

March 13, 1962

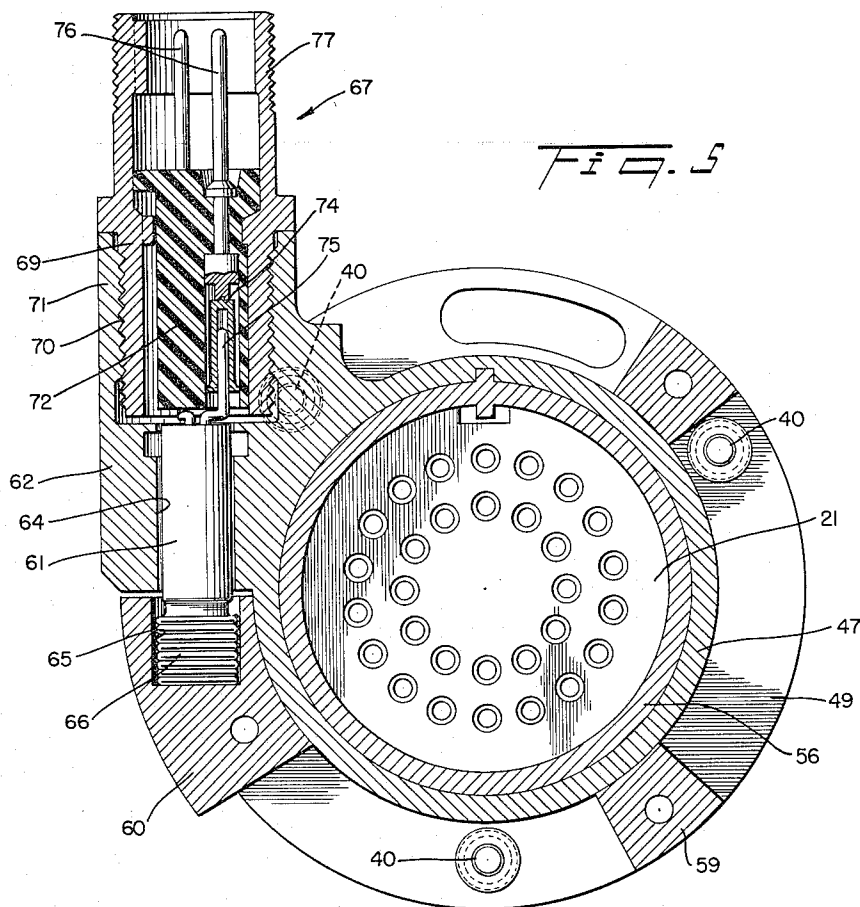
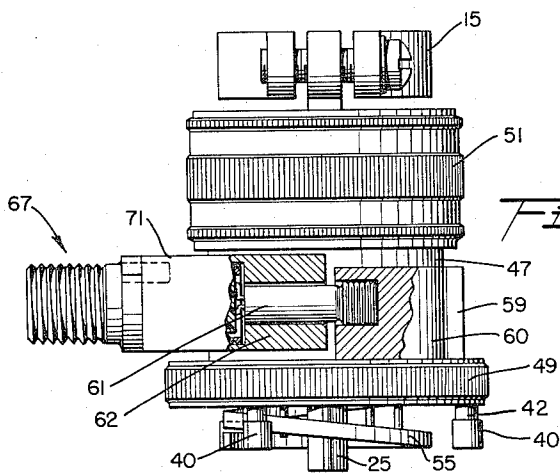
W. F. HENNESSEY, JR

3,025,487

ELECTRICAL CONNECTOR

Filed Jan. 19, 1960

2 Sheets-Sheet 2



INVENTOR.
WALTER F. HENNESSEY, Jr.
BY *Bauer and Seymour*
ATTORNEYS

1

3,025,487

ELECTRICAL CONNECTOR

Walter F. Hennessey, Jr., Sidney, N.Y., assignor to The Bendix Corporation, a corporation of Delaware
Filed Jan. 19, 1960, Ser. No. 3,434
10 Claims. (Cl. 339-45)

This invention relates to a separable electrical connector. The connector of the illustrative embodiment is particularly adapted for use in, although not restricted to, applications wherein the respective parts are mounted upon bodies which are selectively retained together and separated from each other. A use for which the connector is particularly well adapted is the rapid separation of the connector parts while they are in flight.

The invention has among its objects the provision of a novel separable electrical connector.

A further object of the invention lies in the provision of a separable electrical connector having the two main parts thereof adapted to be connected to bodies which are selectively held together and released from each other.

Still a further object of the invention lies in the provision of an improved separable electrical connector having power means for disconnecting the two connector parts, whereby to allow their separation.

Yet another object of the invention lies in the provision of an improved separable electrical connector, wherein one of the connector parts has a relatively smooth outer surface which may be mounted substantially flush with the skin or outer surface of its respective body, the contacts in such body and the parts associated with such body of the means holding the connector parts together lying below such outer surface of the body.

Yet another object of the invention lies in the provision, in a separable electrical connector of the type indicated, of improved simple mechanism for locking the two connector parts together, such mechanism being easily operated both to lock the connector parts together and to unlock them so as to permit their separation.

The above and further objects and novel features of the invention will more fully appear from the following 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 view in axial section of a separable electrical connector made in accordance with the invention, the two main parts of the connector being shown in engaged operative position, portions of the two bodies upon which the two connector parts are mounted being fragmentarily shown, certain of the parts being shown in elevation;

FIG. 2 is a fragmentary view in vertical axial section through the contact pin-carrying portion of the connector shown in FIG. 1, such portion being shown with the parts thereof in the positions which they have when such connector part is disconnected from the contact socket-carrying portion of the connector;

FIG. 3 is a view in vertical axial section through the socket-carrying portion of the connector;

FIG. 4 is a fragmentary view in plan of the connector part of FIG. 3;

FIG. 5 is a view in transverse horizontal section through the contact pin-carrying part of the connector, the section being taken along the line 5-5 of FIG. 1; and

FIG. 6 is a view in side elevation of the first connector part, the view being taken in a direction from left to right in FIG. 5.

2

The embodiment of separable electrical connector shown is particularly adapted for use in applications wherein two bodies are selectively held together or disconnected from each other, and there is an electrical circuit which extends from one body to the other which is broken when the two bodies are separated from each other. Small target or drone airplanes, which are carried aloft by a "mother" airplane and are there separated therefrom, present a need for such separable connector, since the drone airplane has one or more mechanisms, which is supplied with power and/or signals while it remains attached to the mother airplane. Another application in which such separable electrical connector may be used to advantage is with missiles having separable nose cones, the main part of the connector being associated with the body of the missile and the other part thereof being connected to the separable nose cone. Such construction allows the nose cone to be separated from the body of the missile while the two are in flight.

A separable electrical connector, in order to be fit for either of the above two services, must have characteristics which are ordinarily not present in conventional connectors. The connector part mounted on the drone airplane, for example, should present as streamlined a surface as possible. When the parts of the connector are in operative engagement with each other they should be sealed to each other, so that the electrical circuit through the connector is completely sealed from the atmosphere. The two connector parts should be strongly and securely connected together, when operatively engaged, and such connection should be such that it may be quickly and simply effected. The connector parts should be quickly and simply disconnectable from each other; such operation is preferably carried out in such manner as to separate the connector parts quickly and cleanly so as to prevent any possible fouling of either. The illustrative electrical connector fulfills all such requirements satisfactorily, and fulfills the above stated objects of the invention by novel combinations of elements to be described.

In FIG. 1 there are shown a portion 13 of the skin or outer surface of a parent aircraft and a fragment designated 12 of the skin or outer surface of a drone aircraft which is attached to the parent aircraft by releasable means not shown. The connector of the invention includes a contact pin-carrying portion or body generally designated 10, which is connected to the parent aircraft, and a mating socket contact-carrying portion generally designated 11, mounted on the drone aircraft. Referring now to FIGS. 1 and 2, the structure of portion 10 of the connector will now be described.

Connector body 10 has a hollow main shell 14 which may be made, for example, of a metal such as aluminum. The outer end of shell 14 carries a cable clamp 15. Within the forward or lower end of shell 14 there is mounted an electrically insulating contact pin-carrying insert generally designated 16, said insert including a molded resin outer, main insert 17 and a plate-like inner backing member 21 made, for example, of a relatively rigid molded resin. A plurality of parallel pin contacts 22 are mounted in insert 16 so that their lower or forward ends extend somewhat beyond the edge of shell 14. The inner ends of the contact pins carry solder wells 24 by means of which electrical connection is made between the contact pins and the respective conductors of a cable (not shown). An internal shoulder 19 on shell 14, and an outwardly directed flange 20 on insert 17, retain the insert and the contact pins in the desired axial position.

An enlarged metal polarizing pin 25, centrally disposed within insert 17, extends downwardly beyond shell 14. Pin 25 is provided with an axially-extending rib so that

when the pin is received within a central hole 32 in the insulating body 26 of connector part 11, with the rib on pin 25 received in a complementarily shaped groove in passage 32, the two connector parts are locked to each other as shown in FIG. 1. Skin 13 of the parent airplane is provided with an opening 18 therein through which the forward or lower end of connector part 10 extends, and the skin 12 of the drone is provided with a hole 27 to receive the forward smaller diametered portion 29 of body 26. The second connector part or body 11, shown in FIG. 3, has a plurality of axially directed socket contacts 31 disposed in the electrically insulating body 26, as shown. Such socket contacts are retained by a rear or backing plate 34 which is thrust upwardly by a hollow nut 33 screwed into the threads 37 on the rearwardly projecting hood 36 on body 26. Each of the socket contacts has a solder well 35 on the rear or inner end thereof, whereby the contact may be electrically connected to the respective wire of a multi-wire cable. A hood 39 is provided to surround such cable (not shown) and to protect it in its connection to connector part 11.

The connector parts or bodies 10 and 11 are held together in operative relationship by a plurality (three shown) of parallel downwardly-extending headed pins 40 connected to the shell of body 10, such pins being selectively received within a similar number of similarly spaced keyhole slots 44 in body 26 of connector part 11. The body 26 of connector part 11 is provided with means in the nature of keyhole slots, whereby the parts are connected by being first moved axially together and then turned relative to each other through a small angle. The connector parts are disengaged by the reverse of such operations. Such keyhole-like structure receiving the pins 40 may be molded integrally in body 26. Each of such means is in the form of a recess 44 having a first larger diametered end portion 46 which freely receives the enlarged heads 41 on pins 40. Portion 46 of the hole is connected with a short arcuate slot of the same diameter which underlies the surface of body 26 clockwise of each hole portion 46 as the device is shown in FIG. 4. The portion of hole 44 overlying such arcuate slot is of reduced width, such width being sufficient only to receive the shanks 42 of pins 40.

It will be apparent that when the bodies 10 and 11 are placed in alignment and in the correct angular positions relative to each other, pin 26 will enter opening 32, the pin and socket contacts 22 and 31, respectively, will be placed in operative engagement, and the heads 41 of pins 40 will enter the larger ends 46 of the keyhole slots. When the pins 40 are turned clockwise (FIG. 4) as a group, the heads 41 of the pins will lie within the hooded portions of the slots 44, thereby to lock connector parts 10 and 11 together. Conversely, when parts 10 and 11 are locked together, counterclockwise turning of pins 40 as a group relative to body 26 of connector part 11 will free the two connector parts from each other, the parts then being pushed away from each other by the spring 55.

To permit such turning of pins 40 as a group relative to both connector parts 10 and 11, such pins are mounted as follows. A rotatable sleeve member 47 is centrally telescoped over the lower end of shell 14 of connector part 10. A lower outer ring member 49 is disposed about the lower end of sleeve 47 and is connected thereto by a snap ring 48. The shank 42 of each pin 40 is threaded into a tapped hole in ring 49, and is secured in place by having the upper end of the shank peened or upset in place as shown. An upper sleeve member 51 is disposed about the upper portion of shell 14 and has threaded connection therewith as shown at 54. The lower edge of sleeve 51 is rotatably connected to the lower sleeve 47 by means of a split spring ring 52 which lies partially within confronting grooves on each of said two sleeves. The described construction allows the three pins 40 to be rotated as a group about the axis of connector part 10, and to be raised and lowered along such axis as required during the

operations of initially engaging the pins 40 in slots 44 and the subsequent tightening of the connector parts together.

To insure rapid and complete separation of connector parts 10 and 11 upon release of pins 40 from slots 44, there is provided the above-mentioned coil compression spring 55, the upper end of which is telescoped within the lower end of sleeve 47 and about the lower end 56 of shell 14. Portion 56 is provided with an annular groove 57 which receives therewithin the uppermost turn of spring 55, thereby to retain the spring in place.

The means for turning ring 49 and pins 40 connected thereto are shown more clearly in FIGS. 5 and 6. An upstanding abutment 60 is connected to ring 49 as shown in FIG. 5, the abutment 60 occupying the position shown when pins 40 lie in operative locked engagement with slots 44. The lower sleeve 47 has an enlargement 62 thereon at one angular location, said enlargement having a bore 64 therein extending parallel to but somewhat outwardly of a tangent to the outer surface of sleeve 47. A blind opening 65 is located in abutment 60 in alignment with and having its open end confronting the passage 64. Positioned within passage 64 is an expansible explosive bellows actuator 61 which has a forward end 66 positioned within passage 65. Actuator 61 has an explosive mounted within a flexible metal sheath made, for example, of copper, the forward end 66 of the sheath being bent into bellows formation. When the explosive is energized the forward portion 66 of the actuator expands, thereby thrusting abutment 60 in a counterclockwise direction to cause pins 40 to become aligned with the large ends of slots 44, thereby to allow spring 55 to thrust connector parts 10 and 11 apart. Travel of abutment 60 in a counterclockwise direction is limited by its engagement with stop member 59 secured to the sleeve 47.

Means is provided on the outer rear end of enlargement 62 for the loading and unloading of actuators 61, and to provide for electrical connection to the ignition device thereof. Such actuator-securing and connecting means is designated generally by the reference character 67. Means 67 has a shell 69 which is secured to an outwardly directed hood 71 on enlargement 62 by screw threads 70, as shown. An electrically insulating insert 72 is mounted within shell 69, said insert carrying a pair of socket contacts 74 (1 shown) which make contact with outwardly directed pin contacts 75 which project from the actuator 61. The outer end of shell 69 is externally threaded at 77, whereby to receive an outer connector part (not shown) carrying socket contacts which receive the pin contacts 76 of the connector means 67.

Although only one embodiment of the invention has been illustrated in the accompanying drawings and described in the foregoing specification, it is to be expressly understood that various changes, such as in the relative dimensions of the parts, the materials used and the like, may be made therein without departing from the spirit and scope of the invention as will now be apparent to those skilled in the art.

What is claimed is:

1. A separable connector having first and second main parts, each such part having a body, the body of one of the parts having a plurality of keyhole slots therein with large and small portions lying on a circle coaxial of said body, the body of the other of said parts having a ring rotatably mounted thereon, said ring carrying a plurality of angularly spaced headed pins which are secured to the ring to move therewith and which are adapted to be received within the keyhole slots to hold the two bodies against axial separation, and means to move the ring and pins rearwardly along the second body whereby to develop appreciable end thrust between the bodies of the main contact carrying parts.

2. A connector as claimed in claim 1, comprising a coil compression spring interposed between the confronting ends of the connector parts, said spring urging the

two bodies apart and being overcome by the thrusting engagement between the pins and the slots.

3. A connector as defined in claim 2, wherein the means to move the ring and pins rearwardly along the second body comprises a sleeve disposed about the body and rotatably connected to the ring, and a threaded connection between the sleeve and the body.

4. A connector as defined in claim 2, comprising selectively operated power means mounted on one of the connector parts for turning the ring and pins as a group relative to the keyhole slots, whereby to release the connector parts from connection to each other.

5. A connector as defined in claim 4, wherein said power means comprises an axially expansible, explosively powered cartridge, a breach block means fixedly mounted relative to the axis of the connector, and a thrust block adapted to be connected to the ring so as to rotate the ring to release the connector parts when the cartridge is exploded.

6. A separable electrical connector having a first, main contact-carrying part and a second, main contact-carrying part, one of said contacts being a socket and the other of the contacts being a plug, each such part having a body, the body of one of the parts having a plurality of keyhole slots therein with large and small portions lying on a circle coaxial of said body, the body of the other of said parts having a ring rotatably mounted thereon, said ring carrying a plurality of angularly spaced headed pins which are secured to the ring to move therewith and which are adapted to be received within the keyhole slots to hold the two bodies against axial separation, and means to move the ring and pins rearwardly along the second body whereby to develop ap-

preciable end thrust between the bodies of the main contact carrying parts.

7. An electrical connector as claimed in claim 6, comprising a coil compression spring interposed between the confronting ends of the connector parts, said spring urging the two bodies apart and being overcome by the thrusting engagement between the pins and the slots.

8. A separable electrical connector as defined in claim 7, wherein the means to move the ring and pins rearwardly along the second body comprises a sleeve disposed about the body and rotatably connected to the ring, and a threaded connection between the sleeve and the body.

9. A separable electrical connector as defined in claim 7, comprising selectively operated power means mounted on one of the connector parts for turning the ring and pins as a group relative to the keyhole slots, whereby to release the connector parts from connection to each other.

10. A separable electrical connector as defined in claim 9, wherein said power means comprises an axially expansible, explosively powered cartridge, a breach block means fixedly mounted relative to the axis of the connector, and a thrust block adapted to be connected to the ring so as to rotate the ring to release the connector parts when the cartridge is exploded.

References Cited in the file of this patent

UNITED STATES PATENTS

2,575,071	Rockwell	Nov. 13, 1951
2,657,366	Krtous	Oct. 27, 1953
2,939,102	Johnson	May 31, 1960