

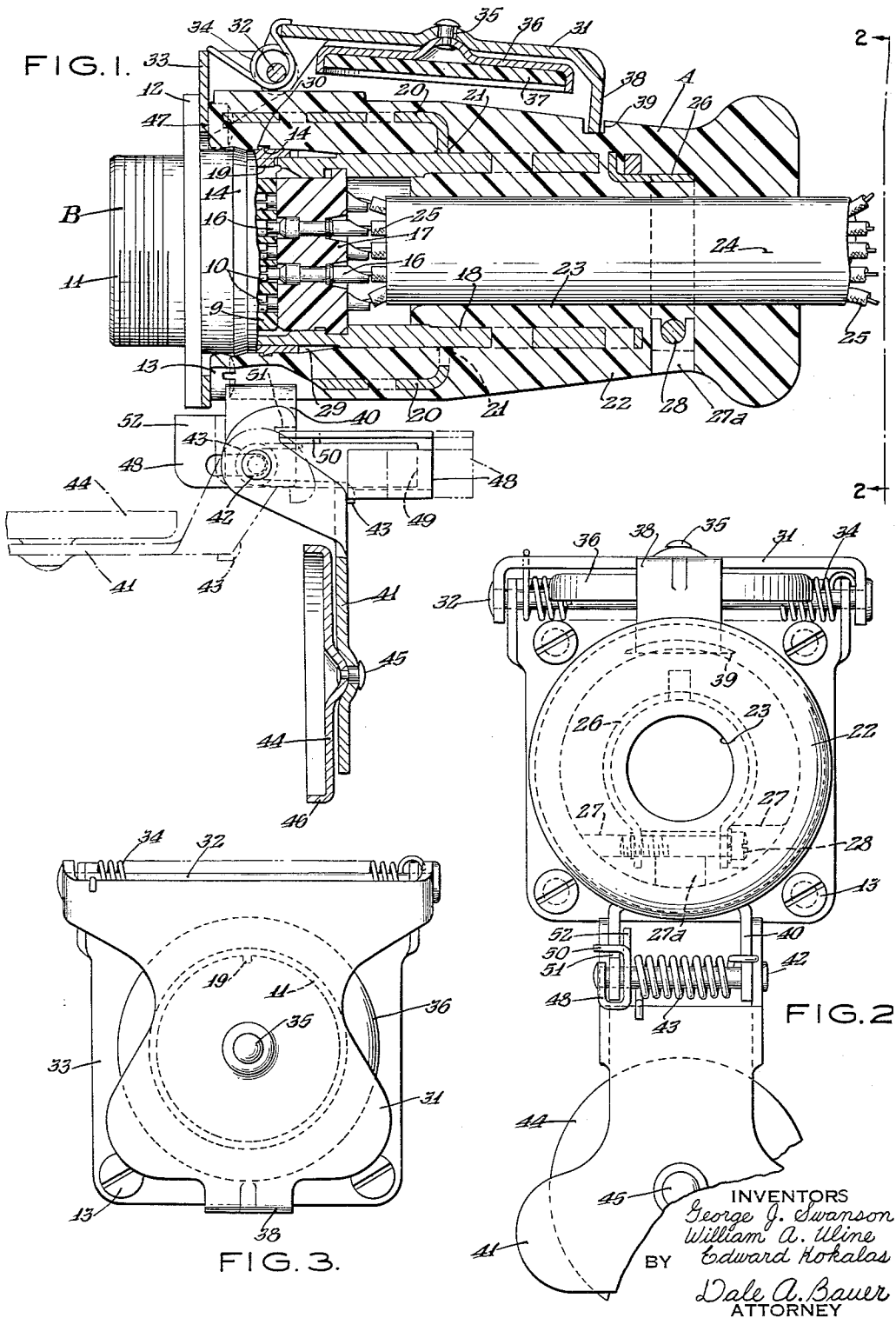
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ELECTRICAL CONNECTORS

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ELECTRICAL CONNECTORS

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This invention relates to electrical apparatus and more particularly to electrical connectors of the type embodying readily separable pin and socket contact carrying units.

One of the objects of the present invention is to provide a novel constructed electrical connector which is sturdy, durable and easy to handle.

Another object of the invention is to provide a novel electrical connector of the readily detachable type which is adapted for use under very severe conditions without material danger of being damaged or contaminated either accidentally or otherwise.

A further object of the invention is to provide an electrical connector embodying readily separable plug and receptacle units which cooperate in a novel manner to yieldably resist intentional or accidental separation of the units.

Another object is to provide a connector unit of the above character which is novelly constructed with a unitary shell to thereby improve its strength, durability and simplicity.

Another object is to provide apparatus of the above character wherein novel means are provided for preventing withdrawal of the incoming cable and for minimizing the passage of moisture and other foreign substances along the cable into the connector shell.

Still another object is to provide a cover for an electrical connector unit or the like embodying novel automatically releasable locking means for holding the cover in open position.

The above and further objects and novel features of the present invention will more fully appear from the following detail description when the same is read in connection with the accompanying drawings. It is to be expressly understood, however, that the drawings are for the purpose of illustration only and are not intended as a definition of the limits of the invention.

In the drawings, wherein like reference characters refer to like parts throughout the several views,

Fig. 1 is a side elevational view, mostly in section and with parts broken away, illustrating an assembled electrical connector embodying one form of the present invention;

Fig. 2 is an end view of said connector as viewed from the right in Fig. 1; and

Fig. 3 is an end view taken from the right in Fig. 1 and illustrating the connector receptacle unit with its cover in closed position when the plug unit has been removed.

The single embodiment of the invention illustrated, by way of example, in the accompanying drawing is in the form of a multiple pin and socket type connector, one part of which is adapted for connection to a cable and for use as a so-called "slave" or "quick disconnect" connector commonly used for electrical connections between tractors and trailers. Another common use for such connectors is on military and commercial vehicles, trucks and the like when it is desired to transmit electrical power from a separate stationary or mobile power source

to the vehicle or vice versa. The complete connector embodies two separable units A and B, one of which carries the socket contacts and the other the pin contacts. Either unit may embody the pin contacts while the other unit embodies the cooperating socket contacts or each unit may have some of each kind of contact.

In the illustrated embodiment, the socket contacts 10 are supported in a resilient insert 9 in a tubular metal shell 11. The contacts and insert may be, and preferably are, of the same construction and are supported within the shell 11 in the same manner as those disclosed in the co-pending application of Uline and Rowell Serial No. 646,788, filed February 11, 1946. Shell 11 is shown as comprising an external flange 12 whereby it may be secured by screws 13 or other suitable means to a support (not shown). For a novel purpose to more fully appear hereinafter, the external surface of shell 11 has one or more (two being shown) annular ribs or lands 14, 14. At the left edge as viewed in Fig. 1, each of said ribs forms a square shoulder while the other edge thereof is tapered. As specifically illustrated, the ribs are of triangular shape in transverse section with the tapered edges thereof facing the open end of the shell.

The plug or pin contacts 16 may be and preferably are mounted in a resilient insert 17 which is in turn removably supported in a shell or tube 18. For a detail description of preferred forms of contacts and inserts, reference may be had to the aforesaid pending application Serial No. 646,788. Electrical connectors having this preferred internal construction are now well-known in the art and hence a more detailed description here is believed to be unnecessary, particularly since this detailed construction is not, per se, a part of the present invention. The contact supporting inserts may be angularly oriented in shells 11 and 18 by cooperating keys and grooves and the shells may be oriented with respect to each other by a key 19 in shell 11 and a cooperating slot in shell 18. Inserts 9 and 17 are preferably interchangeable so that when the pin contacts are to be mounted in shell 11 and the socket contacts in shell 18, the mounting inserts therefor are also reversed.

The tube or shell 18 extends to the right, as viewed in Fig. 1, to a point well beyond the insert 17 and the end thereof containing said insert is reinforced by a second tube 20. The latter may be secured to tube 18 near the center thereof by welding, as at 21, or by other suitable means. To further strengthen the structure and to perform other functions hereinafter specifically referred to, the tube 20 is embedded and the tube 18 is partially embedded in a rubber or the like covering 22 which may be molded in position and externally conveniently shaped to facilitate handling of the connector unit. The cover 22 is preferably composed of a relatively firm but yieldable natural or synthetic rubber-like composition or comparable substance. The cover should preferably be made of a material which will remain yieldable throughout a substantial temperature range so as to render it useful in both the tropic and arctic zones and at high altitudes.

At the right (Fig. 1) molded rubber covering 22 partially fills tube 18 and forms a passage 23 which slidably receives an insulated cable 24, the conductors 25 of which are soldered or otherwise suitably connected to pin contacts 16. A U-shaped clamp 26 of flexible sheet metal is preferably embedded in covering 22 adjacent the end of tube 18 and around the cable. The free ends of the clamp project into a groove or passage 27 in the covering and a bolt 28 may cooperate therewith in any known manner to draw said ends together. As shown, the bolt has screw threaded engagement with the left hand end of the clamp as viewed in Fig. 2. In this manner the cover may be clamped tightly but releasably

around cable 24 for the purposes of excluding moisture from the connector unit and holding the cable against withdrawal from the unit. This clamping action also prevents any unnecessary strain upon the soldered connections between conductors 25 and contacts 16 when a pulling or withdrawing force is applied to the cable 24. The clamping action of clamp 26, 28 may be facilitated by providing a recess 27a in cover 22 below the clamp.

At the forward or left end (Fig. 1) of the plug connector unit A the covering 22 is radially spaced from tube or shell 18 to form an annular recess 29 for receiving the end of shell 11. The outer diameter of said recess is preferably somewhat less than the outer diameter of the wall of shell 11 so that the rubber cover 22 will exert a holding action tending to prevent separation of shells 11 and 18 and hence, separation of the connector units A and B. To further guard against such separation by accident, at least one groove 30 is provided in recess 29 for cooperation with the outermost rib 14 on shell 11. The rib and groove are so positioned as to cooperate when the plug and socket units A and B are in coupled or operative position. This may be when the contact carrying inserts in shells 11 and 18 are in end-to-end contact. The tapered surfaces of ribs 14, 14 permit relatively easy insertion of shell 11 into recess 29, but yieldably lock the two units in connected position by virtue of the square shoulders or sharp edges thereon which engage groove 30 and the rubber surface of the recess.

For the purpose of excluding moisture, dirt and the like from the receptacle or socket unit B, automatically operable means are provided for covering the open mouth of the same when the plug unit A is removed. In the form shown, said means comprises a cover member 31 hinged at 32 on a bracket 33 which is secured to flange 12 by means of set screws 13 or otherwise. A coil spring 34 may be employed in a known manner for urging said cover member toward closed position, i. e., in a clock-wise direction as viewed in Fig. 1. Secured to the lower face of hinged cover member 31 by means of a rivet or pin 35 is a flanged cover 36 which carries a gasket 37 adapted to engage the end edge of shell 11 (Fig. 3).

The outer end of hinged member 31 preferably has a finger or lip 38 depending therefrom. When the connector units A and B are coupled together, spring 34 holds lip 38 into a groove 39 in rubber covering 22 thereby providing additional means for yieldably holding the units against separation by accident.

Novel cover means are also provided for the plug connector unit A when it is disconnected. Said means are preferably automatically operable to insure against the unit falling to the ground, into the water or against another object while uncovered with the contacts exposed. As shown, a bracket 40 welded or otherwise suitably secured to tube 20 pivotally supports a cover supporting member 41 on a pin or axis 42. A tensioned coil spring 43 urges the cover toward closed position. A cup-shaped cover 44 is secured to pivoted member 41 by means of a pin or rivet 45 and the annular flange 46 thereof is adapted to engage the end edge 47 of rubber covering 22 around the mouth of tube or shell 18. The resiliency of said rubber covering makes it unnecessary to provide any other form of gasket.

In order to facilitate the coupling of the connector units, means may be provided for locking cover 44 in open or full-line position as illustrated in the drawings. Said locking means may be in the form of a sheet metal slide 48 slotted to receive pivot pin 42 and shaped to rest on an extension 49 of bracket 40. With the slide 48 in its full line position, as seen in Fig. 1, a laterally extending lug 50 on the slide is adapted to engage a slot 51 in an extended portion of pivot member 41 when the latter is in full-line position (Fig. 1). If desired, the forward end 52 of slide 48 may be designed to engage flange 12, 33 or some other stationary part when

the connector units A and B are being engaged. In this case the final movement of connector unit A toward the left into operative position, i. e., after slide 48, 52 has engaged flange 12, 33 for example, the slide will be moved relatively to the right out of slot 51 and release the cover for movement toward closed position by spring 43. Thus, when the connector unit A is withdrawn from operative or engaged position either purposely or accidentally, cover 44 will immediately snap into closed position against the end 47 of the rubber covering 22.

There is thus provided a novel constructed electrical connector embodying novelly-cooperable, readily-separable complementary units which are exceedingly sturdy and adapted to successfully endure the most severe conditions during use. The novel construction of the connectors and the accessories therefor is simple and such as to eliminate to a large extent the danger of damage thereto which might otherwise result from accidental or careless misuse. Simple and automatic novel means are also provided for protecting the vital parts of the structure from moisture, dirt and the like which would impair the operation and efficiency thereof.

Although only a single embodiment of the invention has been illustrated and described in detail, it is to be expressly understood that the invention is not so limited. For example, the internal construction of the connector units illustrated may be greatly varied in accordance with the knowledge of the art. The number and construction of the contacts or conductors may be varied and the detail construction of the covers may be varied also, such as by the employment of different spring means equivalent to the coil springs shown. If desired, resilient covering 22 may extend beyond the left end (Fig. 1) of unit A for gripping unit B, thereby making it unnecessary for the shells to telescope, particularly when there is only one pin and socket contact. Various other changes, including changes in the design and arrangement of the parts illustrated as well as in the specific materials suggested, may be made without departing from the spirit and scope of the invention.

What is claimed is:

1. An electrical connector embodying two complementary separable units, each of said units comprising a rigid tubular shell, the end portion of one of said shells having a sliding telescopic fit within an end portion of the other of said shells and said shells having cooperating means thereon for holding the same against relative rotation while permitting relative axial movement thereof, and a covering of resilient material on only said one of said shells, said covering being radially spaced from said one shell adjacent one end of the latter to form an annular recess for receiving a bare end portion of said other of said shells and exerting a compressive force on said bare end portion to yieldably resist axial assembly and separation of said units.

2. In apparatus of the class described, a pair of telescoping tubular shells having cooperating means thereon for holding one against rotation relative to the other while permitting relative axial movement thereof, and a covering of resilient material on only one of said shells, said covering being radially spaced from said one shell at one end thereof, thereby forming an annular recess between the covering and said one shell for the reception of a bare end portion of the other of said shells, the outer diameter of said recess being normally somewhat less than the outside diameter of the bare end portion of the shell received therein, whereby said covering exerts a force yieldably resisting axial assembly and separation of said shells.

3. In apparatus of the class described, inner and outer telescoping tubular shells, an auxiliary tubular member rigidly secured to said inner shell and surrounding the telescoped portions of said shells in spaced relation thereto, and a tube of resilient material partially embedding and partially interposed between said auxiliary member

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and said inner shell and radially spaced from the telescoping end portion of said inner shell to provide a recess for the telescoping end portion of said outer shell, said resilient tube being adapted to exert a radially inward compressive force against said outer shell when the parts are in assembled relation.

4. Apparatus as defined in claim 3 comprising an annular rib on said telescoping end portion of the outer shell for engagement with the wall of said recess in the resilient tube.

5. Apparatus as defined in claim 4 wherein the wall of the resilient tube in said recess has an annular groove for receiving said rib.

6. In apparatus of the class described, a rigid tubular shell, a mass of resilient material embedding an end portion of said shell and extending beyond the end thereof, said mass having a central passage therein for receiving a cable, and clamping means substantially embedded in the extended portion of said mass adjacent the end of said shell for releasably tightly clamping a cable in said passage, an annular layer of said mass being interposed between said clamping means and the cable.

7. A detachable unit of a plug and socket connector comprising a rigid tubular body including an inner tube and an outer tube rigidly secured to and surrounding one end portion of said inner tube in radially spaced relation thereto, said tubes being secured together intermediate the ends of said inner tube, and a tube of resilient material, such as rubber, surrounding at least said one end of the inner tube in radially spaced relation thereto and embedding said outer tube and the other end of said inner tube.

8. A connector unit as defined in claim 7 wherein said resilient tube projects beyond said other end of the inner tube and including a U-shaped clamp embedded in the projecting end of said resilient tube, and means for drawing the ends of said clamp together to reduce the diameter of the bore in said resilient tube.

9. A detachable connector unit as defined in claim 7 comprising a bracket secured to said outer tube, a cover for said one end of the inner tube pivotally mounted on said bracket, and torsional spring means at the pivotal axis of said cover for continuously biasing the latter toward closed position.

10. A detachable connector unit as defined in claim 9 comprising locking means on said bracket for releasably locking said cover in open position against the efforts of said torsional spring means, said locking means comprising a slide mounted on said bracket and engageable with a notch in said cover.

11. An electrical connector unit comprising a unitary inner shell, a resilient insert removably mounted in said shell adjacent one end thereof, electrical contacts mounted in said insert, a tubular covering of yieldable material around said shell and partially filling the other end thereof so as to provide a passage for a cable to be connected to said contacts, and an auxiliary outer shell surrounding said one end of the inner shell and rigidly secured thereto intermediate the ends of the latter, said outer shell being wholly embedded in said yieldable covering.

12. An electrical connector unit comprising a unitary inner shell, a resilient insert removably mounted in said shell adjacent one end thereof, electrical contacts mounted in said insert, and a tubular covering of yieldable material around said shell and partially filling the other end thereof so as to provide a passage for a cable to be connected to said contacts, said tubular covering being externally radially spaced from said inner shell at said one end of the latter to form an annular recess for receiving an end portion of the shell of a complementary connector unit.

13. An electrical connector unit comprising a unitary inner shell, a resilient insert removably mounted in said shell adjacent one end thereof, electrical contacts mount-

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ed in said insert, and a tubular covering of yieldable material around said shell and partially filling the other end thereof so as to provide a passage for a cable to be connected to said contacts, said tubular covering having a portion extending beyond said other end of the inner shell comprising adjustable clamp means embedded in said extending portion for varying the size of said cable passage in the covering.

14. An electrical connector unit as defined in claim 11 comprising a bracket secured to said outer shell, end cover means pivotally mounted on said bracket for closing said one end of the inner shell, and resilient means for continuously biasing said cover means toward closed position.

15. An electrical connector unit as defined in claim 14 wherein said cover means comprises a flanged cup-shaped member, the annular flange of which engages the end of said tubular covering around said one end of the inner shell.

16. An electrical connector unit as defined in claim 14 comprising means for releasably locking said cover means in open position.

17. Apparatus of the class described comprising cooperating pin and socket contact units, each including a rigid cylindrical shell, and a resilient covering secured to one of said shells and adapted to surround and compressively grip a bare end portion of the other shell for yieldably holding the units in connected relation, said shells having cooperable means thereon for holding the same against rotation relative to each other while permitting relative axial movement thereof and said end portion of said other shell having at least one external rib thereon for yieldably resisting axial movement of said other shell in said covering.

18. Apparatus as defined in claim 17 wherein said rib has a bevelled surface and a radial surface intersecting at a sharp edge, whereby said other shell may be inserted into said covering more readily than it may be withdrawn therefrom.

19. Apparatus as defined in claim 17 wherein said covering has an internal annular groove positioned to receive said rib when said units are assembled in connected relation.

20. Apparatus of the class described comprising cooperating pin and socket contact units, each including a cylindrical shell, a resilient covering secured to one of said shells and adapted to surround and compressively grip a bare end portion of the other shell for yieldably holding the units in connected relation, said shells having cooperable means thereon for holding the same against rotation relative to each other while permitting relative axial movement thereof, end cover means pivotally mounted on said one shell, said means including a cup-shaped member, the flange of which engages said resilient covering around the end of the shell therein, spring means continuously biasing said cover means toward closed position, and means for releasably locking said cover means in open position against the efforts of said spring means, said locking means being adapted to engage a stationary part and be moved to non-locking position during and in response to the movement of said resiliently covered unit into operative engagement with the other of said units.

21. Apparatus of the class described comprising cooperating pin and socket contact units, each including a cylindrical shell, a resilient covering secured on one of said shells and adapted to surround and compressively grip a bare end portion of the other shell for yieldably holding the units in connected relation, said shells having cooperable means thereon for holding the same against rotation relative to each other while permitting relative axial movement thereof, and a member pivotally mounted on said other shell and adapted to engage a groove in the outer surface of said covering to yieldably resist separation of said units.

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