

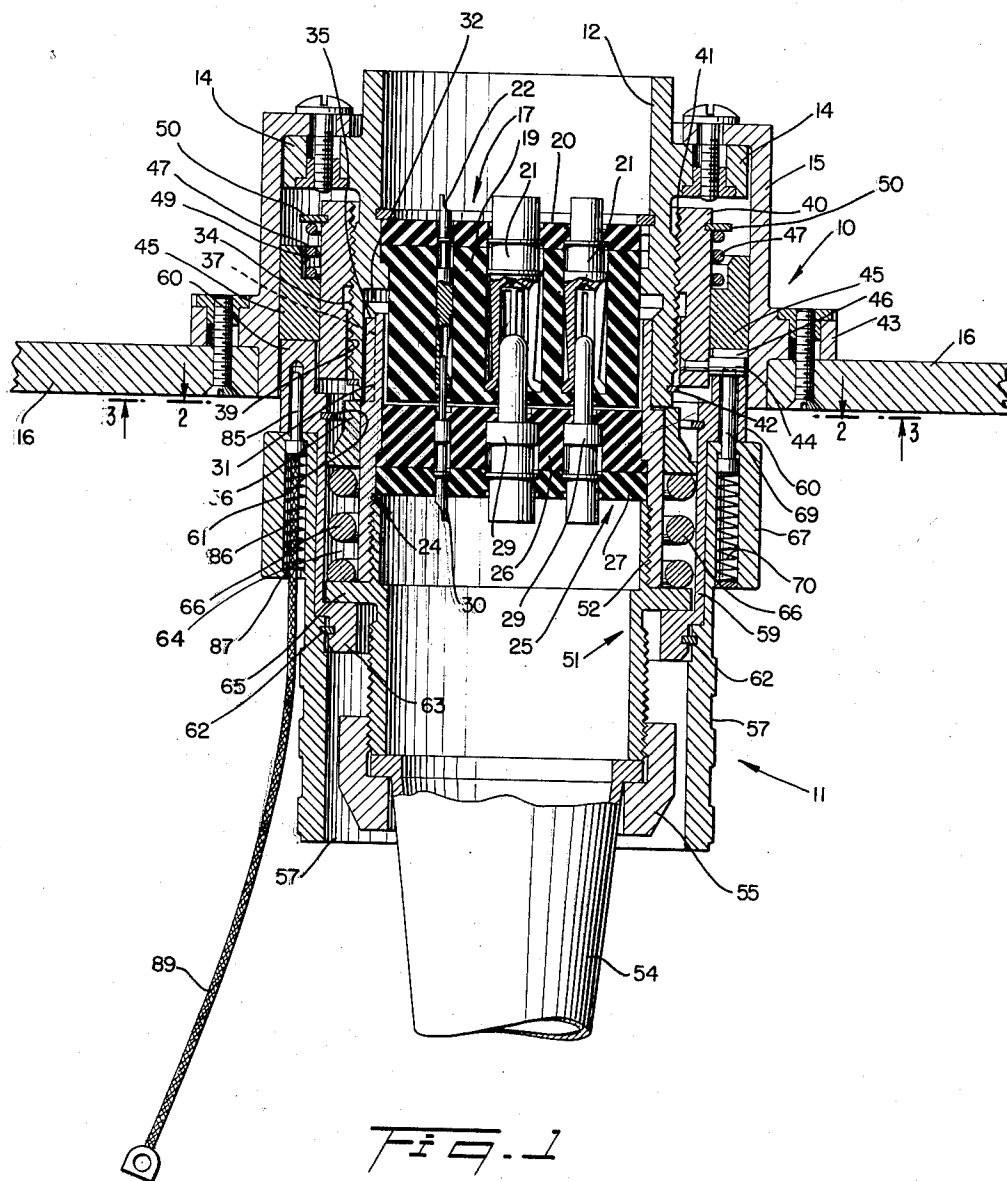
Nov. 6, 1962

R. W. BRUSH
SEPARABLE CONNECTOR

3,063,032

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3 Sheets-Sheet 1



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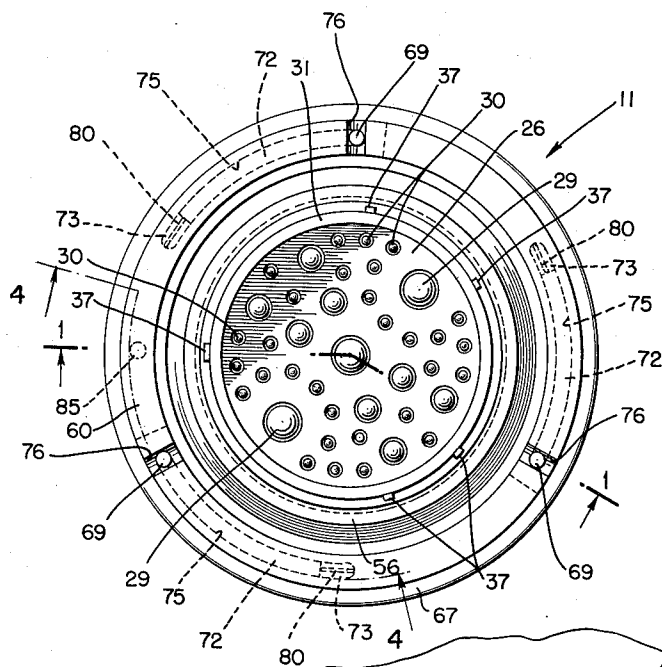


FIG. 2

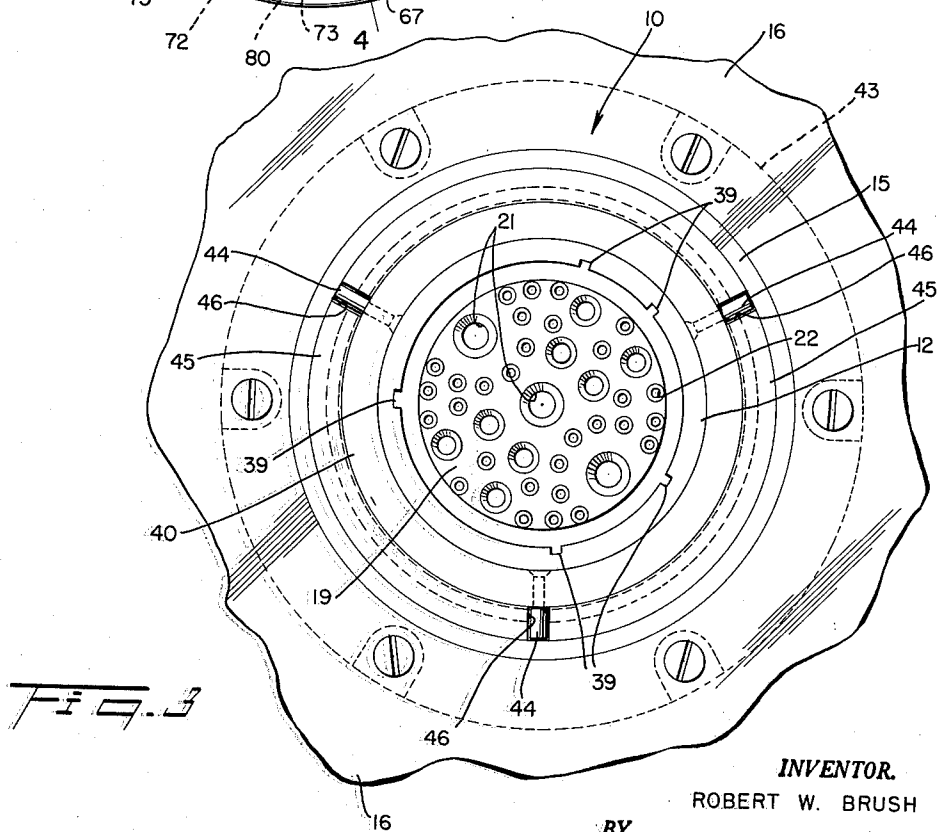


FIG. 3

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Fig. 6

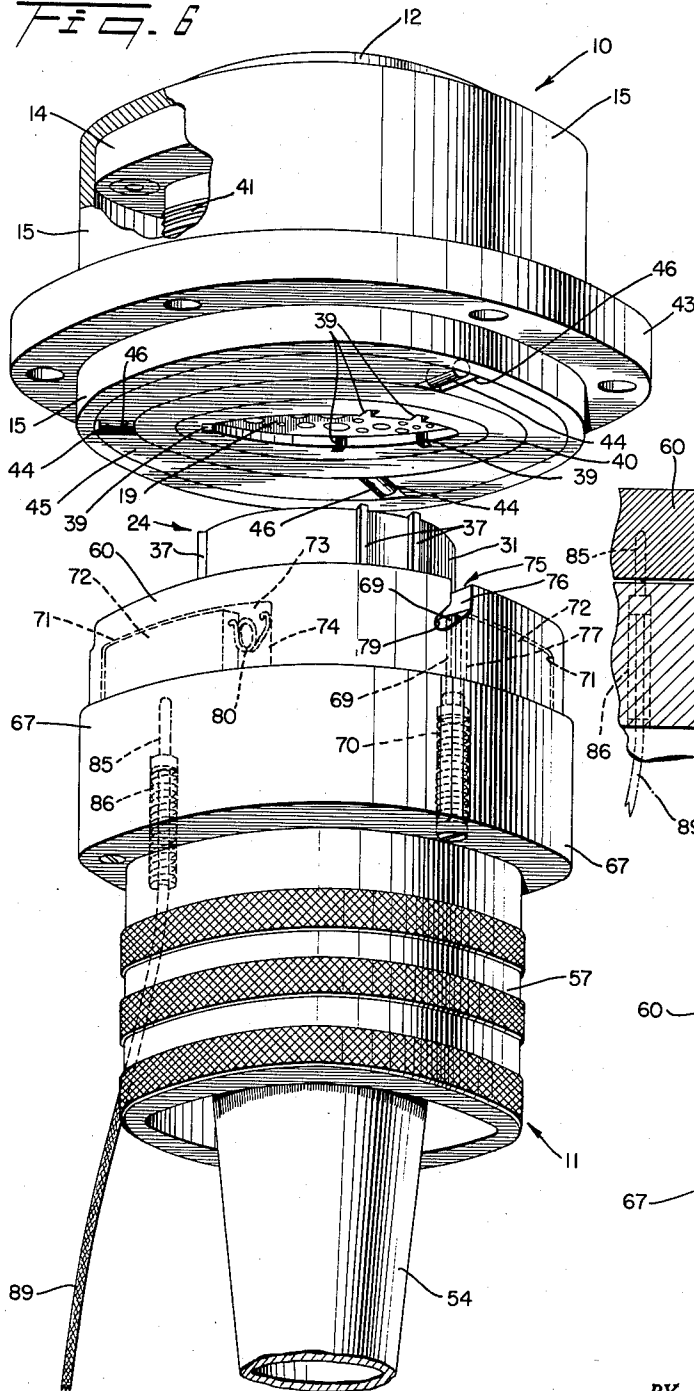


Fig. 4

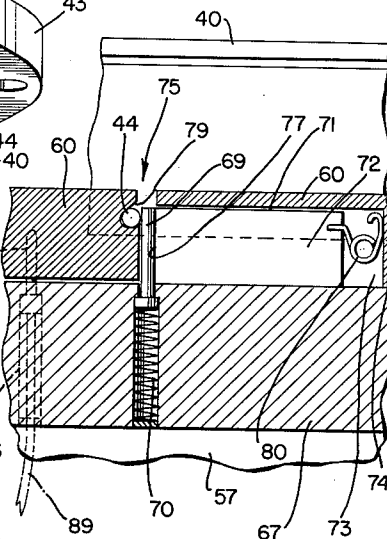
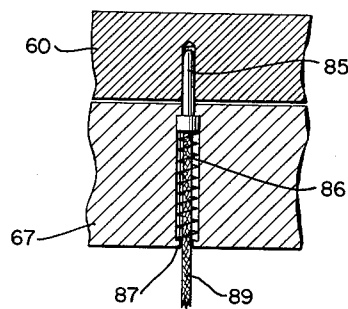


Fig. 5



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3,063,032

SEPARABLE CONNECTOR

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16 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 two-part separable electrical connector of the type indicated 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 improved separable electrical connector having power storing means for disconnecting the two connector parts, whereby forcibly to separate the parts.

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 to permit 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 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, a portion of the body to which the upper connector part is connected being fragmentarily shown, certain of the parts being shown in elevation, the section being taken along line 1-1 of FIG. 2;

FIG. 2 is a view in plan of the lower, contact pin-carrying part of the connector shown in FIG. 1, the view being taken generally from the line 2-2 of FIG. 1;

FIG. 3 is a view in bottom plan of the contact socket-carrying part of the connector, the view being taken from the line 3-3 of FIG. 1;

FIG. 4 is a fragmentary partially developed view in vertical section through a portion of the contact-pin-carrying part of the electrical connector, the view being taken at the location of one of the means for latching the two connector parts together, the structure shown being a fragmentary development along the arcuate line 4-4 of FIG. 2;

FIG. 5 is a fragmentary view in partially developed vertical section through the contact carrying part of the

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connector in the vicinity of the lanyard pin for the latching means; and

FIG. 6 is an exploded view in perspective of the two main parts of the connector, a portion of the socket contact-carrying part of the connector being broken away for clarity of illustration.

The embodiment of separable electrical connector shown is particularly adapted for use in application 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 applied 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 suitable 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 clearly 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 the upper, socket contact-carrying part 10 of the connector is shown operatively engaged with the lower, contact pin-carrying part 11 of the connector. Connector part 11 may, for example, be connected to the main body of a missile (not shown), whereas the part 10 of the connector is shown attached to a sheet metal skin 16 of a body which may be a nose cone for the missile. The missile body and nose cone are releasably secured together by suitable means, likewise not shown, which may be released, for example, by radio signal. In the embodiment of connector shown, the connector parts 10 and 11 are latched together, and are released from each other upon the pulling of a lanyard cord caused by the separation of the nose cone from the missile body.

Connector part 10 has a tubular metallic shell 12 having a flange 14 adjacent its upper end. Shell 12 is attached to skin 16 by means of an outer sleeve member 15, the cylindrical body of which is spaced radially outwardly of the cylindrical body of sleeve 12. The flange 14 is secured to and underlies an inwardly projecting annular flange on the upper end of member 15, the lower end of member 15 projecting into an opening in skin 16 and being secured to the skin by machine bolts extending therethrough into screw threaded inserts in flange 43 on member 15.

Connector part 10 has an electrically insulating insert

17 therein, such insert being made up of a lower or inner insert member 19 and an upper or outer insert disc 20. Within insert 17 there are supported a number of large socket contacts 21, which may form portions of power circuits, and a number of small contacts 22 which may form portions of signal circuits, and the like. Connector portion 11 has a tubular metallic shell 24 within which there is mounted an electrically insulating insert 25 which is made up of an inner or upper main insert member 26 and an outer or lower disc 27. Insert 25 carries a plurality of large contact pins 29 and small contact pins 30 which cooperate, respectively, with sockets 21 and 22. Shell 24 extends outwardly or upwardly in a protruding tubular hood portion 31, which surrounds and protects the contact pins. When connector parts 10 and 11 are engaged as shown in FIG. 1, hood 31 is received within an annular space 32 in connector part 10 between the inner end of insert 19 and a lower skirt 34 on shell 12 of connector part 10. As shown in FIGS. 1 and 6, hood 31 has a plurality of longitudinally extending ribs or splines 37 thereon, such ribs being slidably received within complementary grooves 39 in the inner wall of skirt 34, whereby to retain the shells 12 and 24 from rotation with respect to each other.

A sleeve 40 surrounds skirt 34 of shell 12, and is adjustably connected thereto by threads shown at 41. Sleeve 40 is prevented from escape in an upward direction by flange 14 and in the downward direction by snap ring 42 positioned on skirt 34. Adjacent the lower inner edge of sleeve 40 there are a plurality (three shown) of angularly spaced radially outwardly directed pins 44 which form portions of the mechanism for latching connector parts 10 and 11 together. An outer ring 45, which has a plurality of shallow vertical grooves 46 therein receiving pins 44, surrounds the lower end of sleeve 40. Ring 45 is constantly resiliently thrust downwardly by means of a coil compression spring 47 surrounding sleeve 40, the lower end of the spring being received in an annular spring seat 49 in sleeve 45, the upper end of the spring abutting a radially outwardly projecting spring ring 50 secured to sleeve 40. When connector parts 10 and 11 are engaged as shown in FIG. 1, skirt 34 lies so that its lower edge forcibly contacts the upper end of a sleeve 56, to be described, on the connector part 11, and sleeve 45 is thrust downwardly into contact with the upper edge of an annular member 60 on connector part 11. When the two connector parts are separated as shown in FIG. 6, sleeve 45 moves downwardly so that the pins 44 are housed within slots 46 in the sleeve 45.

The tubular shell of lower connector part 11 has a radially inner body portion generally designated 51. Body 51 is secured to shell portion 24 by a threaded connection shown at 52. A multi-conductor cable (not shown), the wires of which are connected to connector pins 29 and 30, is designed to be connected to body 51 by a cable grip, generally designated 54, which is secured to body 51 by an internally threaded nut 55. Surrounding the upper end of shell portion 24 is a ring or short sleeve 56 which is reciprocable vertically with respect to the shell portion 24. Connector part 11 has an outer tubular sleeve 57 which is mounted for rotation with respect to the body 51 thereof. The outer surface of sleeve 57 is shown as knurled, to allow it to be readily gripped by one's hand. An intermediate sleeve portion 59 is mounted within the upper end of sleeve 57. Member 59 has an enlarged annular head 60 which carries a plurality of axially reciprocable pins 69 which coact with the above described radially directed pins 44 to complete the mechanism releasably latching the two connector parts together. A snap ring 62 between parts 57 and 59 secures them together against axial separation.

The cylindrical upper end of member 59 lies radially outwardly of the outer surface of shell 24, whereby to provide an annular space 64. The lower end of ring 56 is radially enlarged to form a portion accurately fitting

within and guided by the radially inner and outer walls forming space 64. A radially outwardly directed flange 65 on body 51 forms the bottom of said space 64; flange 65 normally rests upon an inwardly extending shoulder 63 on member 59. A strong coil compression spring 66 is disposed within space 64, the lower end of the spring resting upon flange 65 and the upper end of the spring abutting the enlarged lower end of ring 56. Spring 66 functions strongly to thrust ring 56 in an upward or outward direction.

The enlarged head 67 of sleeve 57 is provided with three axially reciprocable pins 69 each which is constantly urged in an upward or outward direction by a coil compression spring 70, as shown. Pins 69 have their outer ends slidably extending through bores in ring member 60, members 59, 60 thus rotating with sleeve 57 when the latter is turned.

Pins 69 and ring 60 interact with radial pins 44 in such manner that, when sleeve 40 lies in its downward or outer position, the connector parts 10 and 11 may be readily manually latched together. After this has been done, sleeve 57 is manually turned, thereby turning parts 59, 60, pins 69, 44, and sleeve 40 in such direction as to screw the sleeve 40 upwardly along shell 12. This causes the members 67 and 60 to be pulled upwardly toward shell 12, and ring 56 forcibly to engage the lower edge of skirt 34 of shell 12, as shown in FIG. 1. When the connector parts 10 and 11 are thus fully engaged, the upper edge of enlarged head 60 on member 59 is in forcible engagement with the spring pressed sleeve 45. Thus the connector parts are effectively sealed together. Springs 66 and 47 are under substantial compression when the connector parts are thus engaged, the expansive force of such springs being instantly available to separate the connector parts when the latching mechanism therefor, now to be described in detail, is released.

As shown in FIGS. 2, 4, and 6, the enlarged head 67 is provided with three equi-angularly spaced arcuate upstanding projections 72 which are coaxial of portion 67. The enlarged head 60 on member 59 is provided with three arcuate slots 71 having a radial width such as accurately to receive projection 72, and having peripheral extents or lengths somewhat exceeding the peripheral lengths of projections 72. Member 60 is thus guided for limited oscillation with respect to member 67 by the projections 72 and the slots 71. Within the spaces 73 formed between the same end of each projection 72 and its slot 71 there is positioned a linearly expansible coil spring 80 one tang of which is positioned in a hole in the end of projection 72. Springs 80 thus constantly tend to thrust the portion of member 60 nearer the reader in FIG. 6 to the right and the portion of member 67 nearer the reader in FIG. 6 to the left. Springs 80 thus function constantly to urge the parts into re-arming position wherein the lanyard pin can enter the pin-receiving hole in part 60.

Member 60 is provided with a slot generally designated 75 positioned generally at the location of the outer end of each pin 69. Slot 75 has a width such as fairly accurately to receive the radial pins 44 on sleeve 40. Slot 75 has a first, upper or outer portion 76 which extends generally axially of connector part 11, and a second, inner or lower portion 79 which inclines angularly downwardly and to the left, as the parts are shown in FIGS. 4 and 6. The passages 77 in element 60 extend vertically along the forward (left, FIG. 4) edge of each respective projection 72 on member 67 when the parts are positioned as in FIGS. 4 and 6.

The thus described parts function to latch connector parts 10 and 11 together as follows. When connector parts 10 and 11 are aligned as shown in FIG. 6, the pins 44 lie opposite the respective slots 75. When the connector parts 10 and 11 are advanced toward each other, splines 37 are first received in slots 39. Continued advance of the parts brings the pins 44 into the first, axial portions 76 of slots 75. When the pins 44 engage the

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outer ends of pins 69, the latter are thrust downwardly against the action of springs 70, thereby allowing the pins 44 to enter into the inner or angularly directed portions 79 of slot 75. Portion 79 of each slot is of such length as wholly to receive pin 44, so that the outer ends of pins 69 may, under such condition, snap past pins 44 to resume their outer position, as shown in FIG. 4. In such position of the parts, pins 44 are locked within slots 45 against both axial and rotational movement with respect thereto. When the parts are thus locked, turning of the sleeve 57 causes the joint rotation therewith of parts 67, 60 and sleeve 40, so that the connector parts may be tightened together, in the manner above described.

Parts 60 and 67 are normally retained from rotation with respect to each other by a lanyard pin 85 which extends upwardly from member 67 into a passage in member 60. Pin 85 is normally held in elevated, locking position by a coil compression spring 86 which acts between the pin and an abutment 87 on member 67, as shown in FIG. 5. When it is desired to separate the locked-together connector parts 10 and 11, lanyard pin 85 is pulled downwardly so as to be disengaged from part 60. Thereupon part 60 is free to move to the left (FIG. 4) with respect to part 67 against the action of springs 80. The thrust imposed upon pins 44 by spring 66 causes the pins to exert a camming action upon portions 79 of slot 75, thus to turn part 60 so that pins 44 may escape from slots 75. As explained, the force exerted by compressed springs 66 and 47 is then sufficient quickly to separate connector parts 10 and 11. After escape of pins 44 from slots 75, the parts of the latching mechanism on connector part 11 are thrust by springs 80 to resume the position thereof shown in FIG. 5.

The lanyard pin 85 may be operated, as shown, by a lanyard cord or chain 89, which may for example, have the lower end thereof attached to the body of the missile to the nose cone of which connector part 10 is attached. In such construction, after the nose cone has begun to separate from the body of the missile, lanyard cord 89 will be pulled, thus causing connector parts 10 and 11 to separate. The parts may be reconnected, assuming they are recovered, by restoring sleeve 40 to its initial position, and again connecting parts 10 and 11 as described.

Although only one embodiment of the invention has been illustrated in the accompanying drawings and described in the foregoing specification, it is to be especially understood that various changes, such as in the relative dimensions of the parts, materials used, and the like, as well as the suggested manner of use of the apparatus of the invention, 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 releasable connector between aligned first and second bodies, means to key the bodies together against relative rotation while permitting their relative axial movement toward and away from each other, and means for securing the bodies together in alignment, for advancing the bodies toward each other, and for releasing the bodies for retraction from each other, said last-named means comprising a first sleeve disposed coaxially of the first body and having screw threaded connection with such body, a second sleeve disposed coaxially of the second body and mounted thereon for rotation but without relative axial movement with respect thereto, means for releasably coupling together the confronting ends of the first and second sleeves, and means for releasing the coupling means, the first and second sleeves being rotatable after being coupled together whereby to screw the first sleeve along the first body and thus to tighten the two bodies together.

2. A releasable connector as defined by claim 1, comprising spring means which is compressed upon the tightening of the two bodies together, said spring means thrust-

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ing the bodies apart upon the release of the coupling means.

3. A releasable connector as defined by claim 2, comprising a third sleeve slidably mounted on the second body and interposed between the spring means and the first body when the two bodies are coupled together.

4. A releasable connector as defined by claim 3, wherein each of the bodies comprises a shell, an electrically insulating insert mounted within each shell, interfitting contact pins and contact sockets on the respective inserts, said contact pins and contact sockets being engageable and disengageable upon axial movement of the two bodies toward and away from each other, the spring means having a compressive range which is at least substantially equal to the length of axial engagement of the contact pins and contact sockets, whereby upon release of the coupling means the spring means thrusts the two bodies apart a distance which is sufficient at least substantially completely to withdraw the contact pins from the contact sockets.

5. A releasable connector between aligned first and second bodies, comprising coupling means having confronting coupling formations on the first and second bodies, the coupling formation on the first body having a plurality of spaced projecting portions disposed in the form of a ring projecting from the first body, each such portion having a slot therein, the slots being similar, said slots having their forward ends opening toward said second body, the coupling formation on the second body comprising a plurality of generally radially disposed pins slidably receivable in said slots, yieldable pin-retaining means normally permitting entry of the pins into said slots but preventing escape of the pins from the slots, said ring comprising two sections, one of said sections including one portion of the sidewall of each of the slots, and the other of said sections including another portion of the sidewall of each of the slots and the pin-retaining means at each of the slots, said sections of the ring being movable relative to each other from a first, normal position in which the pin-retaining means prevent escape of the pins from the respective slots to a second position in which the pin-retaining means are spaced laterally from their first position to open the slots in a direction substantially along the axis of the first body, thereby directly to release the pins from their respective slots.

6. A releasable connector as defined by claim 5, comprising resilient means constantly urging the two sections of the ring into said first position relative to each other, and releasable latching means for holding the two sections in said first position relative to each other.

7. A releasable connector as defined by claim 6, wherein the slots have zones directed at different angles, and the pin-retaining means comprise plungers reciprocable generally toward and away from the body bearing the pins, and spring means constantly urging the plungers outwardly toward a position in which they extend substantially across the slots to prevent escape of the pins therefrom.

8. A releasable connector as defined by claim 7, wherein the slots have a first, outer portion generally parallel to the axis of the connector bodies and a second, inner portion disposed at a marked angle to the first portion of the slot, and the plungers are mounted parallel to said axis so as normally to protrude at least partially into and to block said first portion of the slots.

9. A releasable connector as defined by claim 8, wherein the plungers extend parallel to and in thrust sustaining relationship with projecting portions on the section of ring bearing the plungers.

10. 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 disposed substantially parallel to the axis of its connector part and the other of the contacts being a pin disposed substantially parallel to the axis of its connector part, such connector

parts having first and second bodies each in the form of a shell and comprising an electrically insulating insert carrying the respective contact, releasable connecting means between said bodies effective to retain them in aligned operative relationship, said connecting means comprising coupling formations on the shells of the first and second connector parts, the coupling formation on the first shell comprising a plurality of spaced portions in the form of a ring projection from the first shell, each such portion having a slot therein, said slots being similar, said slots having their forward ends opening toward said second body, the coupling formation on the second shell comprising a plurality of generally radially disposed coupling pins on the second shell and slidably receivable in said slots, yieldable coupling pin-retaining means normally permitting entry of the coupling pins into said slots but preventing escape of the coupling pins from the slots, said ring comprising two sections, one of said sections including one portion of the sidewall of each of the slots, and the other of said sections including another portion of the sidewall of each of the slots and the coupling pin-retaining means at each of the slots, said sections of the ring being movable relative to each other from a first, normal position in which the coupling pin-retaining means prevent escape of the coupling pins from their respective slots to a second position in which the coupling pin-retaining means are spaced laterally from their first position to open the slots in a direction substantially along the axis of the first body, thereby directly to release the coupling pins from the respective slots and to permit axial withdrawal of the contact pin from the contact socket, means to advance the inserts and the contacts of the first and second connector parts relatively toward each other after the shells have been coupled, and spring means which is compressed upon such advance of the inserts, whereby to thrust the two parts of the connector part upon the release of the coupling means.

11. A separable electrical connector as defined by claim 10, comprising resilient means constantly urging the two sections of the ring into said first position relative to each other, and releasable latching means for holding the two sections in said first position relative to each other.

12. A separable electrical connector as defined by claim 11, wherein the slots have zones directed at different angles, and the pin-retaining means comprise plungers reciprocable generally toward and away from the body bearing the coupling pins, and spring means constantly urging the plungers outwardly toward a position in which they extend substantially across the slots to prevent escape of the coupling pins therefrom.

13. A separable electrical connector as defined by claim 12, wherein the slots have a first, outer portion generally parallel to the axis of the connector bodies and a second, inner portion disposed at a marked angle to the first portion of the slot, and the plungers are mounted parallel

to said axis so as normally to protrude at least partially into and to block said first portion of the slots.

14. A releasable connector between aligned first and second bodies, comprising coupling means having confronting coupling formations on the first and second bodies, the coupling formation on the first body comprising a portion having a slot therein, the slot having a first, forward, outer end portion opening toward the second body and extending generally axially of the first body, and a second, inner end portion disposed at an acute angle with respect to the first portion of the slot, the coupling formation on the second body comprising a generally radially disposed pin slidably receivable in said slot so that in fully engaged position the pin lies in the second portion of the slot generally beyond the intersection between the first and second portions of the slot, yieldable pin-retaining means substantially bridging the intersection between the first and second portions of the slot and normally preventing escape of the pin from the slot, said last-named means comprising a second pin mounted in the first body for reciprocation generally along the axis of the first body, resilient means constantly to urge the second pin outwardly into its intersection-bridging position, and means for opening the slot in a direction substantially along the axis of the first body, thereby directly to release the pin from the slot and to permit separation of the first and second bodies of the releasable connector in an axial direction.

15. A releasable connector as defined by claim 14, wherein the second pin is disposed generally in alignment with the first portion of the slot.

16. A releasable connector as defined by claim 15, wherein the first body comprises two parts movable relative to each other, a first one of said parts containing the portion in which the slot is located, the second pin being mounted in the second part of the first body, and releasable means selectively holding the two parts of the first body from relative movement so that the second pin bridges the intersection between the first and second parts of the slot and releasing the two parts of the first body from each other so that the first such part moves to open the slot in a direction substantially along the axis of the first body.

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