Jan. 25, 1949. I. F. MATTHYSSE 2,460,231

SEPARABLE CONNECTOR

Filed Jan. 23, 1943

FIG. 1.

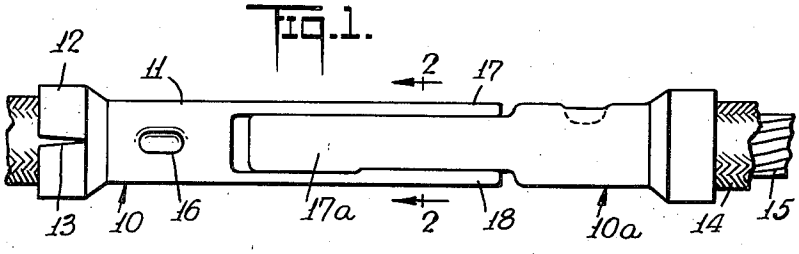


FIG. 2.

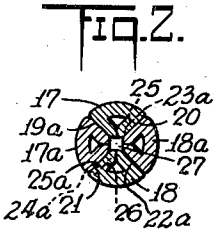


FIG. 3.

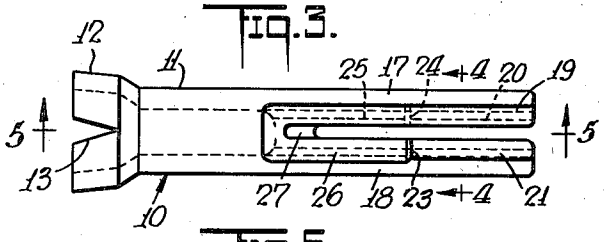


FIG. 4.

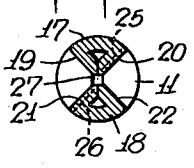


FIG. 5.

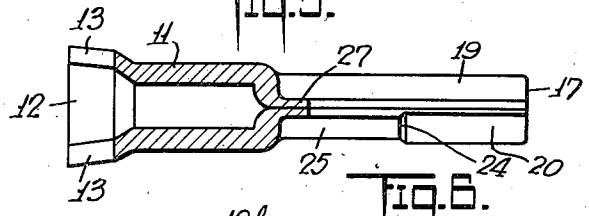


FIG. 7.

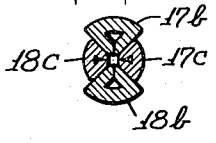


FIG. 6.

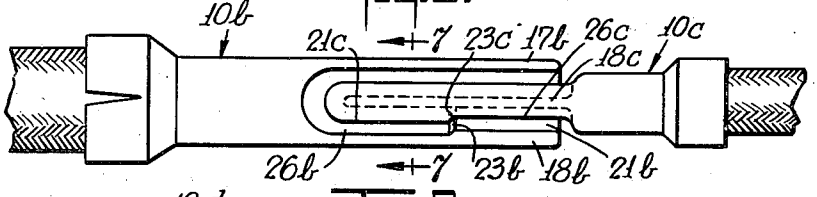


FIG. 8.

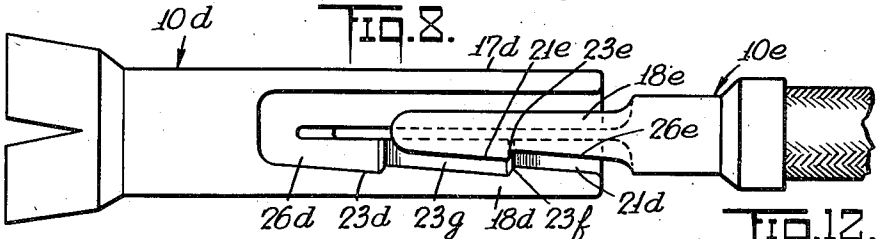


FIG. 9.

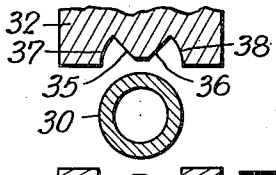


FIG. 10.

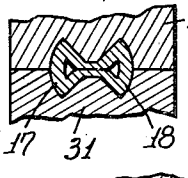


FIG. 11.

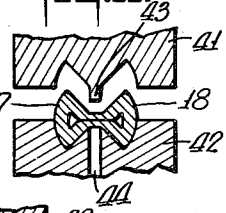


FIG. 12.

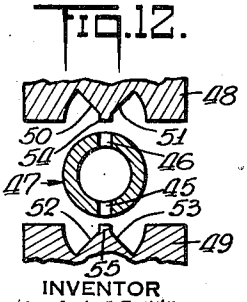
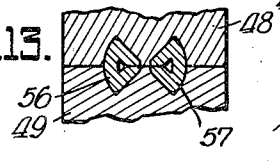




FIG. 13.



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Patented Jan. 25, 1949

2,460,231

UNITED STATES PATENT OFFICE

2,460,231

SEPARABLE CONNECTOR

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Application January 23, 1943, Serial No. 473,414

3 Claims. (Cl. 287—76)

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My invention relates to separable electrical connectors.

It is customary in aircraft wiring to use terminal strips with threaded studs mounted thereon to make connections between wire ends to which wire terminals have been attached. Such terminal strips are bulky, relatively heavy, and require boxes or enclosures to prevent accidental short circuits. One object of my invention is to provide a separable connector for such application which is substantially cylindrical and having approximately the outside diameter of the insulated wire. Such a connector may readily be insulated with insulating tubing or "spaghetti." A further object is to provide such a connector which can be installed directly in the wiring at any desirable point.

Modern airplane construction provides for the assembly of "sub-assemblies." For example, wing sections or tail sections are attached to the fuselage, usually in separable fashion, so that when these parts are damaged they may be readily replaced. It has been found that, under such circumstances, the electrical wiring between the separable parts should be readily detachable. The use of permanent splices in the wire at these points is both inconvenient and wasteful of time. It has been additionally found that the separable connectors in the wiring at these points should be such that they will separate at a definite tensile pull, usually about 10 or 12 pounds. Thus, in case of accidents, the wires will separate at predetermined joints and damage of wiring and of delicate instruments by pulling or shock will be avoided.

Another object of my invention, therefore, is to provide a separable connector which will separate into two sections at a predetermined value, in a longitudinally applied tensile pull.

A further object of my invention is to provide a connector to which the wires may be attached with or without the use of solder, as desired.

Another object is to provide a separable connector which may consist of two identical mating parts. This avoids the necessity for selecting a male part for one of the wire ends and a female part for the other.

Another object is to provide separable connectors such that either half of one size of separable connector will mate properly with either half of a different size. This provides a means for separably connecting a smaller cable size to the end of a larger one, thereby resulting in an economy of cable.

Another object is to provide a separable connector whose two mating parts are each made from a single piece of metal tubing.

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Another object is to provide a separable connector having the interlocking fingers of the mating halves hardened in the manufacturing process to give them a greater resiliency than that of the original material. This provides a connector that will maintain constant spring tension on the current carrying surfaces.

Another object is to provide a separable connector whose interlocking fingers cannot be disturbed by the action of mechanically "crimping" the ends of the connector to the wires.

Still another object is to provide a connector having two parts, each provided with segments interlocking with the segments of the other part, which segments are attached and readily detached by a camming action of the segments on each other.

Another object of my invention is to provide a separable connector which can be manufactured by high speed production methods with a minimum of scrap or material waste.

Another object is to provide a method of manufacturing my separable connector.

I accomplish these and other objects and obtain my new results as will be apparent from the device described in the following specifications, particularly pointed out in the claims, and illustrated in the accompanying drawing, in which:

Fig. 1 is a side elevation of the two parts of my invention assembled to each other.

Fig. 2 is a cross-sectional view taken along the line 2—2 of Fig. 1.

Fig. 3 is a side elevation of one of the two parts shown in Fig. 1.

Fig. 4 is an end view thereof.

Fig. 5 is a longitudinal sectional view of the part illustrated in Fig. 3 taken along line 5—5.

Fig. 6 is a side elevation of a separable connector having two differently sized parts assembled to each other.

Fig. 7 is a cross-section of the same taken along the line 7—7 of Fig. 6.

Fig. 8 is a side elevation of a separable connector having two differently sized parts, with one part designed to engage either an extra large or an extra small sized part.

Fig. 9 and Fig. 10 illustrate a method of forming the connector from a tube.

Fig. 11 illustrates a method of cutting the central slot after the forming operation.

Fig. 12 and Fig. 13 illustrate another method

whereby a slotted tube may be formed into the finished shape.

Referring more particularly to Fig. 1 of the darwing, reference numerals 10 and 10*a* designate the two parts or halves of my separable connector which may be identical halves as shown. Elements on connector half 10*a* corresponding to half 10, will be similarly designated hereafter.

Each connector half is preferably formed from a tubular sleeve made of malleable metal, as indicated by the body 11, and preferably provided with an enlarged head 12 formed by diametrically slotting the end thereof as at 13 to accommodate the insulation 14 covering the conductor 15 to be attached thereto.

The two connector halves are connected together by forming the extending portion of each connector half into extending fingers, two, 17 and 18, being illustrated as an example, on connector half 10.

Each finger is formed in cross-section substantially in the shape of a sector having an angular displacement substantially equal to the space between the fingers and provided with surfaces 19 and 20 being radially formed on finger 17, and 21 and 22 on finger 18, as shown in Fig. 4.

Surfaces 20 and 21 on fingers 17 and 19 are provided with cam steps 24 and 23, respectively. Thus surface 20 of finger 17 drops to sub-surface 25, a depth equal to the height of cam step 24, and surface 21 of finger 18 similarly drops to subsurface 26, an equal distance.

When the two sets of fingers of halves 10 and 10*a* are interlocked, the cam steps 23 and 24, and 23*a* and 24*a* cause the fingers to be resiliently separated, until the cam steps 23 and 24 pass opposite cam steps 23*a* and 24*a*, whereupon the two fingers 17 and 18 will seat themselves against fingers 17*a* and 18*a* by snapping into position.

The cam steps may be provided on all the surfaces, but only one per finger is illustrated. Thus plane surfaces 19 and 19*a*, 22 and 22*a* will ride against each other in a wiping action, thus providing good electrical contact. The cam steps are provided midway on the radially formed contacting surfaces, in the illustration.

To prevent disturbing the relationship of the fingers, when the indentations 16 and 16*a* are formed in securing the connector halves to the conductors, the partially extending web 27 is left between fingers 17 and 18. The web takes the mechanical stress that might tend to spread or distort the fingers when the indentation is made. The web additionally extends to that point between the two fingers which gives the resiliency desired.

The cam steps 23 and 24 may be similarly varied in height to permit the predetermined pull required to separate the two connector halves, and to keep a satisfactory contact pressure.

I have further provided in my device for detachably interlocking two connector halves of different sizes, i. e., different diameters. Thus, as illustrated in Figs. 6 and 7, two halves 10*b* and 10*c* may be interlocked, although their diameters are different with resultant differences in cable diameters and insulation that may be accommodated therein. The length of the radially faced surfaces 21*b* should be substantially equal to the length of surface 20*c*, and similarly so with faces 26*b* and 21*c*.

Where extra large size conductors are to be separably secured, it may be desirable to employ a plurality of steps along the engaging surfaces of the fingers to insure the necessary gripping

action. Even so, as illustrated in Fig. 8, a double cam step connector half may be interlocked with a single cam step connector half. Here connector half 10*d* is provided with extending fingers 17*d* and 18*d*. The interlocking surfaces are illustrated on finger 18*d*, where two steps 23*d* and 23*f* form surfaces 26*d*, 21*d* and intermediate surface 23*g*, all of which are shown of equal length. In Fig. 8, a connector half 10*e* of smaller diameter, employing but a single cam step 23*e* on its engaging surface 21*e* engages cam step 23*f* of connector half 10*d*.

Thus, connector halves employing two cam steps on a single engaging surface may be interlocked with a connector half, using a single cam step.

The connector halves as has been stated, may be made from tubular stock. The fingers may be formed in the manner illustrated in Figs. 9 to 13.

In Fig. 9, the tubular stock 30 is inserted between dies 31 and 32. Each of these dies is shaped to provide opposite faces on each set of fingers. Thus surfaces 33 and 34 of die 31 may be used to form faces 19 and 21 in fingers 17 and 18 respectively, including step 23 and face 25 of connector half 10, in Figs. 3 and 4. Similarly die 32 is provided with surfaces 35 and 36 to form the remaining faces on the fingers 17 and 18. Curved surfaces 37, 38, 39 and 40 of dies 31 and 32 maintain the originally round surfaces of the fingers.

Fig. 10 illustrates the position of the two dies after the fingers are formed.

Fig. 11 illustrates the dies 41 and 42 provided with cutting-off section 43 and slot 44 for removing the material between the fingers 17 and 18 up to the web 27.

In Fig. 12, another method of forming the fingers is shown which comprises first cutting the slots 45 and 46 in tube 47. The dies 48 and 49 provided with surfaces 50 and 51, and 52 and 53 respectively, and projections 54 and 55 are compressed until the projections 54 and 55 abut each other, as shown in Fig. 13, which completely shapes the two fingers 56 and 57. Instead of cable socket ends, one of my connector halves may be provided with a terminal plate for attachment to a bus bar, in a manner known in the art.

The shaping operations for the fingers 17 and 18 harden the relatively soft malleable metal of the tubular body 11 into resiliently actuated fingers. Thus, a separable connector is formed having tubular wire receiving ends ideally suited for indenting with suitable pliers or press, and having extending fingers which are sufficiently hard to avoid excessive wear on the sliding surfaces, and sufficiently resilient to provide satisfactory spring action for efficient mechanical and electrical engagement.

In the foregoing device, I have provided a separable connector especially applicable for aviation use. The contours of my connector make possible the use of insulating tubing. Reliable means are provided for a separation of the two parts forming my connector upon application of a predetermined longitudinally applied tensile force. The two ends of the connector are ideally suited for indentation to the conductor ends. The metal of the connector is sufficiently malleable at the points of indentation and sufficiently resilient and hardened for the extending fingers.

The provision of a web between the extending fingers for a portion of their length, results in a maintenance of the position of the fingers,

during the indentation of the connector body, during which time the developed stresses would ordinarily cause a distortion of the finger portions.

The manufacture of the connector from tubular stock without material waste constitutes a saving in time, material and effort in the manufacture of the device. In addition, the contacting surfaces all have the original finish of the metal tubular stock.

I have thus described my invention, but I desire it understood that it is not confined to the particular forms or uses shown and described, the same being merely illustrative, and that the invention may be carried out in other ways without departing from the spirit of my invention, and, therefore, I claim broadly the right to employ all equivalent instrumentalities coming within the scope of the appended claims, and by means of which, objects of my invention are attained, and new results accomplished, as it is obvious that the particular embodiments herein shown and described are only some of the many that can be employed to attain these objects and accomplish these results.

What I claim and desire to secure by Letters Patent, is as follows:

I claim:

1. A connector for separably connecting two conductors together, consisting of two body halves, each half having means at one end thereof for attaching a conductor thereto, and slotted at the other end thereof to form resiliently extending interlocking fingers, each of said fingers having a pair of flat radially engaging contact surfaces, one of which surfaces has a flat offset portion with a camming surface positioned at the junction of the offset portion therewith for interlocking with a flat offset portion on a finger of the remaining body half, providing a flat engaging electrical contact during the movement of the engaging finger on said one surface and on its offset portion.

2. A connector for separably connecting two conductors together, consisting of two body halves, each half comprising a single piece of tubing having means at one end for attaching a conductor thereto, and bifurcated at the remaining end to form a pair of sector-shaped fingers, each provided with a pair of radially shaped engaging surfaces forming a part of the original surface of the tubing to insure a hard surface resistant to wear and providing good contact surfaces when the two halves are interlocked together.

3. The connector of claim 2 provided with a web of material connecting each pair of sector-shaped fingers for a portion of the distance the fingers extend from the body half, whereby the degree of resiliency of the fingers may be controlled.

IRVING FREDERICK MATTHYSSE.

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