April 21, 1964 J. I. ROSS 3,129,993

HERMAPHRODITIC ELECTRICAL CONNECTORS

Filed March 8, 1961 4 Sheets-Sheet 1

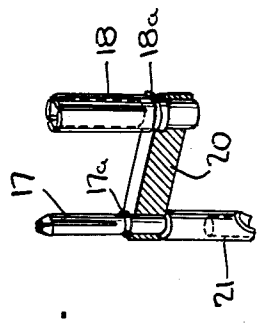


Fig. 4.

Fig. 1.

INVENTOR.
JOSEPH I. ROSS

BY

Kenyon & Kenyon

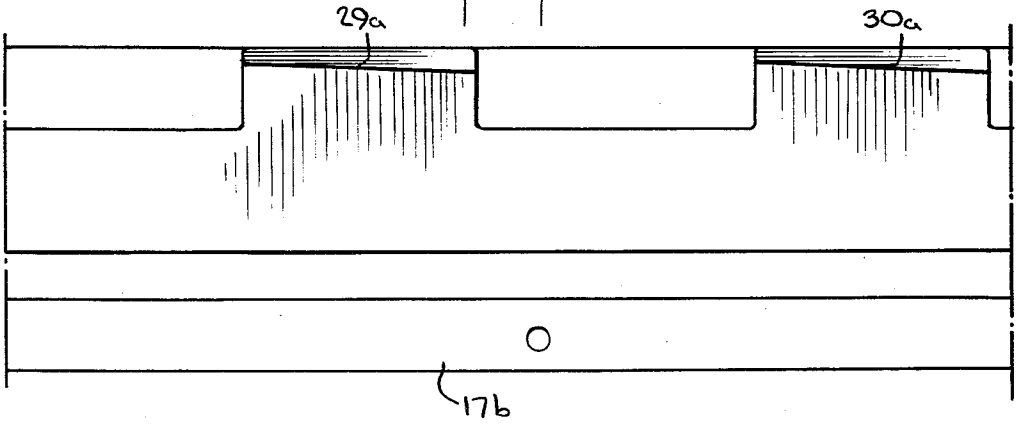
ATTORNEYS

April 21, 1964 J. I. ROSS 3,129,993

HERMAPHRODITIC ELECTRICAL CONNECTORS

Filed March 8, 1961 4 Sheets-Sheet 2

Fig. 10.



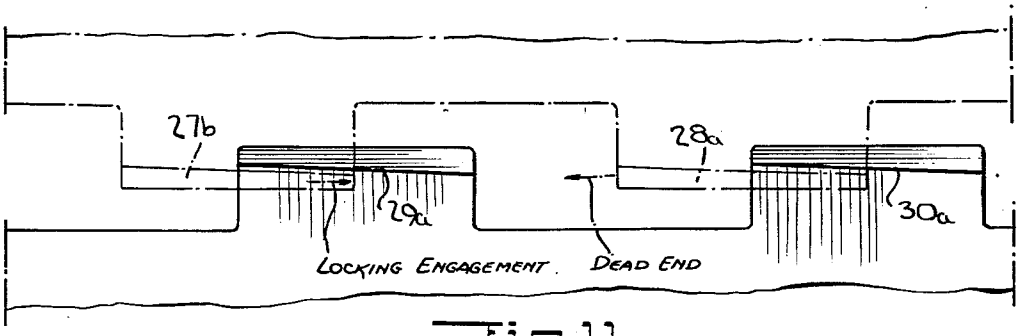
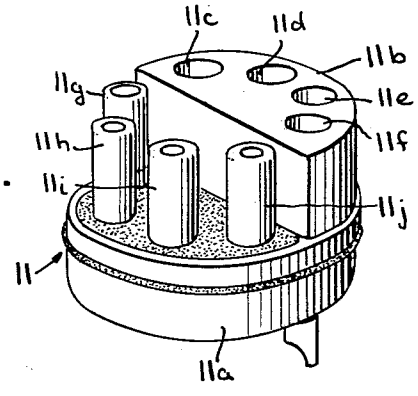


Fig. 11.

Fig. 2.



INVENTOR.
JOSEPH I. ROSS

BY

Kenyon & Kenyon
ATTORNEYS

April 21, 1964 J. I. ROSS 3,129,993

HERMAPHRODITIC ELECTRICAL CONNECTORS

Filed March 8, 1961 4 Sheets-Sheet 3

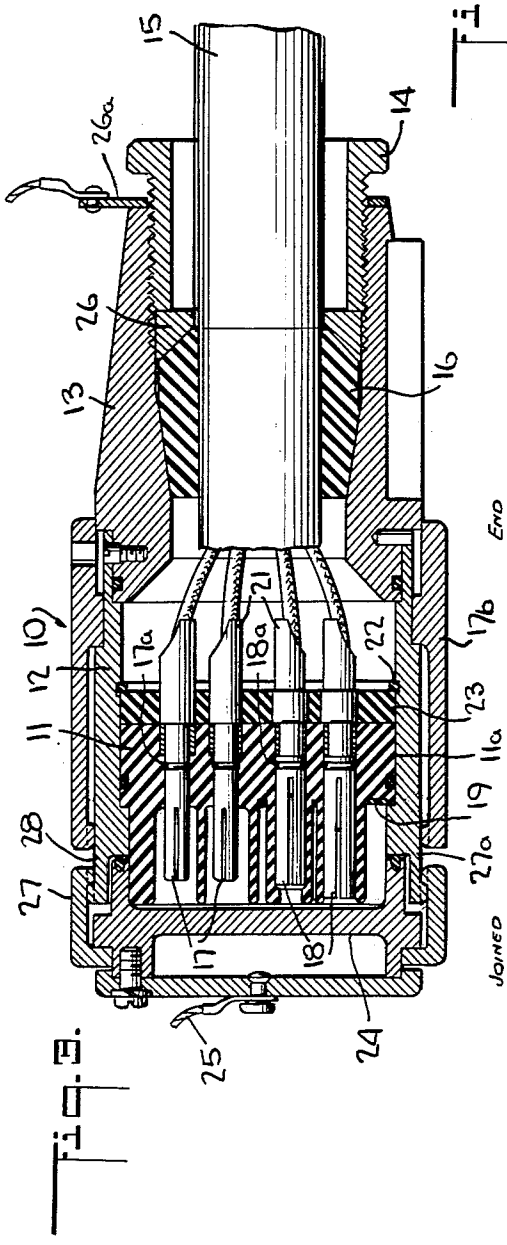


Fig. 3.

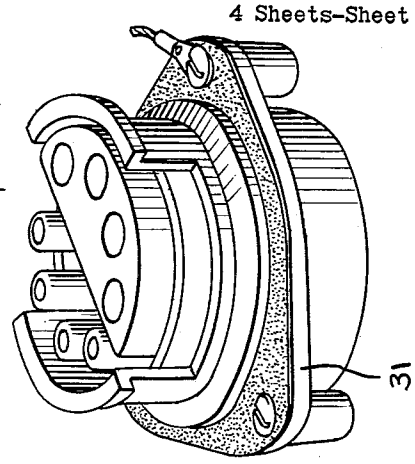


Fig. 12.

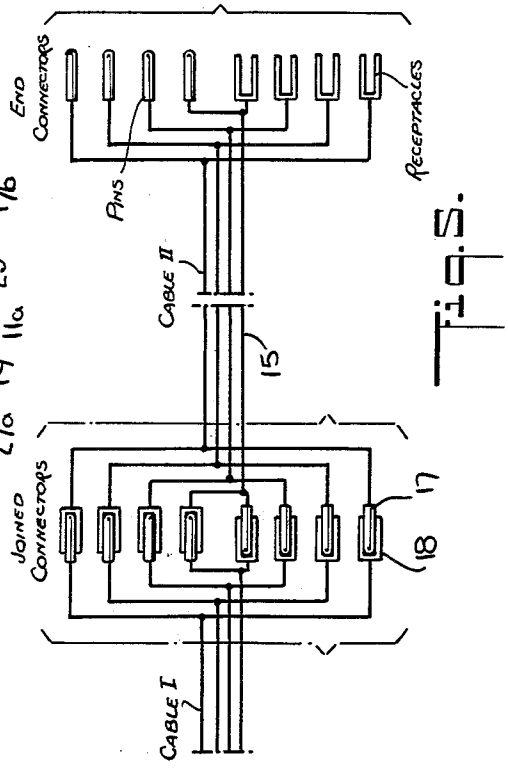


Fig. 5.

INVENTOR.
JOSEPH I. ROSS

BY
Kenyon & Kenyon
ATTORNEYS

April 21, 1964 J. I. ROSS 3,129,993

HERMAPHRODITIC ELECTRICAL CONNECTORS

Filed March 8, 1961 4 Sheets-Sheet 4

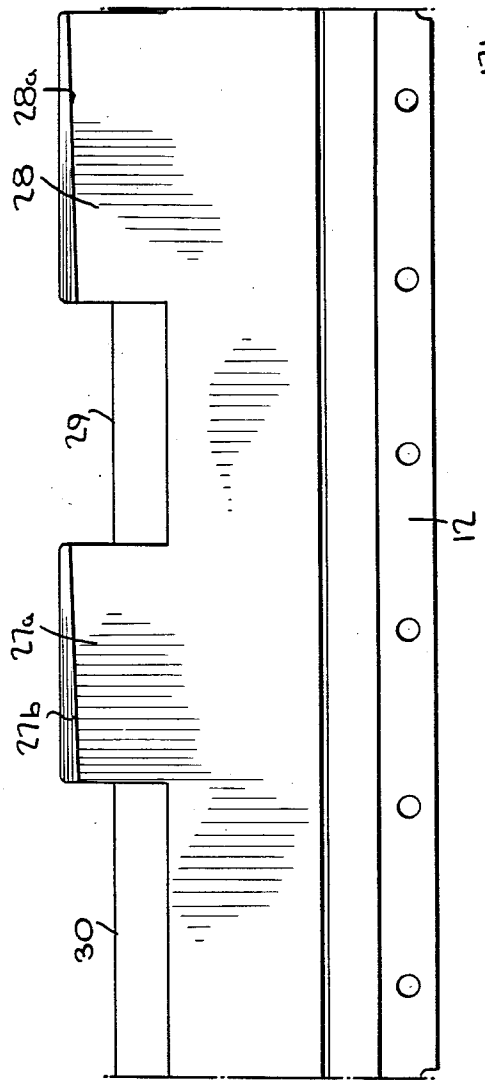


Fig. 7.

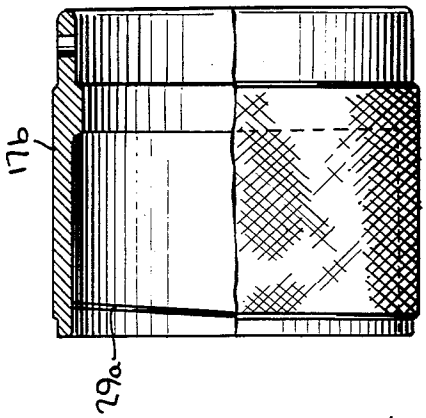


Fig. 9.

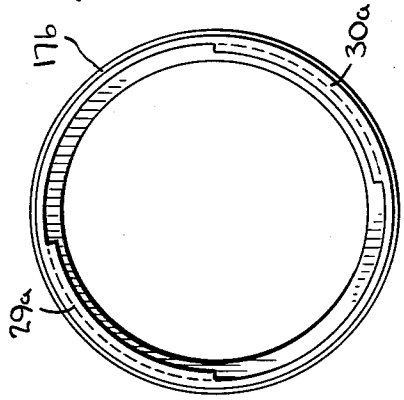


Fig. 8.

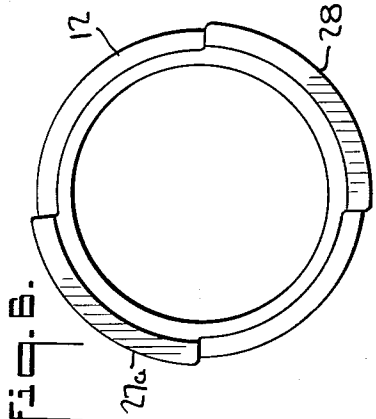


Fig. 6.

INVENTOR.
JOSEPH I. ROSS

BY Kenyon & Kenyon

ATTORNEYS

United States Patent Office 3,129,993 Patented Apr. 21, 1964

3,129,993
HERMAPHRODITIC ELECTRICAL CONNECTORS

Joseph I. Ross, 4 Ridge Rock Lane, East Norwich, N.Y.

Filed Mar. 8, 1961, Ser. No. 94,368
3 Claims. (Cl. 339—49)

This invention relates generally to electrical connectors or termination members for cables and the like, and more particularly to an improved hermaphroditic connector adapted to intercouple with an identical connector.

Multiple-wire cables are used to link the operating units or components of electrical installations. Conventionally such cables are terminated at each end by connectors, one of which is a male member and the other a female member. Cable inter-connections are made by properly mating male and female connectors. It is obviously essential with standard connectors to maintain sex identification. Under difficult field conditions, this need for identification is a serious handicap, for if connections must be made under cover of darkness or under conditions of extreme cold, valuable time is lost in matching male connectors to appropriate female connectors.

It is also common practice to provide locking means to effect tightly clamped engagement of the matching connectors and thereby maintain the desired electrical contacts. Such locking means generally take the form of threaded coupling sleeves or nuts on each of the two connectors, which nuts are rotated several times to produce a locking action. It has been found that when connectors are locked in this manner, uncoupling is difficult to effect.

The reason for this difficulty arises from the fact that two coupling nuts are used in the total engagement of the two connectors, but in the act of disengagement one coupling nut will break fast and the other will remain fully engaged. This places the total locking load on the one remaining coupling nut, thereby increasing the friction between the two members and also removing a convenient point of purchase on the connector nut which is already disengaged and hence free to turn. As a consequence, it becomes quite difficult to disengage the second locking nut.

Accordingly, it is the main object of this invention to provide hermaphroditic connectors which obviate the need to maintain sex identification of male and female connectors, whereby one hermaphroditic connector may be readily plugged into another and identical connector.

Also an object of this invention is to provide a hermaphroditic connector constituted by paired groups of male and female terminals, each group of terminals in one connector being adapted to be engaged by the complementary terminals of a second and identical connector. A significant advantage of this arrangement is that it makes possible the transfer of power from one point to another in polyphase alternating-current lines which require retention of identification of the various phases.

Still another object of the invention is to provide locking means for a connector wherein coupling and uncoupling is effected by camming lock nuts which permit total lock of one connector to another within 90° of lock nut rotation. An important feature of this locking arrangement is that when one cam locking nut is disengaged, it will nevertheless not be free to turn but will dead end on the back face of an opposing cam surface, thereby providing a positive stop which prevents rotation. Thus, when disengaging the second nut, it becomes possible to work against the already disengaged nut since it cannot be turned.

Among the other objects of the invention are the provisions of a connector whose component parts are readily replaceable, the connector construction being such that

it is waterproof in both the mated and unmated condition. The connector is provided with a removable rear gland whose configuration may be made to conform to various cable shapes and sizes and yet maintain waterproof integrity. A connector in accordance with the invention is of efficient and rugged design and may be manufactured at relatively low cost.

Briefly stated, in a connector according to the invention, a drum-shaped insulating block is supported within a housing shell, the block having a raised semi-circular segment which defines a complementary depressed segment, the raised segment having holes therein extending longitudinally, the depressed segment having a like number of columns projecting forwardly therefrom, whereby when two connectors are intercoupled, the columns of one are received within the holes of the other. Positioned within the holes are male contact pins and positioned within the columns are female contact receptacles which accommodate to pins of the other connector.

For a better understanding of the invention, as well as other objects and further features thereof, reference is made to the following descriptions to be read in connection with the accompanying drawing, wherein the components in the several views are identified by like reference numerals.

In the drawing:

FIG. 1 is a perspective view of a pair of hermaphroditic connectors in accordance with the invention.

FIG. 2 is a separate perspective view of the insulating block in the connector.

FIG. 3 is a longitudinal sectional view of one connector.

FIG. 4 illustrates a single contact pin and receptacle combination.

FIG. 5 is the schematic circuit of two intercoupled cables and the connectors therefor.

FIG. 6 is an end view of the housing shell of the connector showing the coupling tongues.

FIG. 7 is a linearly developed projection of the tubular housing shell.

FIG. 8 is an end view of the locking nut.

FIG. 9 is a longitudinal section taken through the locking nut.

FIG. 10 is a linearly developed projection of the locking nut.

FIG. 11 is a linearly developed projection of a locking nut and the tongues of an associated connector.

FIG. 12 is a perspective view of a power connector in accordance with the invention.

Referring now to the drawings, and more particularly to FIGS. 1 and 3, there is illustrated a pair of hermaphroditic connectors, generally designated by numerals **10** and **10A**. Since the two connectors are of identical design, only the components of connector **10** will be identified hereafter.

Connector **10** includes an insulating block **11** for supporting two groups of contact elements, the block being received within a cylindrical metal housing shell **12**. Attached to the rear end of housing shell **12** is a conical closure member **13** which terminates in bushing **14**, threadably received therein. The end of a multiple-wire cable **15** passes through bushing **14** and through an insulating gland **16** of neoprene or a similar resilient material for connection to the terminals supported in the insulating block. A metal cable grip **26** is urged against gland **16** by threaded bushing **14**. Surrounding housing shell **12** is a locking sleeve or nut **176**.

The connector block **11**, as shown separately in FIG. 2, is formed of a molded insulating material, such as a high impact plastic of superior dielectric properties. It is constituted by a drum-shaped base portion **11***a*, surmounted by a semicircular segment portion **11***b* having

four holes 11*c*, 11*d*, 11*e*, and 11*f* extending longitudinally therein to receive male contact pins, the raised segment defining a depressed segment having four column portions 11*g*, 11*h*, 11*i*, and 11*j* projecting forwardly therefrom to receive female contact receptacles. The holes and columns are circumferentially arranged at equispaced points along a circular path, whereby the four contact pins in the holes and the four contact receptacles are symmetrically positioned.

The outside diameter of the four columns is substantially equal to the inside diameter of the holes, and the height of the columns is substantially equal to the depth of the holes so that the columns of one connector may be inserted within the holes of another to effect the desired engagement of contact pins and contact receptacles.

Within each of the holes 11*c* to 11*f* there is coaxially positioned a contact pin 17, and supported within each of columns 11*g* to 11*j* is a contact receptacle 18. Each contact pin 17 is electrically connected to a corresponding receptacle 18 by a jumper bar 20, which extends at right angles to the pins and receptacles and rests within a groove in the rear of the block 11. Placed over the columns and resting against the block 11 is a front gasket 19.

Referring now to FIG. 4, the contact pin and receptacle combination is shown separately. Each pin 17 is cross-slotted longitudinally to define resilient spring fingers to effect a positive connection when inserted in a receptacle. The pin is supported in axial alignment with a hollow connecting lug projecting below jumper bar 20, the lug serving as a rear terminal to receive a bared wire which may be soldered thereto. To prevent water or moisture seepage through the pins and receptacles, elastic insulating O rings 17*a* and 18*a*, respectively, are fitted into circumferential grooves at the bases thereof.

The pin, receptacle and jumper are preferably made of highly conductive metal, such as spring bronze and are silver-soldered together to minimize resistance. Thus, a cable wire attached to the lug 21 is connected thereby to one pin 17 and a companion receptacle.

Referring now to FIG. 5, the circuit formed by cable connectors I and II is illustrated schematically. It will be seen that the four wires in cable 15 are connected respectively to four single poles in the end connectors, each single pole consisting of a pin 17 and a receptacle 18. Thus, the identification of the cable wires is maintained when the end connector of a cable I is joined to the end connector of a cable II. The retention of identification is maintained from cable to cable, for the connectors can be intercoupled in only one manner and a reversal or shift in identification is not possible.

Referring again to FIGS. 1 and 3, it will be seen that the insulating block 11 is retained in place with the tubular housing 12 by a split ring 22, which fits within a circumferential groove on the internal wall of the housing. A circular insulating disc 23 is interposed between the block 11 and the split ring 22, the front end of the base portion 11*a* of the block resting against a shoulder formed internally in the housing. In dismantling the connector, one has merely to remove the split ring, and the disc 23 and insulating block 11 may then be withdrawn from the housing.

To protect the connector when not in use, a cover cap 24 is provided, the cap being tethered to the connector by a flexible wire 25 coupled to a retainer ring 26*a* held to the end of the connector by the bushing 14. The cap 14 is provided with a locking nut 27 which is engageable with the housing of the connector.

Projecting forwardly from the housing shell 12 are two oppositely disposed arcuate tongues 27*a* and 28, separated by spaces 29 and 30. The arcuate dimensions of tongues 27*a* and 28 are unequal and in an actual embodiment are 82° and 98° respectively, with corresponding dimensions for the spaces 29 and 30. Thus, two connectors can engage in only one way, the smaller tongue 27*a* in one being accommodated in the smaller space 29 of the other and the larger tongue 28 of one being received within the larger space 30 of the other.

For locking purposes there is marginally formed on the exterior of tongue 27*a* a cam ridge 27*b* and similarly formed on the exterior of tongue 28 is a cam ridge 28*a*. As best seen in FIG. 7, the cams 27*b* and 28*a* on both tongues are tapered in the same direction.

The locking nut 17*b* on the shell 12 is designed to engage the tongue cams on the shell of a second connector when the two connectors are joined together. Locking nut 17*b* as best seen in FIGS. 8, 9 and 10 is provided internally with arcuate cams 29*a* and 30*a* which are oppositely disposed and are of uniform dimension. In an actual embodiment, the cams 29*a* and 30*a* are both 80°, and the spaces therebetween are both 100°. Therefore, these cams are readily received within the spaces between the tongues on the connector shell.

As will be evident from an examination of FIG. 11, when the locking nut is twisted in one direction relative to the tongues on the shell, the cams on the nut effect locking engagement with the external cams on the tongues. Total lock of one connector to another is effected within 90° lock nut rotation. When the nut is twisted in the other direction the lock is disengaged but the nut is not free to rotate since it dead ends against the cams on the tongues, the wide ends of the nut cams striking the wide ends of the tongue cams. In disengagement, this provides mechanical advantage, for when one nut is free, the other nut may be disengaged by working against the free nut which is not able to rotate.

The locking nut 27 on the dust cap is also provided with internal cams similar to that on the locking nut for the connector. Thus, in FIG. 3, the nut on the cap is shown locked onto the tongues of the connector, very much in the manner in which the nut of another connector would effect a locking action.

Referring now to FIG. 12, there is shown a hermaphroditic power connector which is essentially similar to the cable connector in its contact and receptacle structure, save that a flange 31 is provided for mounting the connector on an equipment panel. Thus, a cable connector may be plugged into a power connector and locked thereto by the locking nut on the cable connector.

It will be noted in FIG. 3 that one of the four female receptacles 18 is longer than the others. This longer contact is designated for ground, this being a safety feature which ensures ground contact engagement before hot leads are brought into contact with each other. It will be also noted (FIG. 1) that the receptacles 18 are protectively housed in columns and the pins 17 are protectively housed in a segment, thereby preventing accidental injury to a user through bodily contact with current carrying members.

While there have been shown what are considered to be preferred embodiments of the invention, it is to be understood that many changes and modifications may be made therein without departing from the essential spirit of the invention as defined in the annexed claims.

What is claimed is:

1. An electrical connector comprising:

(*a*) a drum-shaped insulating block having a diametrical cut-out defining a semi-circular raised segment and a semi-circular depressed segment,

(*b*) said raised segment having a plurality of holes formed longitudinally therein,

(*c*) a contact pin concentrically mounted within each of said holes and protectively disposed therein,

(*d*) said depressed segment having longitudinally projecting insulating columns formed thereon equal in number to said holes and symmetrically arranged with respect thereto,

(*e*) a contact receptacle protectively disposed in each of said columns, and

(*f*) a plurality of jumper bars disposed within said insulating block each of which interconnects a respective contact pin and the correspondingly positioned contact receptacle to render said connector electrically non-reversible, whereby when two such connectors are intercoupled the columns of one are received within the holes of the other and the contact pins in said holes engage the contact receptacles in said columns, and when the two connectors are uncoupled the contact pins and contact receptacles are protected from human contact.

2. A connector as set forth in claim 1, further including a tubular metal housing shell encasing said insulating block, the forward portion thereof surrounding said raised and depresesd segments of said block and being constituted by two oppositely disposed arcuate tongues separated by spaces of unequal length whereby when two such connectors are intercoupled the tongues of one are admitted into the spaces of the other, said tongues being provided at their extremities with raised marginal cams; and a locking nut surrounding said shell and having internally formed thereon two arcuate cam ridges adapted to engage the marginal cams on the tongues of another connector upon a partial rotation of said nut in one direction, the cam ridges on said nut abutting against

the ends of the cams on said tongues upon a partial rotation of the nut in the reverse direction.

3. A connector as set forth in claim 2, further including a conical closure member attached to the rear of said shell, and an insulating gland in said closure member through which a cable is receivable for connection to said contact pins.

References Cited in the file of this patent

UNITED STATES PATENTS

372,790	Etienne	Nov. 8, 1887
482,306	Hall	Sept. 6, 1892
1,474,758	Bissell	Nov. 20, 1923
2,035,657	Kottemann	Mar. 31, 1936
2,411,861	Antony et al.	Dec. 3, 1946
2,572,448	Child	Oct. 23, 1951
2,739,290	Child et al.	Mar. 20, 1956
2,742,624	Stevens	Apr. 17, 1956
2,824,290	Archer et al.	Feb. 18, 1958

FOREIGN PATENTS

71,733	Austria	Nov. 15, 1915
755,385	Great Britain	Aug. 22, 1956
106,882	Switzerland	Sept. 16, 1924