

March 13, 1945.

A. J. SCHMITT

2,371,551

ELECTRICAL CONNECTOR

Filed Jan. 23, 1942

Fig. 1

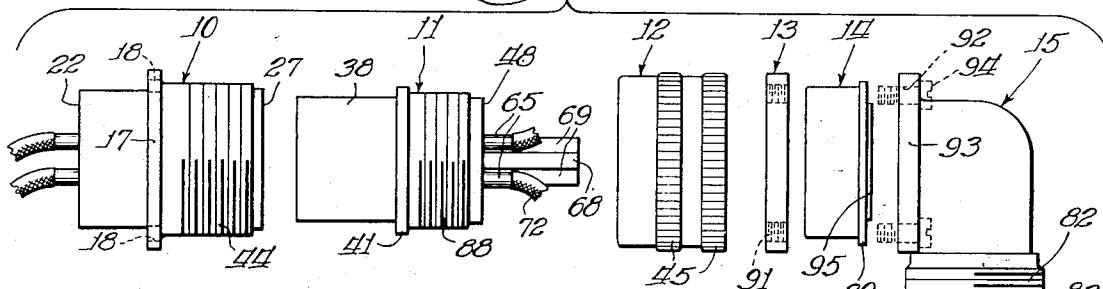


Fig. 6 Fig. 7

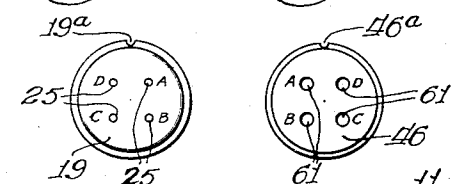


Fig. 2

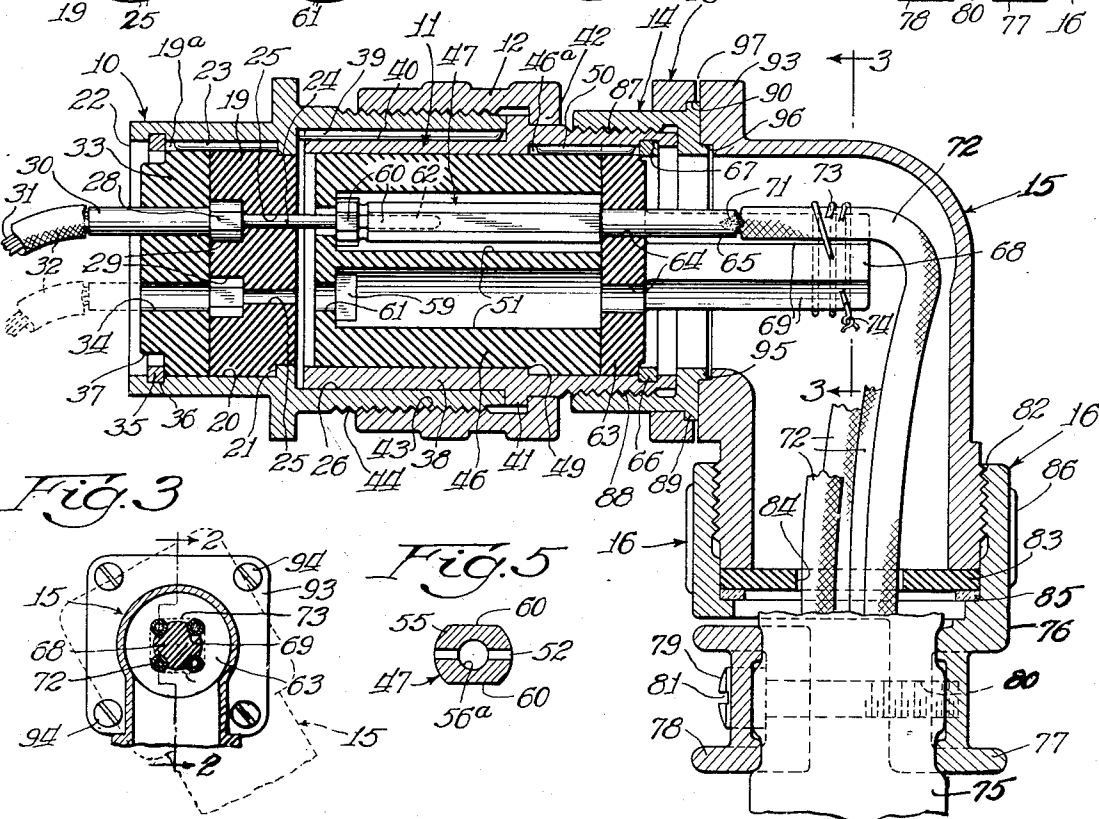


Fig. 3

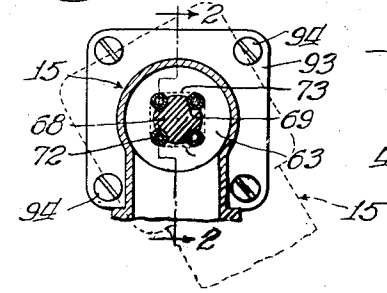


Fig. 5

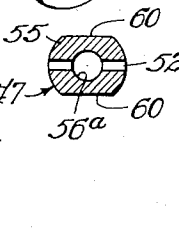
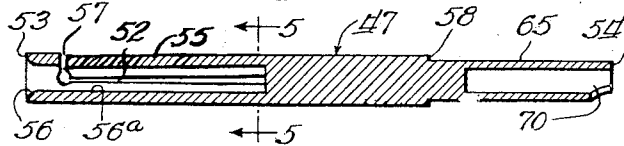


Fig. 4



Inventor:
Arthur J. Schmitt
By:
A. Trevor Jones

Att.

UNITED STATES PATENT OFFICE

2,371,551

ELECTRICAL CONNECTOR

Arthur J. Schmitt, Chicago, Ill.

Application January 23, 1942, Serial No. 427,892

2 Claims. (Cl. 174-86)

This invention relates to electrical connectors more particularly for use in aircraft and other precision equipment subject to severe conditions, such as for example, vibrations and moisture, and a principal object of the invention is to provide an improved and simplified connector of this class having enhanced versatility for various such uses and at the same time providing a positive mechanical and electrical connection, markedly resistant to trouble causes so as uniformly to effect the desired purposes with minimum reliance upon the human element.

These and other objects and advantages will be apparent from the following description of an exemplary embodiment of the invention shown in the accompanying drawing, in which—

Figure 1 is a separated or so-called exploded view of parts of the illustrative connector referred to;

Figure 2 is an enlarged assembled view of parts shown in Fig. 1 but being an axial section showing interior parts and taken on the line 2—2 of Fig. 3;

Figure 3 is a reduced fragmentary cross-section taken on the line 3—3 of Fig. 2 and showing in broken lines an alternative position of the parts;

Figure 4 is an enlarged longitudinal sectional view of one of the female contact elements employed with the present invention;

Figure 5 is a further enlarged cross-section of the element of Fig. 4 taken on the line 5—5 of Fig. 4;

Figure 6 is a reduced end view of one of the core pieces at its end which is adjacent to the other core piece; and

Figure 7 is a similar reduced end view of the other core piece.

Referring in detail to the drawing, the connector body cylindrical parts 10, 11, 12, 13, 14, 15 and 16, which are desirably aluminum castings for lightness, strength and non-sparking qualities, provide an effective housing for the wiring and contact connections later described, and at the same time an electrical shield therefor. The body shell part 10 may be mounted on a chassis panel or other support as by a peripheral mounting flange 17 thereon, rectangular or square in contrast to the cylindrical form of the shell itself. Perforations 18 in the corners of the mounting flange provide screw or rivet apertures for mounting purposes. The hollow interior of the body shell 10 may carry an insulating core 19 (Fig. 2) which is advantageously of a phenolic condensation product of good dielectric properties molded to cylindrical form to snugly fit the

interior 20 of the body shell 10, there being a shoulder formed as at 21 to limit insertion of the core 19 into the body shell 10 from the rear end 22 of the shell. A longitudinal key 23 on the interior 20 mates with a keyway 19a in the core 19 to fix the relative rotative relationship of the core and the shell.

Male metal contact members or prongs 24, in this instance four in all, are carried by the core 19 and pass snugly through passages 25 in the core to project into the interior 26 of the body receptacle shell 10, this interior opening into the end 27 of the shell, which end telescopically receives the body part or plug shell 11 as presently described. The prongs 24 have non-circular enlargements 28 which are received in non-circular counterbores 29 of the passages 25 to prevent rotation of the prongs with respect to the core 19, and continued rearwardly of the enlargements 28 are soldering extensions 30 of the prongs 24 to which wires such as 31, carrying suitable insulating covering 32, are soldered in the usual manner. An auxiliary insulating core piece 33 similar in material to the core piece 19 is placed over the soldering extensions 30, the extensions projecting through suitable perforations 34 in the auxiliary core piece, and a retaining split-ring 35 of spring metal is snapped into an internal annular groove 36 in the interior 20 to abut the auxiliary core piece 33 and retain the latter in abutment with the enlargements 28 of the prongs to hold the prongs and core 19 securely in position. The auxiliary core piece 33 has a keyway continuation of the keyway 19a to fix a single rotative position for the auxiliary core piece 33 with the main core piece 19 in the shell 10. To facilitate insertion of the retaining split-ring 35, the auxiliary core piece 33 may have a reduced outer face 37.

It will now be evident that what has been thus far specifically described including the body shell 10 and its inner parts provides what may be considered as a stationary portion of the connector means, with which the parts to be next described are adapted to be readily interengaged to complete an electrical connection.

The body part or plug shell 11, which mates with the body part or receptacle shell 10 to complete a connection, has, as already alluded to, a smooth cylindrical part 38 of a diameter to be just slidingly received within the interior 26 of the shell 10 through the open end 27 of the latter, the interior 26 having a longitudinal key 39 on its inner surface which enters a mating keyway 40 on the exterior of the part 38 to fix a

single rotative position of the part 38 with respect to the shell 10. An outwardly directed annular flange 41 limits extent of insertion of the part 11 in the shell 10, and this flange also forms a bearing for an inwardly directed flange 42 of a third body part 12 which functions as a coupling collar for the body parts 10 and 11 and is interiorly threaded as at 43 (Fig. 2) to screw upon the external threads 44 of the body part 10. Thus, rotation of the coupling collar 12, which turns freely upon the body part 11 facilitated by knurlings 45, causes a telescoping interengagement of the plug part 38 with the shell 10 and forces the prongs 24 into the female contact elements carried by an insulating core 46 housed snugly within the body part 11, one of these female contact elements 47 being shown separately in Fig. 4. The core 46, which is also advantageously of phenolic condensation material, is inserted from the rear open end 48 of the body shell 11, the shell interior and the core exterior having mating shoulders as at 49 to limit the extent of insertion of the core into the body shell and also having mating key 50 in the interior of its body and keyway 46a in the core to fix a single rotative relationship of these parts.

Interiorly the core 46 has, in this instance, four pockets 51 in which are disposed the four female contact elements 47 here employed, one in each pocket. As best shown in Figs. 4 and 5, the female contact element 47 is somewhat in the form of a fork having a split-sleeve portion split as at 52, intermediate its ends 53 and 54 to provide a spring tongue 55 which is normally biased inwardly of the contact element, as best shown in Fig. 4, to effect a resilient engagement with a prong 24. The prong is first received in the somewhat flared mouth 56 leading into the bore 56a of the female contact element and is thus guided into engagement with the spring tongue 55. The transverse cut 57 rearwardly of the extreme end 53 and communicating with the longitudinal split 52 serves to provide a free end for the tongue 55 by reason of which the tongue may be biased inwardly of the contact element while still leaving the mouth 56 uncontracted for guiding purposes as referred to and facilitating initial interengagement of the prong and female contact element while at the same time enhancing the security of the contact engagement when completed.

The female contact element 47 is inserted in a pocket 51 from the rear end of the core 46, the pocket 51 being just long enough to receive the female contact element up to the shoulder 58 on the element, and, as will be seen from Fig. 2, the pocket 51 is substantially larger in diameter than the female contact element so that the spring tongue 55 of the female contact element may have unobstructed play therein and so that the female contact element may adapt itself to slight deviations in position of the male contact element. To prevent rotation of the female contact element in the pocket, the inner end of the pocket is reduced as at 59 to non-circular form and the female contact element is flattened as at 60 so as to be non-rotative in the pocket. A passage 61 perforates the core 46 at its leading end through which the prong 24 passes to engage the female contact element as described and as shown in dotted lines at 62 (Fig. 2) with reference to the upper pocket in this figure. Both the prong and the female contact element are omitted from the lower part of Fig. 2 for clearness of description, but it will be understood that in general practice there will be four prongs and four female contact elements

in an assembly such as here specifically described.

The female contact elements are held in place longitudinally of the core 46 by a retaining disk 63 also of dielectric material and perforated as at 64 to pass snugly therethrough the soldering shanks 65 of the female contact elements which are of reduced diameter. The key and keyway interlock 46a—50 is continued into the retaining disk 63 and both the core 46 and retaining disk 63 may be held in place by a retaining split-ring 66 which may be sprung into an internal annular groove 67 in the end 48 of the body shell 11.

The prongs 24 and the female contact elements 47 are desirably machined from a hard bronze type metal having spring temper to afford the desired resilience, and are preferably silver-plated, and the retaining split-rings 35 and 66 are of a somewhat softer spring metal so that these latter may be removed with the aid of a simple tool such as a screw driver if access is desired to the interior of the cores 19 and 46, or if it be desired to reverse the assembly, which may be done by say locating the prongs 24 and their insulating carrying parts in the body shell 11 and the female contact elements 47 and their insulating carrying parts in the body shell 10. For this purpose the longitudinal distance between the retainer split-ring 35 and the shoulder 21 is the same as the longitudinal distance between the shoulder 49 and the retainer split-ring 66 so that the parts are interchangeable.

Following the present invention, the retaining disk 63 carries centrally thereof and advantageously molded integrally therewith a dielectric mast 68 exteriorly longitudinally grooved as at 69 adjacent each of the passages 64 and thus adapted to permit the soldering shanks 65 of the female contact elements to lie therein, one in each groove spaced circumferentially about the mast 68, but at the same time freely exposing the soldering recess 70 of the female contact element so that there may be soldered thereto as at 71 the bared end of a covered conductor wire 72. It will be understood that this is commonly done with all four of the soldering shanks 65 and all four of the wires 72 which are connected thereto respectively. The mast 68 is of sufficient length so as to provide longitudinally thereof a space in the groove 69 for the end of the wire 72 so that when the soldering shank 65 and the wire are soldered together, keeper means such as a linen cord 73 may be wound around the mast 68 to encircle the wire ends and may be knotted as at 74 to lash the wire ends to the mast. Thus, the soldering connections are relieved of vibrational or other strains which might tend to break these connections and such stresses are taken up by the cord 73 and mast 68 which are of a sturdy character well able to absorb the attendant reactions. It will be understood that the cord 73 may have any desired number of convolutions to provide the necessary sturdiness and may, if desired, be varnished after being applied about the wire ends so as to enhance the durability and homogeneous character of the keeper means illustrated.

The wires 72 may be carried by a conduit cable 75, the end of which is carried by a nipple 16 which clamps onto the cable end, having for this purpose a clamping jaw body part 76 comprising a fixed jaw portion 77 and a movable jaw portion 78 connected by machine screws 79 which pass freely through the movable jaw portion 78 and into tapped holes 80 in the fixed jaw portion. This arrangement, when suitably tightened as by means of a screw-driver inserted into

the kerf 81 of the screw 79 to rotate the screw inwardly as far as possible, further relieves both the soldering connection 71 and the mast and cord connection 68—73 from strains.

In order to provide a right-angular approach of the cable 75 to the connector without bending of the cable as a whole, the invention contemplates the use of the connector body part 15 in the form of an elbow casing for the adjoining parts of the contact elements and wires. The nipple 16 and one end of the elbow casing 15 are matingly threaded as at 82 to have the nipple screwed onto the casing end preferably before the nipple is clamped to the cable by the jaws 77—78. To guard against entry of moisture from the cable into the casing a rubber guard disk 83 is held against the end of the casing by the nipple and compressed therebetween when the nipple is screwed tightly upon the casing, a central opening 84 in the rubber disk 83 passing the wires 72 therethrough. The disk 83 may be reinforced by a fiber ring 85. The nipple 16 may have ribs 86 upon its exterior to prevent slippage of the fingers of the mechanic when making the connection.

Further in accordance with the present invention, for enhanced flexibility of installation and to permit the shortest possible run of cable for example, the elbow casing 15 is arranged to have its end which takes the nipple 16 adjustable in a plane at right angles to the axis of the mast 68 and to be disposed at any angle in a three-hundred-sixty degree possible movement in such plane. For this purpose, the end of the elbow which adjoins the body shell 11 carries the fully rotatable coupler ring 14 which is interiorly threaded as at 87 to screw upon the external threads 88 of the body shell 11. The coupler ring 14 has a smooth annular flange 89 which rides in an annular counterbore 90 in the rectangular and in this instance square swivel plate 13, which latter at its corners has tapped holes 91 adapted to mate with registering holes 92 in the square face 93 of the elbow casing 15. Machine screws 94 pass freely through the holes 92 and threadedly into the holes 91 to secure the coupler ring 14 to both the swivel plate 13 and the face 93 with the coupler ring flange 89 therebetween. Until the screws 94 are tightened the elbow casing 15 may therefore be swiveled on the coupler ring 14 and located at any position desired in a plane perpendicular to the axis of the coupler ring 14, as indicated by the broken lines in Fig. 3. A reduced annular part 95 of the coupler ring at one end rotatively enters the counterbore 96 in the elbow casing to assist in guiding the swiveling action just referred to and at its other end abuts the shell 11 to secure the attachment of the coupler ring to the shell, it being understood that the coupling ring 14 may at this time be screwed tightly upon the body shell 11, as already mentioned. When, now, a desired angle has been determined upon for the elbow casing 15, the screws 94 may be tightened and the annular flange 89 of the coupling ring 14 thus clamped between the swivel plate 13 and the face 93 of the elbow casing, the counterbore 90 of the swivel plate 13 being made slightly shallower than the thickness of the annular flange 89 of the coupler ring, so that a clearance 97 remains at all times to permit the desired clamping action to fix the relative rotative relationships of the coupler ring 14 and the elbow casing 15.

To insure correct insertion of the wires 31 and 72 as desired, the passages 25 in the core 19 and

the passages 61 in the core 46 are designated as in this instance by the letters "A," "B," "C" and "D" respectively, as shown in Figs. 6 and 7, and when the cores 19 and 46 are in face to face position as shown in Fig. 2, when the connection is made, the keyway 19a of the core 19 and the keyway 46a of the core 46 are rotatively and longitudinally aligned, and the "A" passage 25 is rotatively and longitudinally aligned with the "A" passage 61. Similarly, the "B" passage 25 is aligned with the "B" passage 61, the "C" passage 25 is aligned with the "C" passage 61, and the "D" passage 25 is aligned with the "D" passage 61. Furthermore, the keyways 19a and 46a are rotatively and longitudinally aligned with the key 39 of the body shell 10 and the keyway 40 of the body shell 11. This insures the correct operating connection with the definite polarity desired.

When it is desired to uncouple the connector, the coupling collar 12 is unscrewed and by reason of the inwardly directed flange 42 of the coupling collar abutting the coupler ring 14, the plug shell 11 is moved outwardly of the receptacle shell 10 and the prongs 24 are disengaged from the female contact elements 47. The conversion of the rotary motion of the coupling collar 12 to longitudinal movement of the plug 11 effects a gradual disengagement of the contacting parts so as to avoid jerks or sudden pulls.

It is to be understood that the invention is not intended to be limited to details of construction here shown for illustrative purposes. Furthermore, it is not intended that it be understood that all features of the present disclosure must be used conjointly, since it will be apparent to workers in the art that various combinations or sub-combinations may at times be advantageously employed.

Having described my invention, I claim:

1. In an electrical connector of the class described embodying a cylindrical metallic shell and an insulating contact carrying core therein, said shell having an external thread at one end, the combination, with the shell, of a cylindrical coupler ring having an internal thread and threadedly engaging the external threads of the shell to attach the coupler ring to the shell, said coupler ring having a cylindrical external annular flange, a swivel plate having a round aperture therein telescoping on said coupler ring and having an annular counterbore rotatably but snugly receiving said flange, a cable casing having a face plate abutting the swivel plate in any selected rotative position of the casing with respect to the coupler ring, said counterbore being shallower than the flange to space the swivel plate and face plate apart whereby when the casing and swivel plate are clamped together the coupler ring flange is clamped therebetween against relative rotation of the coupler ring and casing, an annular counterbore in said face plate, an annular extension on the coupler ring at one end snugly but rotatably received in the face plate counterbore and at its other end abutting the shell to secure the attachment of the coupler ring and shell, registering holes in the swivel plate and face plate, clamping elements passing through said holes to clamp the casing and swivel plate together, and an internally threaded coupling collar carried by the shell apart from said coupler ring and adapted to engage the shell with another contact carrying member, said coupler ring limiting movement of the coupling collar with respect to the shell.

2. In an electrical connector of the class described embodying a cylindrical metallic shell and an insulating contact carrying core therein, said shell having an external thread at one end, the combination, with the shell, of a cylindrical coupler ring having an internal thread and threadedly engaging the external threads of the shell to attach the coupler ring to the shell, said coupler ring having a cylindrical external annular flange, a swivel plate having a round aperture therein telescoping on said coupler ring and having an annular counterbore rotatably but snugly receiving said flange, a cable elbow casing having a face plate abutting the swivel plate in any selected rotative position of the casing with respect to the coupler ring, said counterbore being shallower than the flange to space the swivel

plate and face plate apart whereby when the casing and swivel plate are clamped together the coupler ring flange is clamped therebetween against relative rotation of the coupler ring and casing, an annular counterbore in said face plate, an annular extension of the coupler ring at one end snugly but rotatably received in the face plate counterbore and at its other end abutting the shell to secure the attachment of the coupler ring and shell, registering holes in the swivel plate and face plates, and clamping elements passing through said holes to clamp the casing and swivel plate together to fix the rotative position of the casing with respect to the coupler ring.

ARTHUR J. SCHMITT.