May 18, 1965 H. J. TENNISWOOD 3,184,702

ELECTRICAL CONNECTOR APPARATUS

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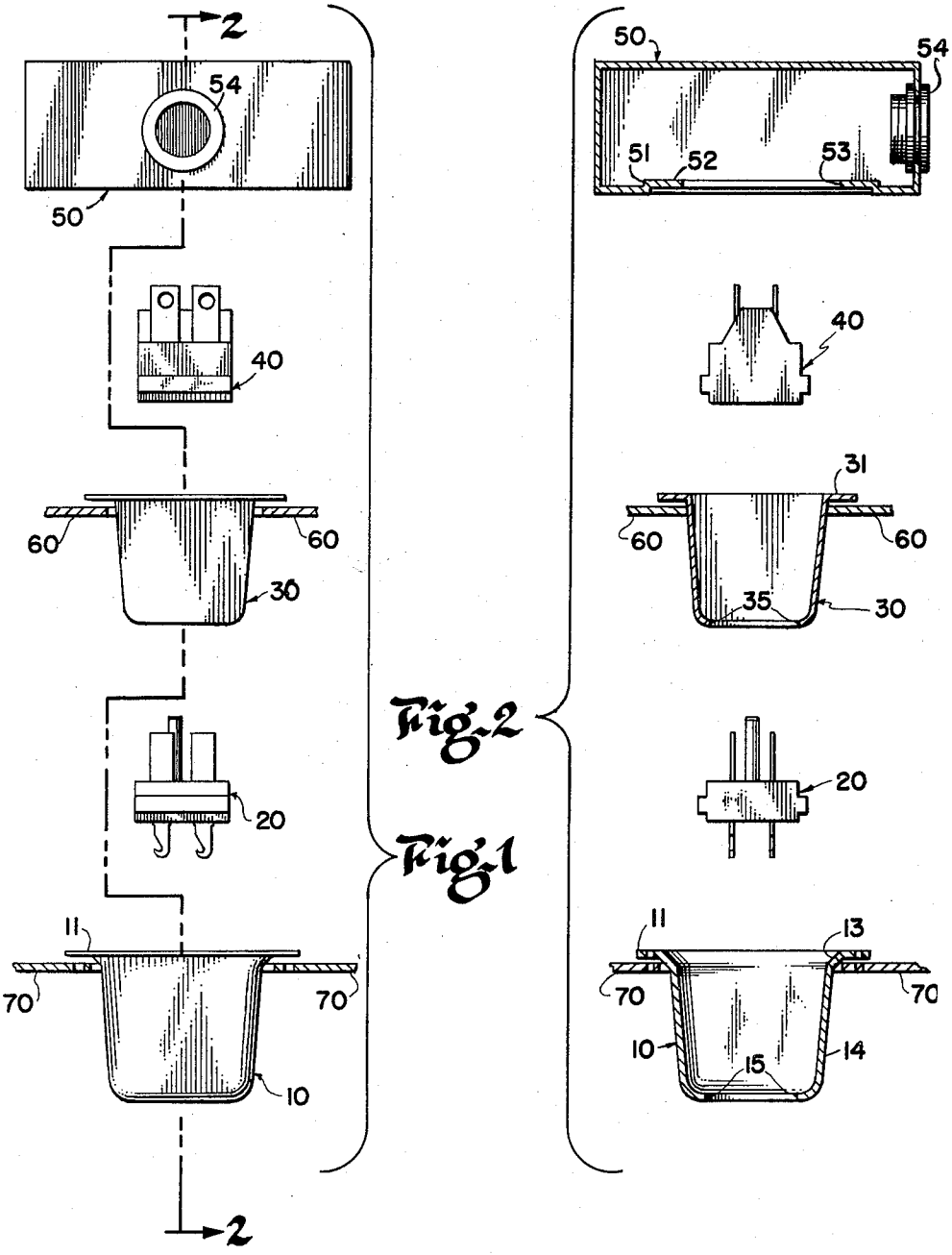


Fig. 2

Fig. 1

INVENTOR.
HOWARD J. TENNISWOOD

BY

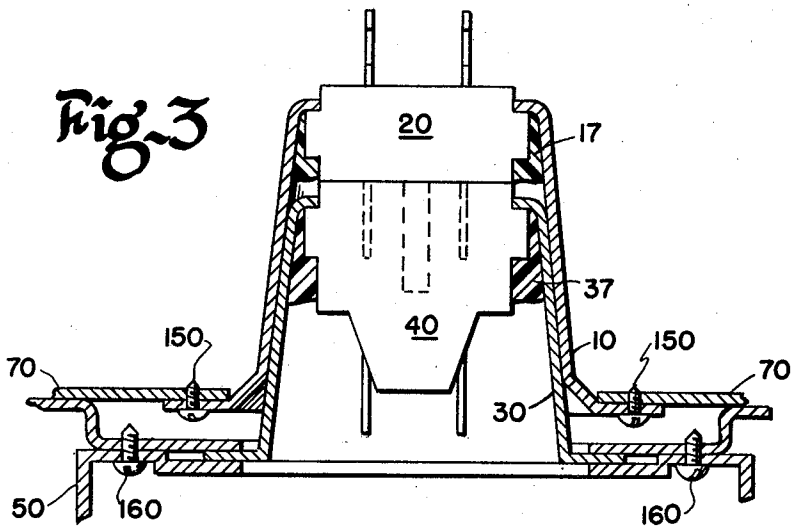
Marshall, Wilson, Click and Yeasting
attys.

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ELECTRICAL CONNECTOR APPARATUS

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Fig-3



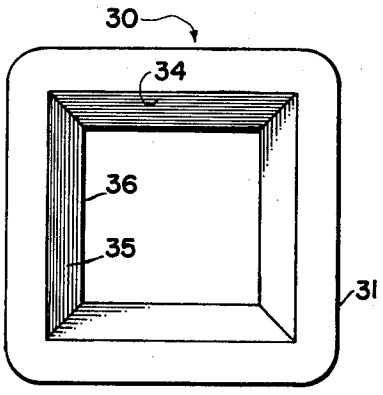


Fig-7

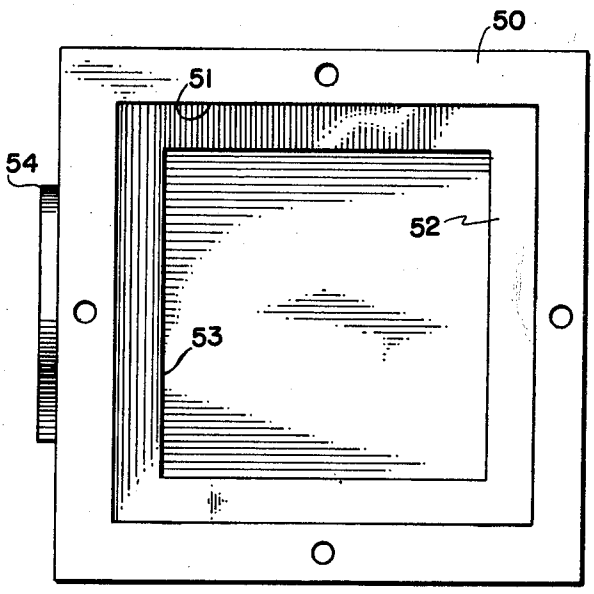


Fig-8

INVENTOR.
HOWARD J. TENNISWOOD

BY

Marshall, Wilson, Glick & Yeasting
attys.

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ELECTRICAL CONNECTOR APPARATUS

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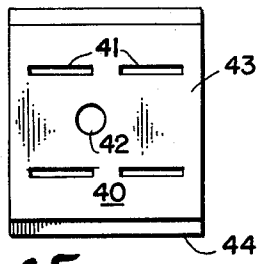


Fig. 5c

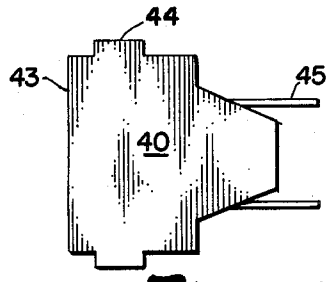


Fig. 5b

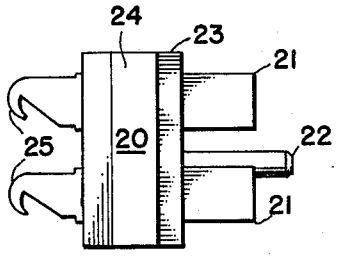


Fig. 4b

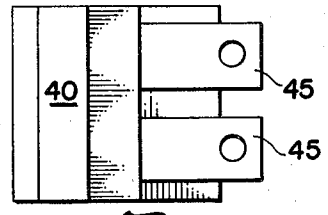


Fig. 5a

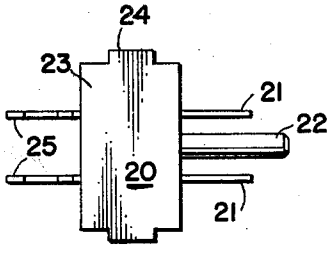


Fig. 4a

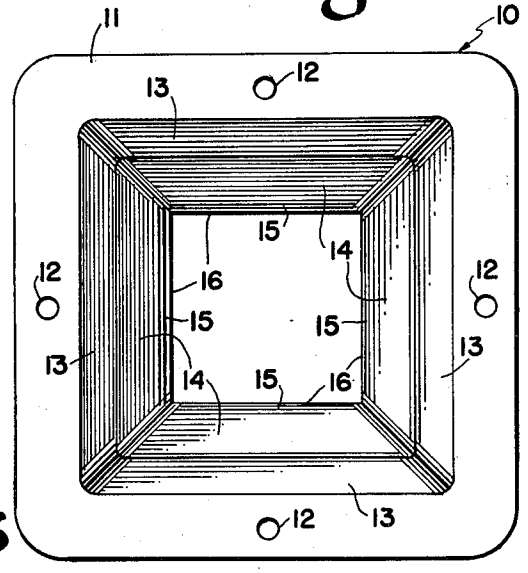


Fig. 6

INVENTOR.
HOWARD J. TENNISWOOD

BY
Marshall, Wilson, Click & Yeasting
attys.

United States Patent Office 3,184,702 Patented May 18, 1965

3,184,702

ELECTRICAL CONNECTOR APPARATUS

Howard J. Tenniswood, Adrian, Mich., assignor to Revco, Inc., Deerfield, Mich., a corporation of Michigan

Filed Nov. 1, 1962, Ser. No. 234,755
5 Claims. (Cl. 339—66)

This invention relates to electrical connector apparatus in general and, in particular, to such apparatus when used for making connections in a blind area.

With the advent of detachable power units it has become desirable to furnish power to these units via an electrical connecting means between the detachable power units and the stationary unit from which it is detached. Thus the power units can be detached for service, testing, etc., without disturbing the electrical connections of the stationary unit. In order to most efficiently utilize electrical connections between the detachable power units and the stationary units the electrical connection should not have trailing cord means which can become entangled, broken, or otherwise interfere with the free detachability of the unit. Further, the electrical connection is usually in a blind area so that the serviceman or installer cannot see normal electrical connections to line them up to make contact.

It is, accordingly, an object of this invention to provide improved electrical connector apparatus.

It is a further object of this invention to provide an improved electrical connector apparatus which may be utilized on detachable power units and disposed in blind areas wherein the electrical connector apparatus must provide its own aligning and positioning without benefit of aid from the one installing the detachable power unit.

In accordance with the above objects there is described herein electrical connector apparatus which may comprise a first element having a non-circular aperture formed therein, the perimeter of the aperture being chamfered to provide guide surfaces. A second element is utilized having a projection with an end adapted to be inserted into the aperture of the first element, the projection having a cross section substantially identical in shape and area to the figure defined by the perimeter of the aperture. Successive parallel cross sections of the projection toward the end thereof maintain substantially the same shape and disposition with respect to an axis of the projection which is parallel to the direction of insertion. Means are provided for supporting one of the first and second elements so that cross sections of the projections toward the end thereof are in approximate alignment with the aperture. Means are also provided for supporting the elements to allow relative centering movements between the projection and the aperture. Means are then provided for attaching one contact means on the end of the projection and for carrying another contact means spaced from the aperture to contact said one contact means when the projection is inserted into the aperture.

The above described electrical connector apparatus may be modified by providing a second element having a projection with successive cross sections of said projection toward the end thereof retaining substantially the same shape and disposition, with respect to an axis of the projection which is parallel to the direction of insertion. A first of the cross sections is substantially identical in shape and area to the figure defined by the perimeter of the aperture formed in the first element. The successive cross sections of the projection then diminish in area to provide a guide means with respect to the side of the aperture.

The invention disclosed herein may also be described as a first element having a cavity formed therein wherein the cavity has a mouth with a non-circular perimeter.

The cavity has successive similar cross sections normal to an axis of insertion of a projection of the second element, each of the successive cross sections diminishing regularly in area. The end of the projection may be formed substantially in the same shape and area as the smallest of the successive cross sections of the cavity to provide axial guiding. In this modification means are provided for attaching one contact means on the end of the projection while means for carrying another contact means are provided at the bottom of the cavity.

More specifically there is described and disclosed herein electrical connector apparatus in a preferred embodiment which comprises a first element having a cavity formed therein wherein the inner surface of the cavity defines a first truncated pyramid. A second element having a projection wherein the outer surface of the projection defines a second truncated pyramid adapted to be inserted into and mate with the cavity. The mouth of the cavity is chamfered to guide the projection into the cavity. Means are provided for supporting the elements to allow relative centering movements between the projection and the cavity which comprise flange means on one of the elements extending normally with respect to the direction of insertion and confining the movement in said normal direction only between bearing means which are shown as bearing plates. An electrical plug means is supported by one of the elements and an electrical socket means is supported by the other of the elements in position to receive the plug means when the projection is inserted into the cavity. Male guide means are attached to one of the plug and socket means and extends toward the other of the plug and socket means during insertion. Female guide means are formed in the other of the plug and socket means and adapted to receive said male guide means. The first element has an aperture formed in the rear of the truncated pyramid cavity to receive one of the plug and socket means. The received one of the plug and socket means comprises an electrical contact means supported in a body of insulating material. The body of insulating material may be secured in place in the aperture by a potting compound. Similarly, the projection of the second element may be hollowed to receive the other of the plug and socket means, the body of the insulating material of the plug or socket means received by the hollow and the projection being secured in place in the hollow projection by a potting compound.

Other objects, advantages, and features of this invention will become apparent when the following description is taken in conjunction with the accompanying drawings, in which:

FIG. 1 is an exploded plan view of the elements embodying the features of this invention;

FIG. 2 is an exploded side view in section taken along lines II—II of FIG. 1;

FIG. 3 is an assembled view from the side of the elements shown in FIG. 2;

FIGS. 4*a* and 4*b* are detailed illustrations of the plug means;

FIGS. 5*a*, 5*b* and 5*c* are detailed views of the socket means utilized herein;

FIG. 6 is an end view of the plug case utilized herein;

FIG. 7 is an end view of the socket case utilized herein; and

FIG. 8 is an end view of the socket case support housing utilized herein.

Referring to the drawings and in particular to FIGS. 1 through 3, there is shown an electrical connector apparatus which comprises a plug case **10**, a plug means **20**, a socket case **30**, a socket means **40**, and a socket case support housing **50**.

Referring now particularly to FIGS. 2, 3 and 6, it is

shown that the plug case **10** comprises and element having an attaching flange **11**, apertures **12** to secure the flange to a wall **70** of a stationary unit, a non-circular chamfered aperture or cavity opening **13**, walls **14** and a rear end **15**, the inner surfaces of which define a truncated-pyramid shaped cavity, and an aperture **16** formed in the rear wall **15**. It is to be noted that successive cross sections of the cavity, starting with the cross section defined by the mouth of the cavity are substantially the same in shape while diminishing regularly in area.

Referring now to FIGS. 1, 2 and 4 in particular, there is shown a plug means **20** which comprises an insulating body **23** having supported therein contact means. Of these contact means terminals **25** project from the rear for making permanent electrical connections thereto. Male terminals **21** project from the front adapted to be received by female terminals in the socket means. A male guide means **22** having a chamfered end projects past the terminals **21** and is adapted to be received by a female guide means in the socket means. A ridge **24** formed on the body of insulating material provides a seating means so that the body of insulating material may be inserted up to the ridge **24** in the aperture **16** formed in the rear wall **15** of the plug case **10**. The plug means **20** may be secured in place in the plug case **10** by means of an epoxy or other potting compound as shown at **17** in FIG. 3.

Referring now to FIGS. 1, 2 and 7 in particular, there is shown a socket case which comprises an element having flanges **31** extending normally from a direction of insertion of a projection formed by walls **34** and a rear wall **35** into the cavity of plug case **10**. As is most apparent in FIGS. 1 and 2, the walls **34** and the real wall **35** form an exterior surface which defines a truncated pyramid adapted to be received and to mate with the cavity of element **10**. An aperture **36** is formed in the rear wall **35** of the projection of the element **30** to receive a socket means **40**.

Referring to FIGS. 1, 2 and 5 in particular, there is shown a socket means designated generally at **40** comprising a body of insulating material **43** supporting female contact members **41** in recesses formed therein and externally extending permanent connector terminals **45**. A female guide recess **42** is formed in the face of the socket means to receive the male guide means **22** of the plug means **10**. A ridge or other stop means **44** is formed on the sides of the body **43** of insulating material so that when the socket means **40** is inserted through the aperture **36** formed in the rear wall **35** of the element **30** the ridge means **43** can rest against the rear wall **35** and the socket means can be securely attached in place by use of an epoxy or other potting compound as designated at **37** in FIG. 3. It is to be noted that the projection has one cross section substantially identical in shape and area with respect to the cross section defined by the non-circular aperture or mouth of the cavity of element **10**. Successive cross sections of the projection toward the end thereof maintained substantially the same shape as said one cross section while diminishing regularly in area.

Referring to FIGS. 1, 2, and 8 in particular, there is shown a support housing **50** for the socket case **30**. The support housing **50** may also act as a terminal box and as such is provided with a terminal outlet means **54** to accommodate wires that are to be permanently attached to the terminal means **45** of the socket means **40**. The rear face of the housing means **50** is recessed at **51** to receive the flange means **31** of the socket case **30**. The depression formed by the recessing at **51** is formed larger than the extension of the flange means **31** so that the flange **31** of the socket case **30** may move upwardly and downwardly or laterally in the depression in the direction normal to the housing means **50**. The socket case support housing **50** is to be attached to a wall **60** of the detachable power unit by, for example, screw means **160**, as shown in FIG. 3. By the attachment of the socket case support

housing **50** to the walls **60** of the detachable power unit, the wall **60** and the wall **52** of the depressed portion of the rear face of the housing cooperate to form two bearing surfaces or points between which the socket case **30** is held by its flange **31** for movement normal to the direction of insertion of the socket case **30** into the plug case **10**. An aperture **52** is formed in the rear face of the housing **50** to allow passage of connecting wires to the socket means **40**.

Having thus described the preferred embodiments of the components utilized in this invention, reference to FIG. 3 shows the assembled components. It is apparent that the assembly as utilized may allow the making of electrical contacts from a blind area since the chamfered aperture of the plug case cavity, the truncated pyramid inner surface of the cavity of plug case **10** and outer surface of the projection of element **30**, the male guide means **22** of the plug means **20** and the female recess guide means **42** of the socket means **40**, and the laterally movable support means provided by the flange **31** of the socket case **30** in the cooperating bearing surfaces provided by the socket case supporting housing **50** and the wall **60** of the detachable portable unit, all cooperate to insure that an electrical connection can be made in a blind area with the connection being keyed by the various surfaces so that the proper terminals of the plug and socket are brought together and so that no binding will occur during the process of bringing same together.

Having thus described and disclosed a preferred embodiment for practicing the invention, it is to be noted that the embodiments described and disclosed herein are meant to be illustrative only and not limiting in any sense. The embodiments serve merely to illustrate the spirit and scope of the invention.

Having described the invention, I claim:

1. Electrical connector apparatus comprising a first element having a cavity formed therein, the inner surface of said cavity defining a first truncated pyramid; a second element having a projection, the outer surface of said projection defining a second truncated pyramid adapted to be inserted into and mate with said cavity; means supporting said elements to allow relative lateral centering movements between said projection and said cavity comprising flange means on one of said elements extending normally with respect to the direction of insertion and bearing surface means adapted to receive said flange means and confine movement of said flange means in said normal direction; an electrical plug means supported by one of said elements; and an electrical socket means supported by the other of said elements and positioned to receive said plug means when said projection is inserted into said cavity.

2. Electrical connector apparatus as defined in claim 1 in which the mouth of said cavity is chamfered to guide said projection into said cavity.

3. Electrical connector apparatus as defined in claim 1 in which a male guide means having a tapered end is attached to one of said plug and socket means and extends toward the other of said plug and socket means during insertion, and in which a female guide means is formed in the other of said plug and socket means and adapted to receive said male guide means.

4. An electrical connector apparatus as defined in claim 1 in which said first element has an aperture formed in the rear of the truncated pyramid to receive one of said plug and socket means; said received one of said plug and socket means comprising electrical contact means supported in a body of insulating material; said body of insulating material being secured in place in said aperture by a potting compound.

5. An electrical connector apparatus as defined in claim 1 in which said projection of said second element has been hollowed to receive one of said plug and socket means; said received one of said plug and socket means comprising electrical contact means supported in a body

of insulating material; said body of insulating material being secured in place in said hollowed projection by a potting compound.

References Cited by the Examiner

UNITED STATES PATENTS

2,396,871	3/46	Meyerhans	339—92 X
2,939,102	5/60	Johnson	339—66 X
2,944,240	7/60	Barber	339—66 X
2,984,814	5/61	Scott	339—66 X
3,091,748	5/63	Takes et al.	339—64 X
3,094,364	6/63	Lingg	339—64

FOREIGN PATENTS

108,720	10/39	Australia.

JOSEPH D. SEERS, *Primary Examiner.*