, such connector being made up of a pair of parts connected respectively to electrical cord lengths and utilized for interconnecting the cord lengths by interconnecting the said parts.

The device, as will be brought out fully hereinafter, may serve alternatively as a male or a female connector part, and thus will be a plug when serving as a male connector part and a socket when serving as a female connector part. The term "plug" is sometimes commonly used generically to include connector parts of both male and female character, but as used hereinafter it will designate a male connector part.

An object of the invention is to provide an electrical connector part of the foregoing general character and of novel construction that is adjustable for converting it selectively to a male part to be used as a plug or a female part to be used as a socket.

Another object is to provide an electrical connector part of novel construction, that is, adjustable for rendering its contact terminals inaccessible, and thus the device unusable, whereby a safety measure is provided against irresponsible use, as by a small child.

A further object is to provide a connector part of the foregoing character having contact terminals movable to projected position whereby the device may be used as a plug, and to a retracted position whereby the terminals of a cooperating plug may be inserted into the device in engagement with the retracted terminals, and to a third position in which the terminals are positioned totally within the housing of the device and inaccessible to the hands or practically speaking to an element inserted into the housing.

Another object is to provide a connector part of the foregoing character having novel means for releasably locking the terminal-carrying member in any of the positions of the terminals.

A still further object is to provide an electrical connector part of the foregoing character including a control key for releasing the terminal-carrying member from any of its locked positions, that is detachable from the fitting and without which the terminal-carrying member cannot practically be released, whereby the device may be locked in any of its positions and the key removed therefrom; and when the device is locked in unusable position it is rendered safe from attempted irresponsible use as by a small child.

Still another object is to provide a device of the foregoing character that is of unusually simple construction and thus inexpensive, and which is very rugged.

Other objects and advantages of the invention will be apparent from the following detail description taken in conjunction with the accompanying drawing in which:

Fig. 1 is a longitudinal sectional view of the connector part embodying the invention, showing the contact terminals in projected position and the device in position for serving as a plug;

Fig. 2 is a view similar to Fig. 1 but with the terminals in retracted position and the device in a position to serve as a socket;

Fig. 3 is similar to Figs. 1 and 2 but with the contact terminals inaccessible and the device locked against use;

Fig. 4 is a perspective view of the main part of the housing with a portion broken away, and indicating in dot-dash lines certain grooves that may be provided therein;

Fig. 5 is a perspective view of the unlocking key; and

Fig. 6 is a cross sectional view of the device as taken on line 6—6 of Fig. 3, and including the key applied thereto.

Referring in detail to the accompanying drawings, the connector part, which may also be referred to as a line terminal device, is made up of two main parts, namely, a housing or casing **12** and a central core or movable member **14** mounted in the housing. The housing **12** includes preferably two pieces, a main part **16** and a cap **18**, while the central core or movable member **14** includes a body **20**, a flange **22** at an inner end thereof and a pair of contact terminals or prongs **24**.

The housing or casing **12** serves as the means for grasping the device or handling and manipulating it and the central core or movable member **14** is adjusted or moved within the housing for converting the connector part selectively to a plug or socket or, in other words, to a male connector part or female connector part, respectively. The contact terminals **24**, when the device is converted to a plug, are positioned for insertion into a cooperating conventional socket. On the other hand, when the device is converted to a socket, the contact terminals or prongs are withdrawn substantially into the housing as in Fig. 2 and the device then serves as a socket.

The piece **16** of the housing **12** includes a cylindrical wall **26** and an end wall **28** which may be and preferably are integral. The piece **16** may suitably be of a molded plastic, a plastic that possesses high insulating characteristics as is of course desirable in an electrical plug. In fact, all of the parts are of similar insulating characteristics except of course the contact terminals themselves and elements connecting them in circuit.

The end wall **28** is formed with a pair of spaced openings **30** for receiving the contact terminals or prongs **24**, the latter as in the case of conventional connectors, being flat and plate-like in shape. The holes **30** are elongated slots of a dimension in their long direction similar to the width of the prongs but of a width substantially twice the thickness of the prongs. Such relative dimensioning of the prongs and holes enables reception of contact elements of another plug (**32**, Fig. 2) thereinto in engagement with the prongs **24**. The details of this relationship will be discussed fully hereinafter.

The opposite end of the housing piece **16** itself is open, but is normally closed in the assembled device by the cap **18** which may also be of molded plastic. The cap has a skirt **34** frictionally fitted or otherwise detachably secured to the open end of the housing piece **16**. This relation normally retains the cap on the housing piece but enables it to be removed therefrom when force is applied for that purpose, as by grasping it by the hand and withdrawing it. The cap conveniently includes a tapered wall **36** defining a central opening **38** for receiving the body **20**.

The central core or movable member **14** has sliding and guiding engagement at opposite ends with the housing **12**. The flange or disc **22** is dimensioned for slidingly engaging the inner surface of the wall **26** and is thus guided at its inner end. The other and outer end of the body has similar sliding and guiding engagement in the hole **38**. The fit at both of these locations is such as to enable

free sliding movement of the movable member **14** in response to manual manipulation but is such as to prevent undue side play.

The movable member **14** which carries the contact terminals **24** is also preferably of molded plastic and it may be a unitary piece having the body **20** or flange and disc **22** molded in one operation. The contact terminals or prongs **24** are secured to the body by any suitable means such as a conventional arrangement of screw securement and extend longitudinally from and beyond the inner end of the body. The body **20** is preferably tubular in form having a central bore **40** (Fig. 6) through which the electric cord or line **42** extends. This cord includes separate conductors respectively secured to the contact terminals **24** in the usual way.

The means mentioned above for releasably locking the central movable member **14** in any of the positions to which it is moved takes the form of a flexible and resilient element **44**. This means functions to lock the member in any of its two positions of Figs. 1 and 2 and a third position of Fig. 3 which will be fully described hereinafter. The resilient element in the present instance is a leaf spring secured to the body **20** by suitable means such as rivets **46** at a central portion of the spring. This spring is arcuate as viewed axially (Fig. 6) and has at each end a lug **47** extending radially outwardly therefrom. The two lugs at the end of the leaf spring are urged outwardly by the self-biasing effect of the leaf spring for projection into the sets of apertures **48**, **50** and **52**. These apertures are formed in the cylindrical wall element **26** and the apertures of each set are disposed generally diametrically opposite each other. The lugs **47** being biased outwardly are adapted to enter into the respective apertures when in register therewith for detachably locking the movable member in the corresponding positions, the sets of apertures being located appropriately for that purpose. The spring **44** is secured to the body **20** preferably at a location adjacent the flange or disc **22**, thee beng a substantial space between the body **20** and cylindrical wall **26** in which the spring is accommodated and since it is adjacent the flange **22** it enables substantial axial movement of the member **14**.

The position of the parts as indicated in Fig. 1 renders the device a male connector part or plug. In this position the core or movable member **14** is moved to its "forward" or projected position in which the contact terminals or prongs **24** are projected the maximum extent through the slots **30**, movement of the member **14** in that direction being limited by the flange **22** engaging the end wall **28**. The first set of apertures **48** in the cylindrical wall element **26** are located to receive the lugs **47** when the movable member is moved to its projected position. These lugs thus lock the movable member in that location so that the connector part can be used as a plug, namely, it can be fitted to a socket by inserting the prongs **24** into the latter. The leaf spring **44** is of course of substantial strength and capable of withstanding all normal forces imposed on it in inserting the plug into a socket and removing it therefrom.

The locking means **44**, **47** is manually releasable from its locked position as will be described in detail later, whereby the core or movable member **14** is movable from its projected position of Fig. 1 to its retracted position of Fig. 2. This is accomplished by ejecting the lugs **47** from the apertures and when this is done, the user may, by grasping the exposed end portion of the body **20** and drawing outwardly on it, move the member **14** to retracted position, as shown in Fig. 2, and when it reaches that position the lugs **47** snap into the apertures **50** and lock the member in that position. The arrangement between the elements is such that in the retracted position the extended ends of the prongs remain within the axially spaced confines of the slots or holes **30**. The thickness of the end wall **28** is substantial and the ends of the prongs when the central member is in its retracted position bear against one side surface of the slots. There is space between the prongs and the opposite side surfaces of the slots sufficient to snugly receive the contact elements **32** of the plug **33** with which the connector part can be connected to form a connector in a line. These contact elements **32** as is common in conventional connectors, may be of flat plate-like form, similarly to the prongs **24**, and when they are inserted in the slots **30**, as noted above, a tight friction-gripping relation is established between the elements **32** and the opposite confining surfaces so that firm contact engagement is established between the elements **32** and the contact terminals or prongs **24**. Thus the position of the device of Fig. 2 renders the device as a socket or female connector part cooperable with a plug to form a connector. The thickness of the end wall **28** is preferably such that the prongs **24** may be retracted to such an extent that the ends thereof are not exposed at the outer surface of the end wall, avoiding contact of a person's fingers with them and consequent shock, while providing the necessary support for engagement by the ends of the prongs to maintain them solidly in position in contact with the elements **32**.

The present invention also includes a feature whereby the device can be rendered unusable. This is accomplished by withdrawing the prongs entirely into the housing and moving them out of alignment with the slots **30**. After releasing the lugs **47** from the upper apertures **50** the core or movable member **14** can then be withdrawn further in a rearward direction (upwardly from Fig. 2) so that the prongs **24** are withdrawn entirely from the slots **30**. The member **14** can then be rotated, it being freely rotatable in the housing, to a position in which the prongs are disposed out of alignment with the slots and spaced in a direction transverse to the spacing of the slots. The third set of apertures **52**, as will be seen best in Fig. 2, are disposed for receiving the lugs **47** when the member **14** is moved to its third position as just described, being positioned substantially transversely to the other sets. The member **14** is thus locked in that position. The prongs are withdrawn from access to the exterior; for convenience they may actually engage the inner surface of the end wall **28**. The connector part is thus rendered safe from irresponsible attempted use as noted above and from engagement by the fingers with the prongs or contact terminals. Preferably grooves are provided in the inner surface of the housing for guiding the prongs **47** in movement between positions, namely, longitudinal grooves **49** interconnecting the respective apertures **48**, **50**, a circular groove **51** extending the full circumference of the housing and including the apertures **50** and short longitudinal grooves **53** connecting the latter with the apertures **52**.

It is desired that the device be rendered immune against unauthorized tampering. For this purpose a detachable key (Fig. 5) is provided, the device having construction for cooperation with the core. The key **54** is made up of a piece of flexible spring steel material and includes opposite rounded portions **56** connected together by a central piece **58** and having end finger grip pieces **60**. Extending inwardly laterally from the rounded portions **56** are pins **62**. The key is thus in the form generally of a band and is of such dimensions and shape as to effectively surround a cylindrical wall **26**; that is, the rounded portions **56** are of such dimensions that when they engage and grip the cylindrical wall they retain the key thereon. The key is applied to the cylindrical wall for unlocking the lugs **47** which is accomplished by fitting the key to the cylindrical wall with the pins **62** extended into the apertures of a pair (**48**, **50**, or **52**) from which the lugs **47** are to be ejected. The key or band is of resilient material and self-biased inwardly, and of such strength that when it is released on the cylindrical housing with the pins inserted into the apertures the pins engage the lugs **47** and eject them from the apertures. The core or member **14** is thus unlocked and free to be

moved from the position it happens to be in to another position.

The key may be removed from the connector part so that the device cannot be tampered with and the device can be adjusted practically only by use of the key. Thus the device may be adjusted to its locked position of Fig. 3 and the key removed. It is then rendered safe against attempted use. The device may similarly be locked in either of its other positions (Fig. 1 or Fig. 2) and rendered non-adjustable therefrom by removing the key.

We claim:

1. An electrical connector part comprising a housing having openings therein, a member movably mounted in the housing and having contact terminals thereon, an electrical cord connected with the terminals and extended to the exterior of the housing, the member being movable between a projected position wherein the contact terminals are extended through the openings and positioned exteriorly for insertion into a socket, and a retracted position wherein the terminals are entirely within the exterior surface of the housing and in alignment with the openings, the terminals and openings being so relatively dimensioned that contact elements of another plug can be inserted through the openings and into direct contact engagement with the retracted terminals, whereby the present device is usable alternatively as a plug or a socket, the housing having a portion engaged with said terminals when said member is in its retracted position for supporting the terminals against lateral displacement by the said contact elements of another plug from a predetermined position relative to the openings, and means for releasably locking the member in each of its said positions.

2. An electrical connector part comprising a housing having an end wall with spaced openings each of elongated shape, a movable member mounted in the housing carrying contact terminals respectively positionable in said openings, the terminals being of blade-like form, and straight with uniform flat contact surfaces, a cord connected with the terminals and extending to the exterior of the housing, the member being movable between a projected position in which the terminals are extended through the openings to the exterior and the device is usable as a plug, and a retracted position in which the terminals are totally within the outer surface of the housing but the ends thereof are positioned in the openings and within the inner and outer surfaces of the end wall, the openings being wider in their short-dimension direction than the thickness of the terminals whereby similar blade-like contact elements of another plug can be inserted into the openings and friction-gripped between the surfaces of the openings and the retracted terminals and thus into firm contact engagement with the latter, and means releasably locking the member in either of its said positions.

3. An electrical connector part comprising a housing having openings therein, a member movably mounted in the housing and having contact terminals thereon, an electrical cord connected with the terminals and extended to the exterior of the housing, the member being movable between a projected position wherein the contact terminals are extended through the openings and positioned exteriorly for insertion into a socket, and a retracted position wherein the terminals are entirely within the exterior surface of the housing and in alignment with the openings, the terminals and openings being so relatively dimensioned that contact elements of another plug can be inserted through the openings and into contact engagement with the retracted terminals, whereby the present fitting is usable alternatively as a plug or a socket, and means for releasably locking the member in each of its said positions, a flexible element carried by the movable member and having lugs biased outwardly, and the housing having pairs of apertures positioned respectively for receiving said lugs in the said positions of the movable member, and the flexible element being manually manipulable for removing the lugs from the apertures and releasing the member for movement between its said positions.

4. An electrical connector part comprising a housing having openings therein, a member movably mounted in the housing and having contact terminals thereon, an electrical cord connected with the terminals and extended to the exterior of the housing, the member being movable between a projected position wherein the contact terminals are extended through the openings and positioned exteriorly for insertion into a socket, and a retracted position wherein the terminals are entirely within the exterior surface of the housing and in alignment with the openings, the terminals and openings being so relatively dimensioned that contact elements of another plug can be inserted through the openings and into contact engagement with the retracted terminals, whereby the present device is usable alternatively as a plug or a socket, and means for releasably locking the member in each of its said positions, a leaf spring secured at its central portion to the movable member and having lugs at its end biased outwardly, the housing having pairs of apertures positioned respectively for receiving said lugs in said positions of the movable member, and the lugs being accessible from the exterior for depression inwardly from the apertures and release of the movable member for movement between its said positions.

5. An electrical connector part comprising a housing having an end wall at one end and a reduced diameter body-opening at the other end, a movable member generally within the housing and including a body portion with an outer end extending through said body-opening and having sliding and guiding fit therein, and a flange on the body portion at an inner end having sliding and guiding fit in the housing, the member having contact prongs mounted on its inner end, a cord connected with the prongs and extending to the exterior of the housing, the end wall having openings for receiving the prongs, the member being movable longitudinally between a projected position in which the prongs are extended through the prong-openings and the connector part is usable as a plug and a retracted position in which the terminals are entirely within the exterior surface of the housing and in alignment with the openings, the terminals and openings being so relatively dimensioned that contact elements of another plug can be inserted through the openings and into contact engagement with the retracted terminals, whereby the present device is usable alternatively as a plug or a socket, and means for releasably locking the member in each of its said positions.

6. An electrical connector part comprising a housing having an end wall with spaced openings therein, a member movably mounted in the housing with contact terminals for projection through said opening, a cord connected with said terminals and leading to the exterior of the housing, said member being movable in said housing selectively to any of three positions, namely, (first) a projected position in which the terminals are extended through said openings and the connector may be used as a plug, (second) a retracted position in which the terminals are within the outer surface of the housing and in alignment with the openings and the connector may be used as a socket with the openings receiving contact elements of another plug in contact engagement with said terminals, and (third) a locked position in which the terminals are within the housing and positioned out of alignment with the openings and the connector is then unusable, and means for releasably locking the member in each of its said positions.

7. An electrical connector part comprising a housing having spaced openings therein, a member movably mounted in the housing and having contact terminals for projection through said openings, the member being movable between a projected position in which the terminals

are extended through the openings and a second position wherein the terminals are positioned within the outer surface of the housing, means for releasably locking the member in either position including an element carried by the member and having lugs projected into respective sets of apertures in the housing, the lugs when in the apertures being exposed to the exterior of the housing, and a key for detachably mounting on the exterior of the housing having pins projectable into the openings corresponding to each position for ejecting the lugs therefrom and thereby releasing the movable member from its locked position and enabling its movement to another position.

8. An electrical connector part comprising a housing having spaced openings therein, a member movably mounted in the housing and having contact terminals for projection through said openings, the member being movable between a projected position in which the terminals are extended through the openings and a second position wherein the terminals are positioned within the outer surface of the housing, means for releasably locking the member in either position including an element carried by the member and having lugs projected into respective sets of apertures in the housing, the lugs when in the apertures being exposed to the exterior of the housing, and a key for releasing the movable member from locked position including a flexible and resilient band attachably mounted on and effectively encircling the housing and having inwardly extending pins, the band being positionable on the housing with the pins projecting into a set of apertures for ejecting the lugs therefrom.

9. A connector part comprising a housing, a member carrying contact terminals in the housing movable between a position in which the terminals are projected through openings in the housing, and a position in which they are withdrawn in the housing, means releasably locking the member in either position and having lugs retractably extended into a respective set of openings in the housing and exposed to the exterior, and a key detachably mounted on the exterior of the housing having pins retractably extendible into the apertures and thereby effective for ejecting the lugs therefrom.

10. A connector part comprising a housing having an end wall with spaced terminal openings therethrough and having a body-opening at its opposite end of smaller diameter than the housing, a movable member in the housing having a body with an outer end portion guided in the body-opening and a flange on the inner end guided in the housing, contact terminals extending longitudially from the flange end of body, the member being movable to any of three positions, namely (first) a projected position in which the terminals extend through the terminal openings and the device can be used as a plug, (second) a retracted position in which the terminals are positioned within the outer surface of the housing in alignment with the openings whereby the device can be used as a socket with the openings receiving the contact elements of another plug in engagement with said terminals, and (third) a locked position in which the terminals are within the housing and rotated to a position disposed generally transverse to the spacing of the openings, means for releasably locking the member in any of its said positions including a leaf spring secured at a position between its ends to said body between said flange and the outer end of the body and having outwardly directed lugs at its ends, the spring being self-biased for urging the lugs outwardly into apertures in the housing, the housing having a set of apertures positioned according to each said position for receiving said lugs, the lugs when in the apertures being exposed to the exterior of the housing, and a key consisting of a flexible and resilient band dimensioned for effectively surrounding the housing and detachably mountable thereon and having inwardly directed pins for projection into the apertures of a set, selectively, for ejecting the lugs therefrom and thereby releasing the movable member from the corresponding position and enabling its movement to another one of its said positions.

11. The invention set forth in claim 9 wherein the respective sets of openings are interconnected by grooves for guidingly receiving the lugs in movement from one position to another.

References Cited in the file of this patent

UNITED STATES PATENTS

2,538,296 Crocker ---------- Jan. 16, 1951