United States Patent

[11] 3,631,377

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[54] COUPLING
12 Claims, 12 Drawing Figs.

[52] U.S. Cl. ..... 339/91 B,
24/211 L, 85/5 B, 287/119 R, 292/261
[51] Int. Cl. H01r 13/54
[50] Field of Search 339/45, 75,
91, 92; 24/211 L, 230 AN; 85/5 B; 70/386;
292/252, 261; 287/119

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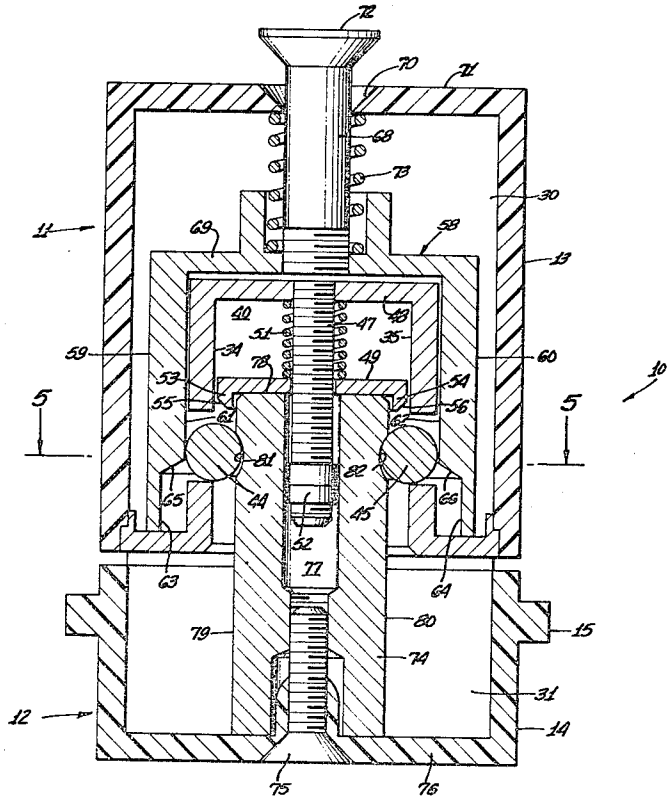
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Primary Examiner—Joseph H. McGlynn
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ABSTRACT: This invention provides an electrical connector and coupling arrangement including a plug and receptacle of rectangular cross section, with each having an integral shell and inner portion, the latter carrying contacts engaged when the connector is mated, with a centrally located coupling mechanism including a post on one member having shallow transverse recesses receiving rollers carried by the other member and held in engagement with the recesses by a retractable member which is moved by an exteriorly operable element to release the coupling mechanism.



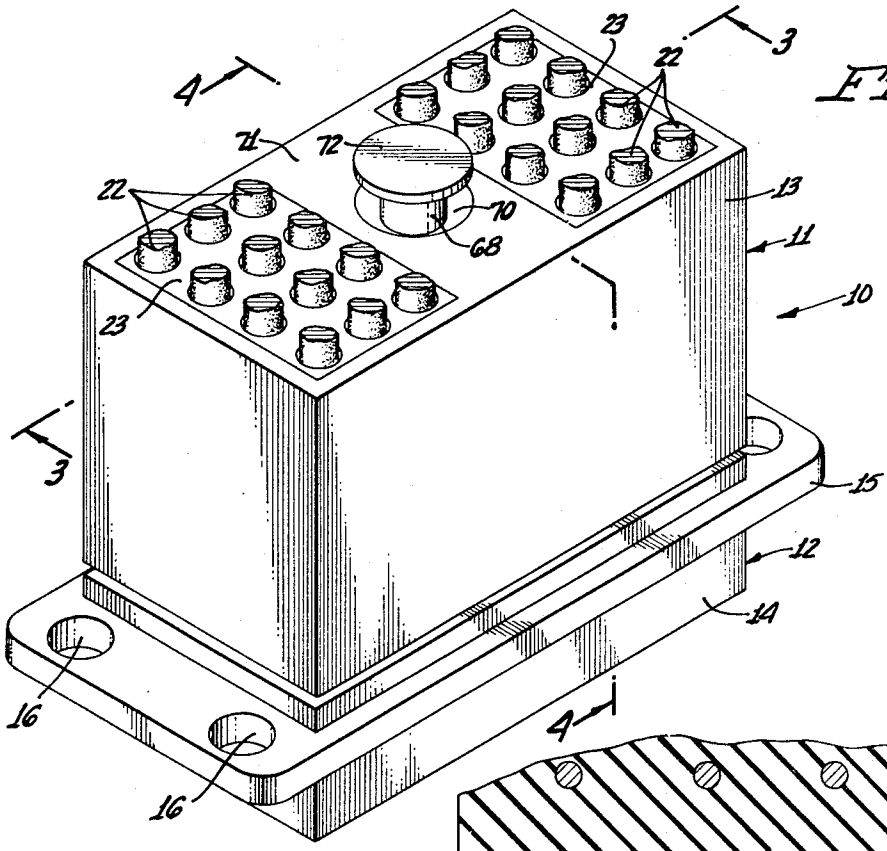


FIG. 1.

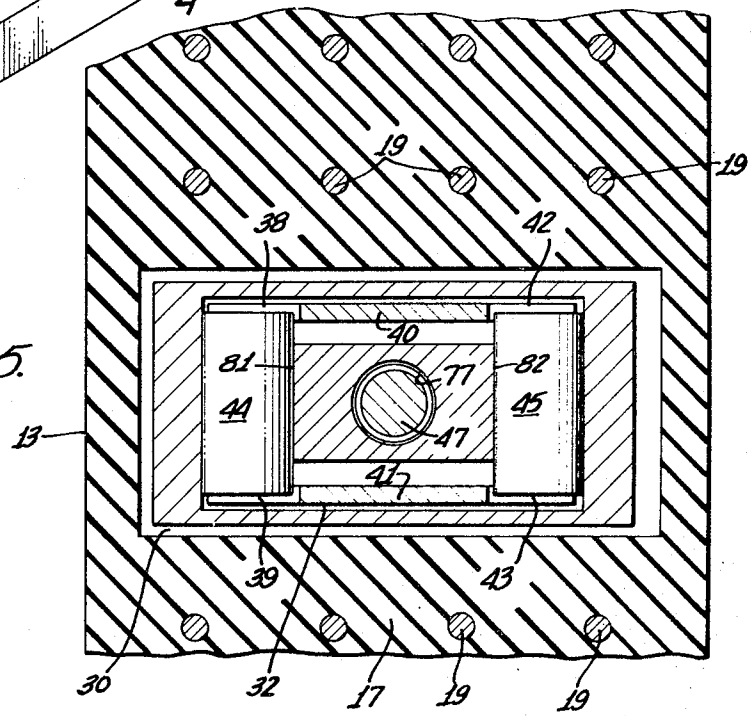
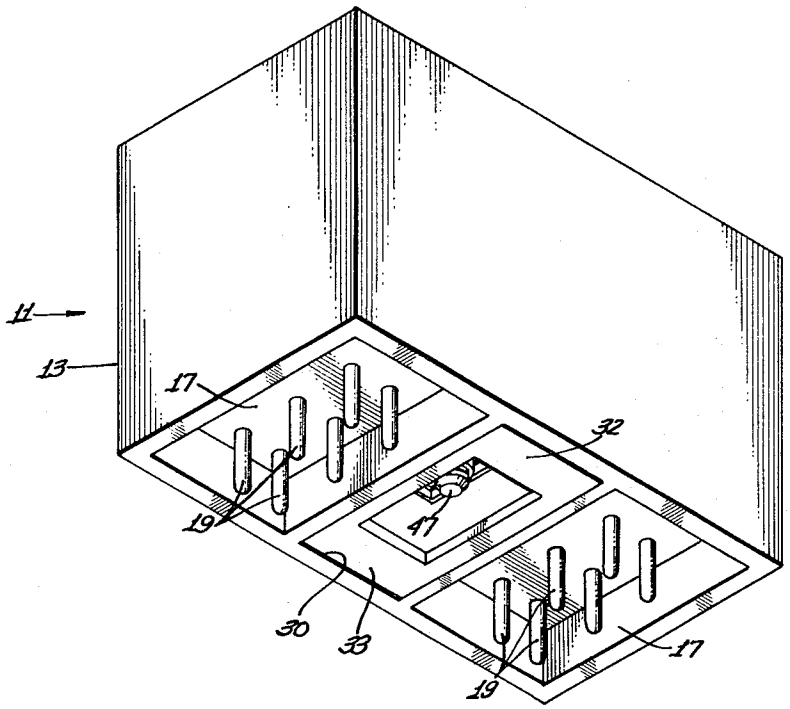


FIG. 5.

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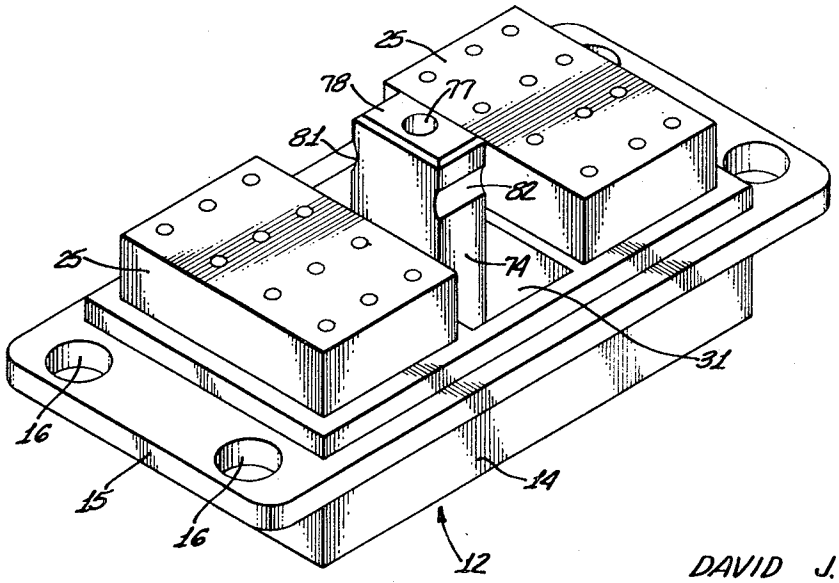


FIG. 2.

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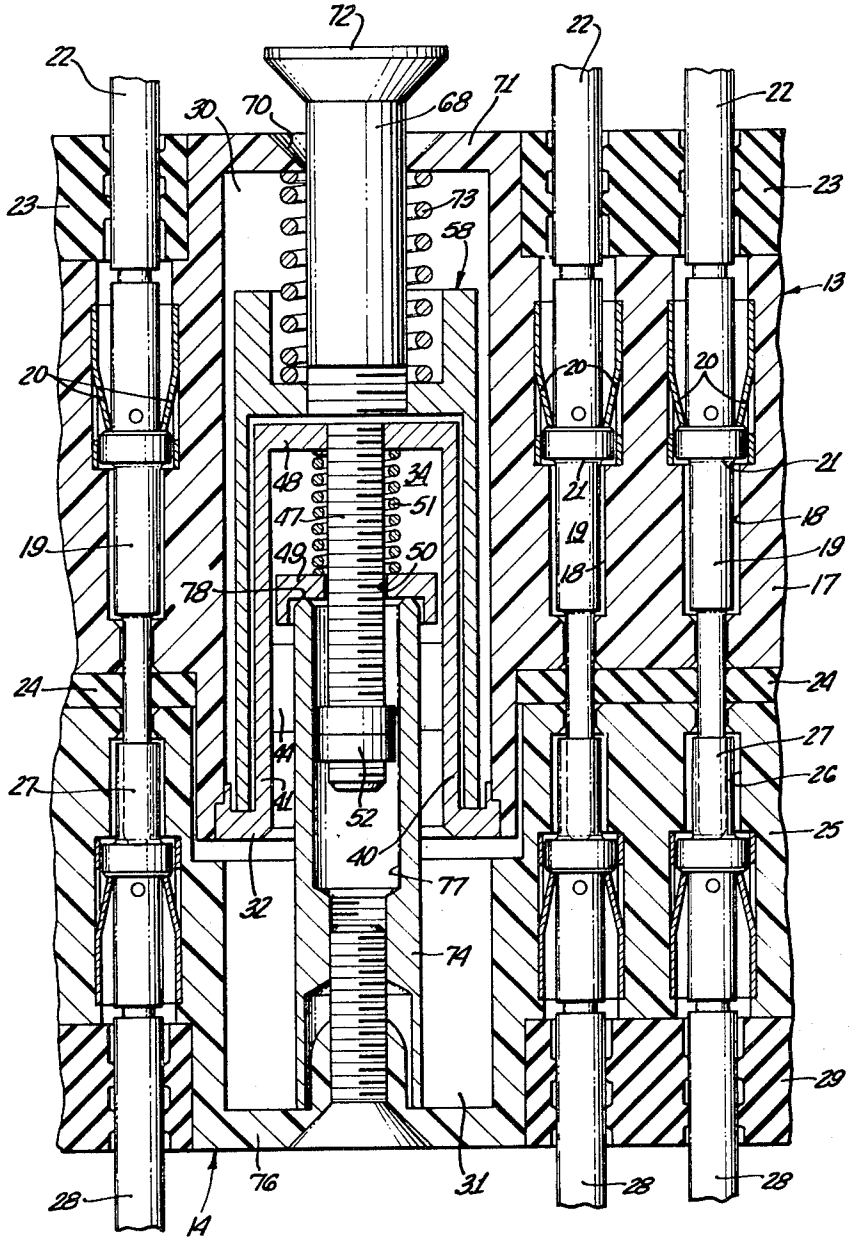
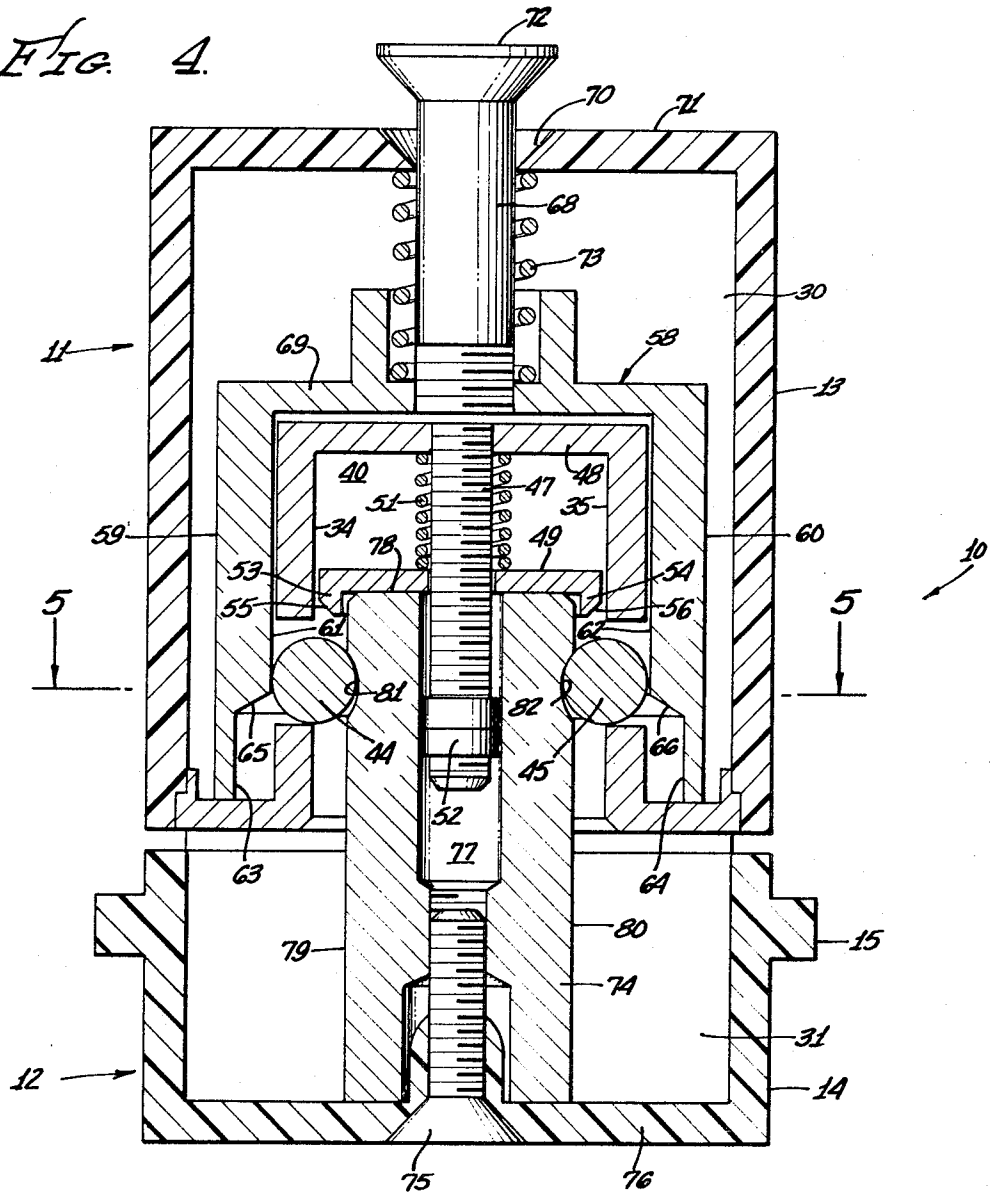


FIG. 3.

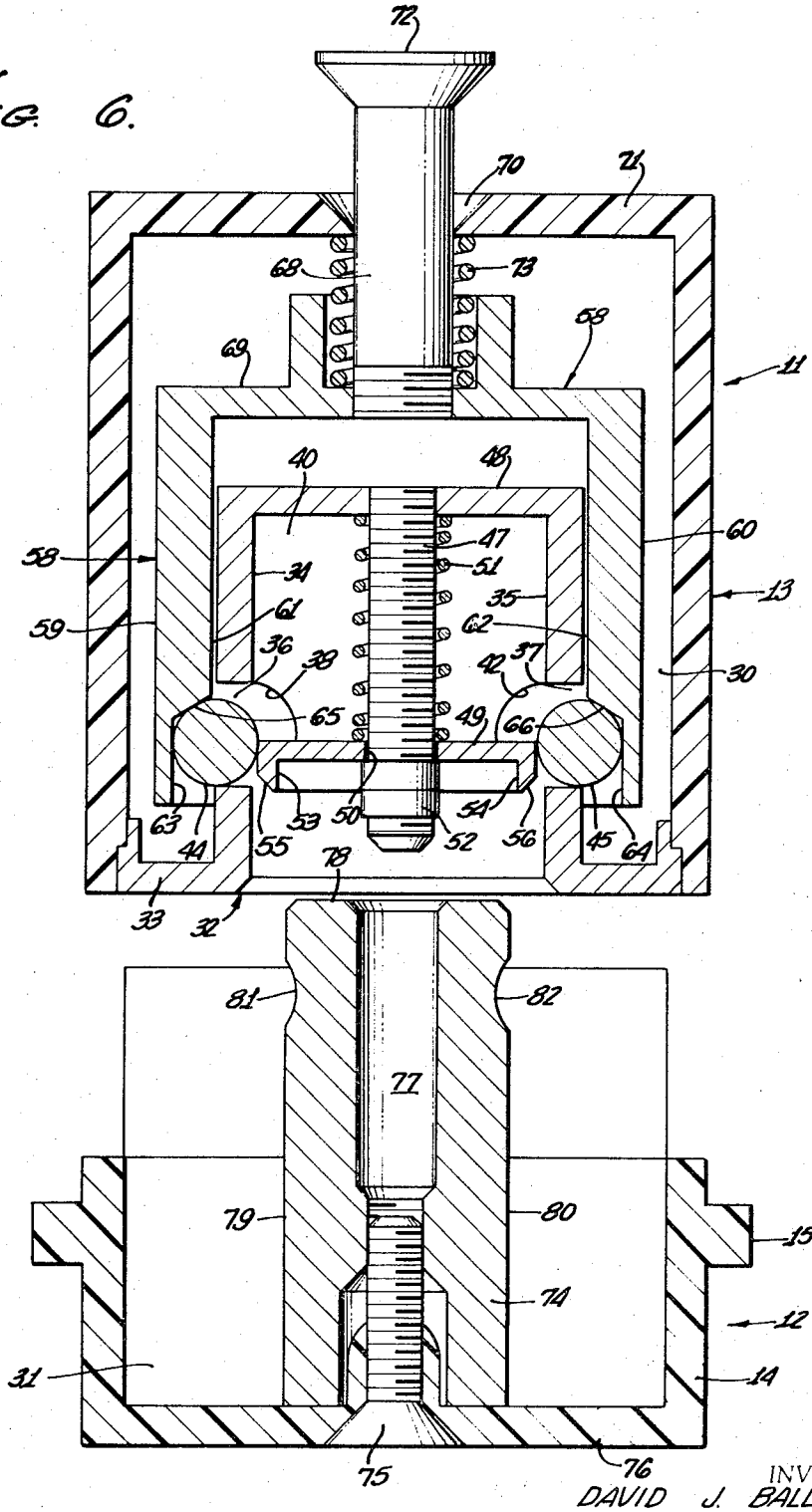
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FIG. 4.



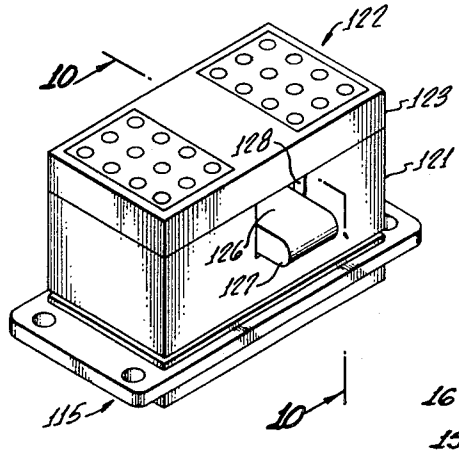
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FIG. 6.



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FIG. 9



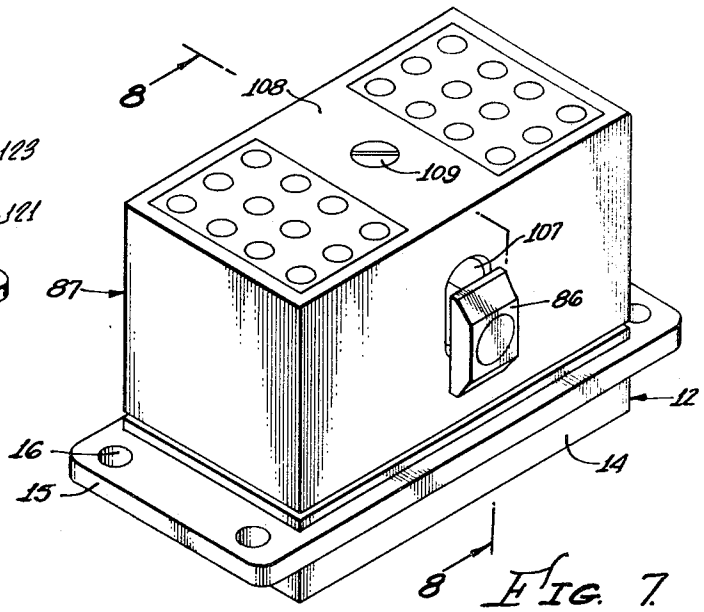


FIG. 7

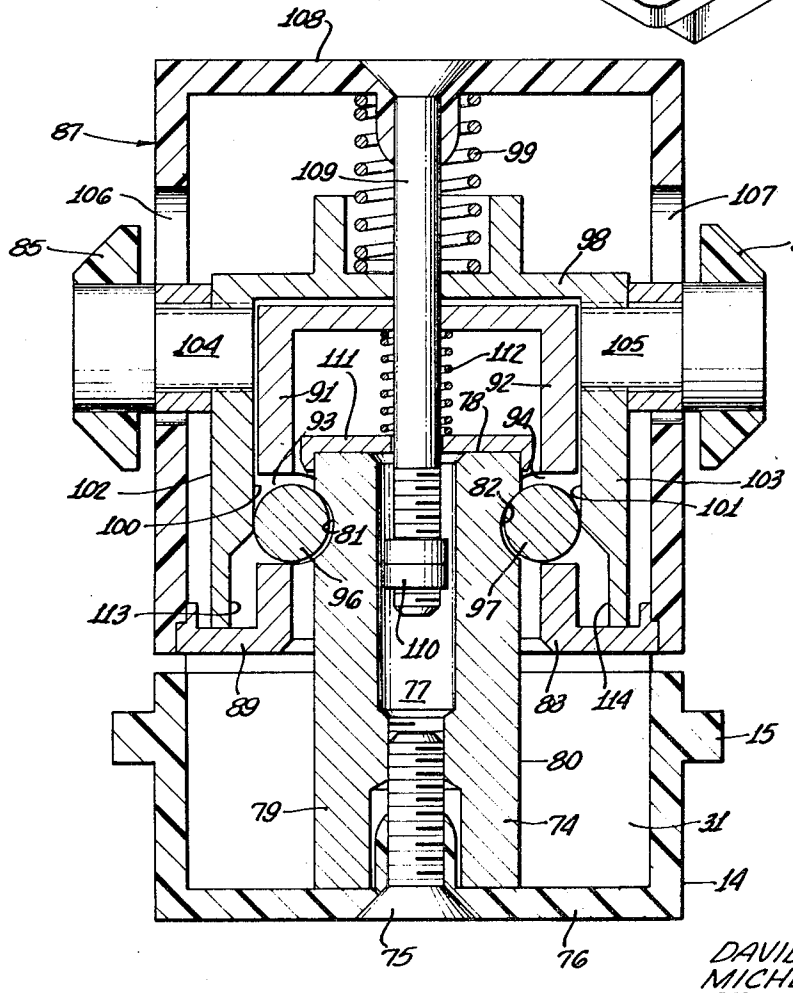


FIG. 8

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FIG. 10.

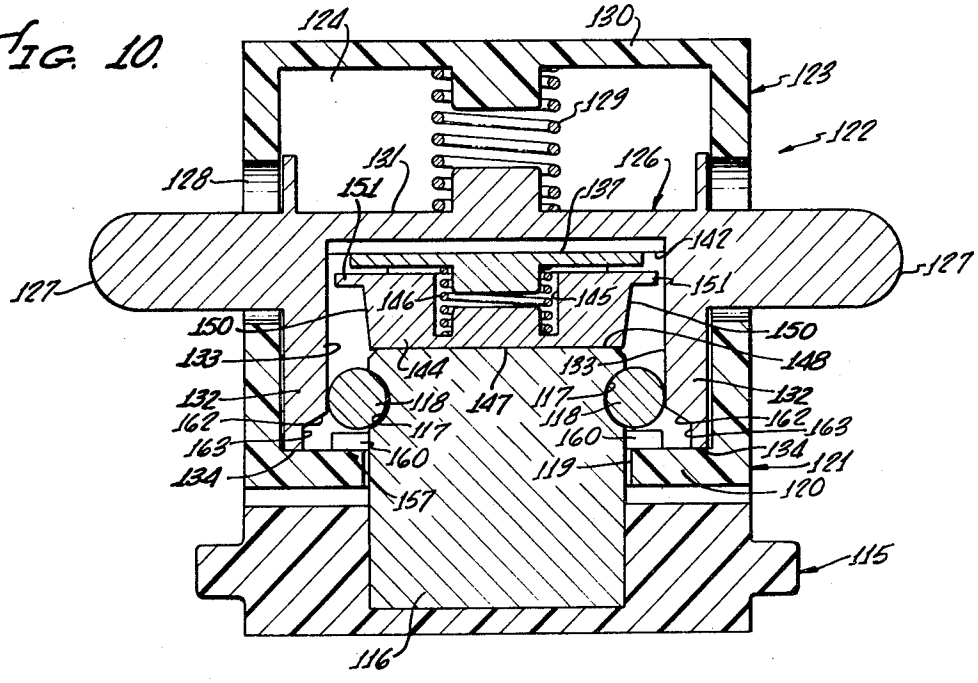
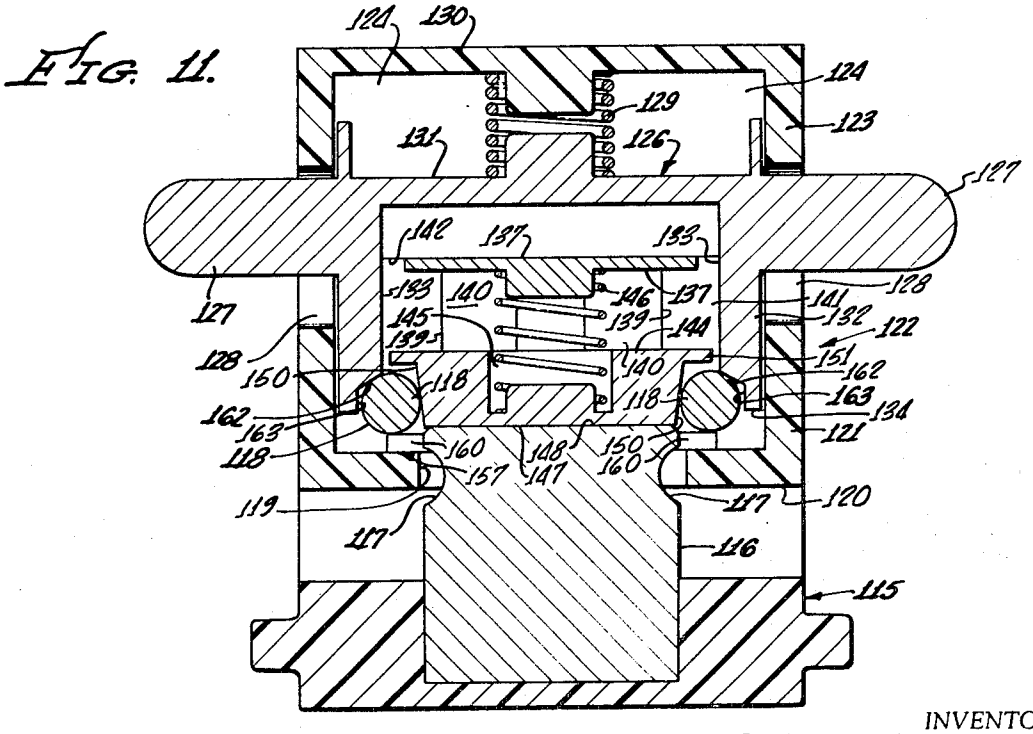


FIG. 11.



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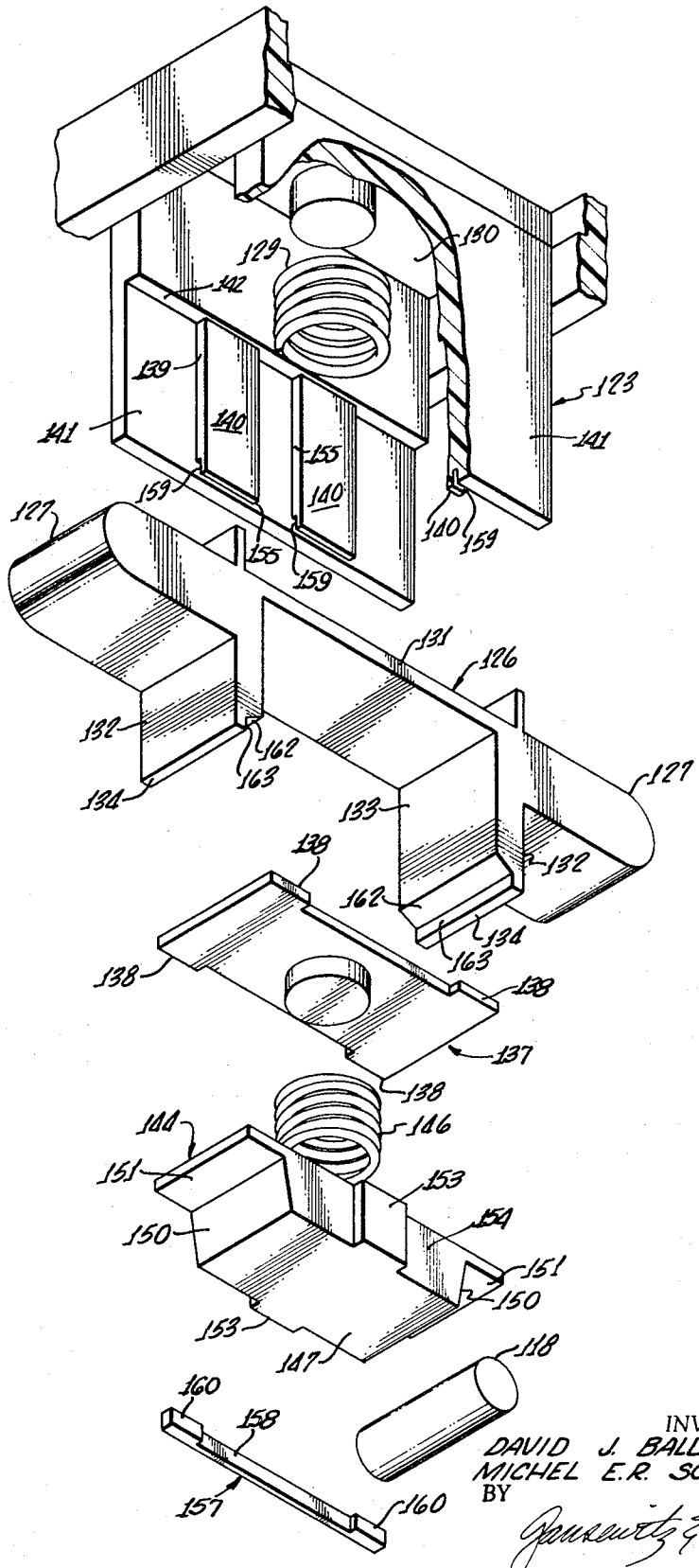


FIG. 12.

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COUPLING

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to electrical connectors and coupling devices therefor.

2. The Prior Art

Electrical connectors normally are formed either to cylindrical or rectangular cross section, depending upon the use and location where the connector is installed. Rectangular connectors conventionally have projecting parts, such as flanges, at their ends through which bolts or screws are extended in securing together the two portions of the connector. Mating or separation of the connector, therefore, becomes relatively slow and laborious because of the time required in manipulating the attaching screws. Also, such attaching mechanisms are relatively heavy, which imposes a severe penalty when the connector is to be used in the aerospace field. These attaching mechanisms occupy considerable volume so that the connector becomes somewhat larger because of the coupling arrangement, and the number of contacts it can accommodate may be reduced. With the coupling mechanism projecting outwardly from the edges of the connector, it is impossible to associate a number of the connectors together in a compact side-by-side relationship. Moreover, it becomes particularly difficult to mate or separate the connector components when they are closely grouped in view of the limited access to the attaching screws. A further problem is encountered in the lack of reliability of the threaded connections which, even with locking devices, are subject to loosening from vibrational loads.

Push-pull coupling mechanisms have been used on cylindrical connectors, overcoming many of the difficulties mentioned above. Examples of such designs may be seen in U.S. Pat. No. 2,892,991 and 2,933,712. These coupling devices require an exterior annular member, however, to circumscribe the unit for manipulation in releasing the coupling mechanism so that the plug and receptacle may be separated. Such an annular member is not adapted for use with connectors of rectangular configuration. Also, this still requires access to the periphery of the side of the connector so that several of the connectors cannot be placed in close adjacency because of the need for operating the coupling mechanisms. These cylindrical connectors have used balls as the locking elements. As a result, when separating forces are imposed on the connector, they are transmitted by the balls at localized points of contact. These load concentrations cause brinelling, limit the capacity of the connector to withstand separating forces and can lead to premature failure.

Prior electrical connectors have included separate outer plug and receptacle shells, each of which carries an insert to receive and retain the electrical contacts. A provision must be made for retaining the insert in each of the shells upon assembly of the plug and receptacle of the connector.

SUMMARY OF THE INVENTION

The present invention provides a compact and light push-pull coupling mechanism of high-load capacity for an electrical connector or other device of rectangular cross-sectional configuration. One portion of the connector is provided at its central portion with a forwardly projecting post that is provided with two shallow transverse recesses in its opposite sidewalls. The central portion of the other member to be connected includes an element that receives the post when the unit is in the mated position. This element is provided with two transverse slots in its opposed walls, with rollers being received in these slots. Portions of the rollers extend out of the slots to engage the post at the shallow recesses, being held in the recesses by a retention member that has surfaces adjacent the outer sides of the rollers.

The retention member is pulled rearwardly to release the coupling mechanism, thereby bringing second surfaces adjacent the rollers. The second surfaces are spaced further outwardly and allow the rollers to be moved from the recesses in the post, thereby permitting the sections of the connector to be separated. A transverse plate engages the end of the post when the coupling is mated, but is moved forwardly by a spring to engage the inner surfaces of the rollers when the coupling is separated. This forces the rollers outwardly to the outer surfaces of the retention member, and causes the rollers to engage shoulders on the retention member, which holds the retention member in the retracted position.

The connector is mated merely by pushing the two parts together, which releases the retention member and brings the rollers into the recesses in the post.

The retention member may be moved to the retracted position for separating the connector by a knob projecting from the rearward end of the connector, which permits the connectors to be grouped in an edge-to-edge relationship without the necessity of providing clearance for a coupling mechanism. This saves weight and space at the mounting panel. Alternatively, side elements may be provided for moving the retention member when such spacing is not critical. A variety of other techniques may be used for moving the retention member to accomplish the release of the coupling mechanism.

The use of rollers as the locking elements provides relatively large areas of contact, so that loads are distributed and the connector will withstand large forces tending to separate the two components. In this respect, it is far superior to the prior designs for circular parts which use balls in the coupling mechanism, with resulting load concentrations. The coupling mechanism is not sensitive to vibrations, but will remain in the secured position until actuated for release. Unlike the screw connections conventionally used for rectangular connectors, the mechanism is either fully mated or separated, with no intermediate positions possible.

The electrical connector incorporating the coupling mechanism of this invention has plug and receptacle shells of rigid dielectric material, such as plastic. These have integral inner portions provided with openings to receive electrical contacts that are interconnected when the connector is in the mated position. This integral construction avoids the use of separate inserts in the plug and receptacle shells as commonly provided in electrical connectors. Insert retention problems are avoided and weight is minimized. The arrangement of the rectangular shells with a central push-pull coupling mechanism houses a maximum number of contacts in a connector of minimum volume and weight. A single standard size of coupling mechanism, which occupies only a small volume, may be used for electrical connectors of a variety of sizes.

An object of this invention is to provide a push-pull coupling mechanism for parts of noncircular cross section.

Another object of this invention is to provide a compact coupling mechanism received in the central portion of the parts being connected without projecting laterally to one side.

An additional object of this invention is to provide a coupling mechanism that will withstand relatively high separating forces.

A further object of this invention is to provide a coupling mechanism relatively simple to manufacture and operate and which is not sensitive to vibrational loads.

Yet another object of this invention is to provide an electrical connector of minimum volume and weight, having a rectangular configuration and coupled by a push-pull mechanism.

A still further object of this invention is to provide an electrical connector that eliminates a separate insert for retaining the contacts.

These and other objects will become apparent from the following detailed description taken in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of an electrical connector embodying the present invention, with the connector in the mated position;

FIG. 2 is an exploded perspective view of the electrical connector in the separated position;

FIG. 3 is a longitudinal sectional view taken along line 3—3 of FIG. 1;

FIG. 4 is a longitudinal sectional view taken along line 4—4 of FIG. 1;

FIG. 5 is a transverse sectional view taken along line 5—5 of FIG. 4;

FIG. 6 is a longitudinal sectional view similar to FIG. 4, but illustrating the connector in the separated condition;

FIG. 7 is a perspective view of a modification of the invention which incorporates side release members;

FIG. 8 is a longitudinal sectional view taken along line 8—8 of FIG. 7;

FIG. 9 is a perspective view of another embodiment of the invention;

FIG. 10 is an enlarged sectional view taken along line 10—10 of FIG. 9;

FIG. 11 is a view similar to FIG. 10, but with the coupling released; and

FIG. 12 is an exploded perspective view of the plug portion of the connector of FIG. 9.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The connector 10 constructed in accordance with this invention includes a plug 11 and a receptacle 12. Both of these units are of rectangular configuration, with the plug having a shell 13 of such a cross-sectional shape, while the receptacle shell 14 likewise is rectangular. A flange 15 projects laterally outwardly from the receptacle 12 and is provided with openings 16 for mounting. Other attaching arrangements may be provided if desired. Both the plug and receptacle shells 13 and 14 may be made of rigid dielectric material, such as plastic, and extend inwardly of the periphery of the connector to provide the means for receiving and retaining the electrical contacts. In this manner, the conventional separate insert is eliminated.

As shown in FIGS. 2 through 5, the plug shell 13 includes an inner portion 17 provided with a plurality of cylindrical openings 18 extending through it. The inner portion 17 is integral with the periphery of the plug shell and takes the place of a separate insert. Electrical contacts 19 are received and retained in the openings 18. In the example illustrated, the contacts 19 are pin contacts, held axially by the tabs of the retainer clips 20 and by shoulders 21, but the plug shell 13 also can accept socket contacts. Wires 22 extend inwardly from the rearward end of the plug 11, with their ends being attached to the contacts 19. The rearward end of the plug shell 13 is recessed to receive a resilient rubber sealing member 23. The forward end of the plug shell 13 is more deeply recessed and may be provided with a relatively thin resilient sealing insert 24.

In a generally similar manner, the receptacle shell 14 includes integral inner portions 25 that project forwardly beyond the outer sides of the receptacle shell. Cylindrical openings 26 extend between the rearward and forward ends of the receptacle shell 14, receiving and retaining socket contacts 27. Wires 28, extending through a resilient sealing insert 29, connect to the contacts 27. When the connector 10 is in the mated position shown in FIGS. 1, 3, 4 and 5, the forward parts of the inner portions 25 of the receptacle shell 14 enter the recessed forward end of the plug shell 13, and the pin contacts 19 are received in the socket contacts 27. This provides an electrical connection between the wires 22 and 28.

The coupling mechanism for holding the plug 11 and receptacle 12 in the mated position is located at the central portion of the connector 10. A portion of it is in a recess 30 in the plug shell 13, which opens to the forward end and bisects the plug shell, extending from one side of it to the other. The mating part of the coupling mechanism is in a similar central recess 31 in the receptacle shell 14. Except for an actuating element, the coupling mechanism is entirely buried within the connector.

In the recess 30 in the plug shell 13, the coupling mechanism includes a hollow member of rectangular cross-sectional shape having a base flange 33 that connects to the plug shell 13. Two opposed sidewalls 34 and 35 of the member 32 are provided with slots 36 and 37. Arcuate recesses 38 and 39 are formed in the other two opposed sidewalls 40 and 41 and connect to the slot 36 (see FIGS. 5 and 6). Similar recesses 42 and 43 in the sidewalls 40 and 41 connect to the slot 37. The slot 36 and its adjacent recesses 38 and 39 receive a cylindrical roller 44. A second cylindrical roller 45 is positioned in the slot 37 and the recesses 42 and 43.

A stud 47 projects forwardly from the rearward end wall 48 of the member 32 along the longitudinal center of that member. A plate 49, which is transverse to the stud 47, is provided with a central aperture 50 that slidably receives the stud. A compression spring 51 circumscribes the stud 47 and biases the plate 49 toward a stop 52 on the distal end of the stud 47. Flanges 53 and 54 project forwardly from the edges of the plate 49 adjacent the rollers 44 and 45. Chamfered surfaces 55 and 56 are formed on the forward ends of the flanges 53 and 54, respectively, being inclined toward the forward end of the plug 11 and inwardly toward its longitudinal axis.

Also received within the central recess 30 in the plug shell 13 is a cup-shaped retention member 58 which extends around the member 32. The member 58 includes forwardly extending parallel walls 59 and 60 alongside and parallel to the walls 34 and 35 of the member 32. The thicknesses of the walls 59 and 60 are reduced at their forward edges. Consequently, these walls provide rearward inner surfaces 61 and 62, which are closely adjacent the walls 34 and 35 of the member 32, and forward inner surfaces 63 and 64, which are spaced outwardly from the walls 34 and 35. Shoulders 65 and 66, which incline outwardly and forwardly from the surfaces 61 and 62, interconnect those surfaces with the surfaces 63 and 64.

A stud 68 connects to the end wall 69 of the member 58 and extends outwardly through an opening 70 in the wall 71 at the rearward end of the plug shell 13. A head 72 is provided on the end of the stud 68 exteriorly of the rearward end of the plug 11. Within the plug shell 13, a compression spring 73 circumscribes the stud 68, bearing at one end against the wall 71 of the plug shell 13 and at the opposite end against the end wall 69 of the member 58. Hence, the spring 73 biases the member 58 forwardly with respect to the plug shell 13. When the connector is in the mated position of FIGS. 1, 3, 4 and 5, the forward end of the retention member 58 engages the base flange 33 of the member 32, which limits the forward travel of the retention member.

Within the recess 31 in the receptacle shell 14 is a post 74, secured to the receptacle shell 14 by means of a screw 75 and projecting forwardly from rearward wall 76 of the receptacle shell. An axial opening 77 extends inwardly from the distal end 78 of the member 75 and receives the end of the stud 47 when the connector is in the mated position of FIGS. 1, 3, 4 and 5. The post 74 is rectangular in cross section, with opposite straight parallel sidewalls 79 and 80. Adjacent but inwardly of the end 78, these sidewalls are provided with transverse recesses 81 and 82, which are relatively shallow and shaped as segments of cylinders that are less than semicylinders. These recesses are for receiving portions of the rollers 44 and 45 when the connector 10 is in the mated position.

In the normal secured position of the connector mechanism, the retention member 58 is shifted forwardly to the position shown in FIGS. 3 and 4, where its distal end engages the flange 33 of the member 32. The member 58 is held in this forward position by the spring 73. At this time, the inner portions of the rollers 44 and 45 extend from the slots 36 and 37 into the recesses 81 and 82, while the surfaces 61 and 62 are located immediately outwardly of the rollers. The surfaces 61 and 62,

therefore, will not allow the rollers 44 and 45 to escape from the recesses 81 and 82. This secures the plug 11 to the receptacle 12. Any forces tending to separate the plug 11 and receptacle 12 will be borne by the rollers 44 and 45, the surfaces of the recesses 81 and 82, and the edges of the slots 36 and 37. As long as the rollers are held in the recesses 81 and 82, the plug and receptacle are locked together and cannot be moved apart. The retaining strength of the coupling mechanism is particularly high, because the rollers 44 and 45 make line contact with the edges of the slots 36 and 37 and area contact with the recesses 81 and 82. This contrasts with designs sometimes used in circular connectors in which balls are used as locking elements. The point contact in such a coupling arrangement at the locations where the balls engage the associated parts concentrates the loads and reduces the retention capacity of those units.

Release of the coupling mechanism, so that the plug 11 and receptacle 12 can be separated as shown in FIGS. 2 and 6, is accomplished merely by pulling rearwardly on the knob provided by the head 72 of the stud 68. This moves the retention member 58 rearwardly relative to the plug 11. As this takes place, the surface portions 61 and 62 are moved away from the rollers 44 and 45. The forward and outwardly spaced surfaces 63 and 64 then are positioned adjacent the rollers. When this occurs, a separating force on the plug and receptacle easily cams the rollers 44 and 45 out of the shallow arcuate recesses 81 and 82 so that the plug 11 and receptacle 12 can be moved apart.

As the member 58 is pulled rearwardly and the plug 11 begins to separate from the receptacle 12, the spring 51 continues to hold the plate 49 in engagement with the end 78 of the post 74 of the receptacle 12. Thus, there is forward movement of the plate 49 relative to the plug 11. Ultimately, this brings the inclined edges 55 and 56 at the forward end of the plate 49 into engagement with the rollers 44 and 45. This contact of the inclined surfaces 55 and 56 is inwardly of the axes of the rollers 44 and 45, so that the inclined surfaces 55 and 56 cam the rollers outwardly toward the surfaces 63 and 64 of the member 58, and allow the plate 49 to pass between the rollers. This brings the rollers into engagement with the outer surfaces of the flanges 53 and 54 of the plate 49, while the stop 52 limits the forward travel of the plate 49 so that it does not move beyond the rollers. Therefore, the rollers 44 and 45 are held between the plate 49 and the surfaces 63 and 64, with their inner portions remaining in the slots 36 and 37. This retains the rollers 44 and 45 to the mechanism within the plug 11 when the connector is in the separated position. This also maintains the member 58 in its retracted rearward position, as the rollers 44 and 45, supported by the forward edges of the recesses 36 and 37, and engaged by the shoulders 65 and 66, will not allow the member 58 to move forwardly.

The connector is moved back to the mated and secured position merely by shifting the plug 11 relatively toward the receptacle 12. As this takes place, the plate 49 is brought into engagement with the end 78 of the member 74 of the receptacle 12, thereby pushing rearwardly on the plate 49. This removes the plate 49 from its position adjacent the rollers 44 and 45, so that the rollers can move inwardly toward the sides 79 and 80 of the post 74. When the rollers 44 and 45 reach the recesses 81 and 82, the inclined shoulders 65 and 66 provide an inward force component on the rollers as a result of the forward biasing force on the member 58 exerted by the spring 73. Consequently, the rollers 44 and 45 are forced into the recesses 81 and 82, and the member 58, no longer held retracted, moves forwardly to position the surfaces 61 and 62 outwardly of the rollers. As a result, the connector is secured and locked in the mated position. Thus, both attachment and release are accomplished by relative rectilinear movement of the parts of the connector. Coupling and uncoupling take place very rapidly, yet the device is securely held in the attached position.

One of the advantages of the arrangement of FIGS. 1 through 6 is that it permits a number of the connectors to be positioned in a closely grouped relationship. It is only necessary to have access to the rearward end of the plug of each connector in order to release it. This allows the connectors to be mounted in an abutting relationship at their sides. Consequently, a maximum number of connectors can be grouped in a limited space.

In some instances, however, this feature may not be as important, and it may be considered more convenient to provide the side release illustrated in FIGS. 7 and 8. Here, the general construction of the connector is the same as that of the connector 10. However, release is effected by moving a pair of knobs 85 and 86 rearwardly relative to the plug 87, rather than through the manipulation of a single knob at the rearward end of the connector as in the previous embodiment. The receptacle 12 may be used with the embodiment of the plug 87 illustrated in FIGS. 7 and 8.

The plug 87 includes a member 88 similar to the member 32 in the previously described embodiment. Thus, the member 88, which includes a flange 89 that is attached to the peripheral wall of the plug shell, has a pair of spaced opposed walls 91 and 92 having slots 93 and 94 that receive rollers 96 and 97. A retention member 98 extends around the member 88 and is biased forwardly by a compression spring 99 so that its forward end is held in engagement with the flange 89 when the connector is in the mated position. This positions the inner wall surfaces 100 and 101 of the sidewalls 102 and 103 outwardly of the rollers 96 and 97, holding the rollers in the recesses 81 and 82. This maintains the coupling mechanism in the secured position.

The knobs 85 and 86 have inner threaded ends 104 and 105 which connect to the sidewalls 102 and 103 of this member 98. The knobs extend outwardly from this location through longitudinal slots 106 and 107 in the plug 87.

Extending longitudinally forwardly from the rearward end wall 108 of the plug 87 is a stud 109. This member is attached adjacent its head to the plug shell and at its opposite end, which is received in the opening 77 in the post 74 when the connector is mated, carries a stop 110. A plate 111, which is similar to the plate 49, is slidable along the stud 109 and, when the connector is mated, is held against the end 78 of the post 74 by a spring 112 that circumscribes the stud 109.

The knobs 85 and 86 conveniently may be gripped by a thumb and forefinger of one hand for movement rearwardly to release the coupling mechanism. This movement carries with it the member 98, causing the rollers 96 and 97 to be positioned adjacent the remote forward inner surfaces 113 and 114 of the sidewalls 102 and 103 of the member 98. This allows the rollers 96 and 97 to be moved out of the recesses 81 and 82 so that the plug 87 may be separated from the receptacle 12. When this takes place, the plate 111 holds the rollers 96 and 97 adjacent the surfaces 113 and 114 of the member 98, retaining them to the coupling mechanism. The parts are locked by rectilinear movement again, as merely pressing the plug 87 onto the receptacle 12 causes the plate 111 to be pushed rearwardly, and the rollers 96 and 97 to be released and moved into the recesses 81 and 82 by forward movement of the member 98.

In the simplified construction of FIGS. 9–12, side release of the coupling mechanism also is provided. In this design, the receptacle 115 includes a post 116 at its central portion, provided with transverse grooves 117 adjacent its outer end, which are adapted to receive the rollers 118 when the mechanism is in the coupled position of FIG. 9. The post 116 is dimensioned to extend through a rectangular opening 119 in the forward wall 120 of the cover 121 of the plug 122. The cover 121 cooperates with the plug shell 123 in defining a chamber 124 that houses the coupling mechanism.

Within the chamber 124 is a retention member 126 having ends 127 that extend outwardly through openings 128 defined by the cover 121 and the plug shell 123. The ends 127 of the member 126 provide a means for gripping this member with one hand and moving it linearly in operating the coupling mechanism. The retention member 126 is biased forwardly by

a compression spring 129, one end of which bears against the rearward end wall 130 of the plug shell 123 and the opposite end of which engages the rearward surface 131 of the retention member 126. When the retention member 126 is in the forward position of FIG. 9, its forwardly projecting spaced parallel walls 132 are positioned with their inner surfaces 133 outwardly of the rollers 118, thereby holding the rollers 118 in the grooves 117 of the post 116 for maintaining the mechanism in its coupled position. The forward ends 134 of the walls 132 at that time are in engagement with the transverse forward wall 120 of the cover 121.

Also within the chamber 124, intermediate the spaced parallel walls 132 of the retention member 126, is a plate 137. Short outwardly projecting tabs 138 are located at the corners of the plate 137. These fit outwardly of the longitudinal side edges 139 of the spaced parallel rectangular protrusions 140 that extend longitudinally of sidewalls 141 of the plug shell 123. By engaging the protrusions 140 in this manner, the plate 137 is held in position against transverse movement. The tabs 138 of the plate 137 also bear against transverse shoulders 142 that project inwardly at intermediate portions of the walls 141.

Forwardly of the plate 137 inside the plug shell 123 is a follower plate 144, which is rectangular in overall configuration. A recess 145 in the rearward wall of the follower plate 144 receives a compression spring 146 which also bears against the forward side of the plate 137. The spring 146, therefore, holds the plate 137 in engagement with the shoulders 142 of the sidewalls 141 of the plug shell 123, and also biases the follower plate 144 forwardly relative to the plug. In the secured position of the coupling mechanism shown in FIG. 9, the forward transverse surface 147 of the follower 144 engages the outer wall 148 of the post 116 of the receptacle.

The follower 144 includes two opposite side surfaces 150, which diverge rearwardly away from the forward surface 147 of the follower 144. Transverse tabs 151 project outwardly from the rearward end of the follower 144 beyond the divergent surfaces 150. The follower 144 is movable longitudinally of the plug 122, and is guided in a straight path by ribs 153 which project outwardly from the other two sidewalls 154 of the follower 144. The ribs 153 fit between the inside edges 155 of the longitudinal protrusions 140 on the sidewalls 141 of the plug shell 123. This provides a guide that assures that the follower 144 will move in a straight line longitudinally of the plug 122.

At the forward ends of the protrusions 140 of the sidewalls 141 are transverse members 157 which are engageable by the ends of the rollers 118. The members 157 include central portions 158, which are relatively thin and fit within end recesses 159 in the protrusions 140. The thicker ends 160 of the members 157 extend outside the outer longitudinal edges 139 and the protrusions 140, thereby retaining the members 157 against movement transversely of the plug 122. The forward wall 120 of the cover 121 maintains the members 157 within the recesses 159.

In the coupled position of FIG. 9, the rollers 118 are held in the grooves 117 of the post 116 by the surfaces 133 of the opposite walls 132 of the member 126, as mentioned above. Separation of the plug 122 from the receptacle 115 is prevented by the engagement of the rollers 118, which are held in a fixed position, with the ends 160 of the members 157. Thus, if a force should be exerted on the plug 122 tending to move it away from the receptacle 115, the interengagement of the ends 160 of the members 157 and the ends of the rollers 118 will block such movement.

The coupling is released by pulling rearwardly on the outer projections 127 of the member 126 to shift it to the position of FIG. 10. When this is done, the surfaces 133 are removed from adjacency with the rollers 118. This shifts outwardly flaring surfaces 162 of the walls 132 to the rear of the rollers 118, while outwardly recessed surfaces 163 of the walls 162 are positioned immediately outside the rollers 118. Therefore, the rollers 118 no longer are held in the grooves 117 so that, upon a relative separating force between the plug 122 and the receptacle 115, the rollers will be cammed outwardly, releasing the plug from the receptacle.

As the plug and receptacle move apart, the follower 144 is biased forwardly to bring its tapered surfaces 150 outside the rollers 118, holding the rollers 118 outwardly toward the recessed surfaces 163. Rollers 118 continue to engage the members 157 so that they cannot drop out of the chamber 124 in the event that the follower 144 should become cocked from its normal transversely aligned position.

The plug and receptacle are mated substantially as for the other embodiments, with the end 148 of the post 116 pushing against the surface 147 of the follower 144, shifting the follower 144 rearwardly so that the rollers 118 then can be forced into the grooves 117 by the inclined surfaces 162 of the forwardly biased retention member 126.

We claim:

1. An electrical connector comprising

a first unit,

a second unit,

said first unit including a member of substantially rigid dielectric material defining a sidewall generally rectangular in cross section, and an intermediate portion having a plurality of openings extending from the rearward end to the forward end of said member,

a plurality of electrical contacts in said openings,

and means for holding said electrical contacts in said openings,

said second unit including a member of substantially rigid dielectric material defining a sidewall generally rectangular in cross section, and an intermediate portion having a plurality of openings extending from the rearward end to the forward end of said member of said second unit,

a plurality of contacts in said openings of said second unit,

and means for holding said electrical contacts in said openings of said second unit,

said first and second units being adapted to assume a mated position in which said electrical contacts of said units are in interengagement for forming an electrical circuit therebetween, and a separated position in which said electrical contacts of said first and second units are remote from each other,

said first and second units including first and second recesses, respectively, in the intermediate portions thereof extending inwardly from said forward ends thereof,

and a coupling mechanism for releasably holding said first and second units in said mated position,

said coupling mechanism including a forwardly extending post in said first recess,

said post having opposed outer walls,

each of said walls inwardly of the distal end of said post having a transverse recess therein,

said coupling mechanism including in said second recess an element having opposed walls receiving said opposed walls of said post when said coupling mechanism is in said mated position,

each of said opposed walls of said element having a transverse slot therein,

a roller in each of said slots,

said rollers projecting inwardly of said slots into said recesses when said first and second units are in said mated position for holding said first and second units in said mated position,

a retention member in said second recess movable between a forward position and a rearward retracted position,

said retention member including opposed walls outwardly of said opposed walls of said element,

said opposed walls of said retention member having first inner surfaces relatively adjacent said opposed walls of said element when said retention member is

in said forward position for holding said rollers in said recesses,

said opposed walls of said retention member having additional inner surfaces at the forward end of said retention member relatively remote from said opposed walls of said element,

said additional inner surfaces being positioned relatively adjacent said slots when said retention member is in said retracted position for allowing said rollers to leave said recesses to permit said first and second units to be moved to said separated position,

a transverse member engaging the distal end of said post when said first and second units are in said mated position,

means resiliently biasing said transverse member against said end of said post,

whereby when said first and second units are moved to said separated position said transverse member moves forwardly relative to said second unit for engaging said rollers and holding said rollers outwardly adjacent said additional inner surfaces of said retention member,

stop means for limiting the forward movement of said transverse member,

resilient means biasing said retention member toward said forward position thereof,

and exteriorly operable means for moving said retention member to said retracted position thereof.

2. In combination with a first member and a second member, a coupling device comprising

a first element carried by said first member,

said first element having an elongated transverse recess therein,

a second element carried by said second member,

said second element having an elongated transverse slot therein,

a roller in said slot,

said roller extending out of said slot on one side so that a portion of said roller is received in said recess when said first and second members are in a mated position,

a retention member on the opposite side of said slot,

said retention member having a surface adjacent

said roller for holding said roller in said recess when said first and second members are in said mated position,

whereby the edges of said slot and said recess hold said first and second members in said mated position,

and means for moving said retention member to shift said surface thereof away from said roller for allowing said roller to leave said recess and permitting said first and second members to be moved to a separated position,

a third movable element on said one side of said slot,

and resilient means biasing said third element toward said slot,

said third element engaging said second element when said first and second members are in said mated position,

whereby said third element is held remote from said slot,

said third element being movable to a position of adjacency with said slot when said first and second members are in said separated position for engaging said roller and holding said roller in said slot.

3. An electrical connector comprising

a first member,

a second member,

said first and second members being noncircular in exterior periphery,

electrical contact means in each of said first and second members,

said first and second members being relatively positionable in a mated position in which said electrical contact means are in interengagement forming an electrical circuit therebetween, and relatively positionable in a separated position in which said first and second members and said contact means therein are remote from each other, and coupling means for releasably holding said first and second members in said mated position,

said coupling means including a first element carried by said first member,

said first element having an elongated transverse recess therein,

a second element carried by said second member,

said second element having an elongated transverse slot therein,

a cylindrical roller in said slot,

said roller extending out of said slot on one side so that a portion of said roller is received in said recess when said first and second members are in said mated position,

a retention member on the opposite side of said slot,

said retention member having a surface adjacent said roller for holding said roller in said recess when said first and second members are in said mated position,

whereby the edges of said slot and said recess hold said first and second members in said mated position,

and means for moving said retention member a to shift said surface thereof away from said roller for allowing said roller to leave said recess and permitting said first and second members to be moved to said separated position,

said means for moving said retention member including a duality of exteriorly projecting members,

said exteriorly projecting members being on opposite sides of said second member.

4. An electrical connector comprising

a first member,

a second member,

said first and second members being noncircular in exterior periphery,

electrical contact means in each of said first and second members,

said first and second members being relatively positionable in a mated position in which said electrical contact means are in interengagement forming an electrical circuit therebetween, and relatively positionable in a separated position in which said first and second members and said contact means therein are remote from each other,

and coupling means for releasably holding said first and second members in said mated position,

said coupling means including a first element carried by said first member,

said first element having an elongated transverse recess therein,

a second element carried by said second member,

said second element having an elongated transverse slot therein,

a cylindrical roller in said slot,

said roller extending out of said slot on one side so that a portion of said roller is received in said recess when said first and second members are in said mated position,

a retention member on the opposite side of said slot,

said retention member having a surface adjacent said roller for holding said roller in said recess when said first and second members are in said mated position,

whereby the edges of said slot and said recess hold said first and second members in said mated position, and

means for moving said retention member to shift said surface thereof away from said roller for allowing said roller to leave said recess and permitting said

first and second members to be moved to said separated position,

a third movable element on said one side of said slot carried by said second member, and resilient means biasing said third element toward said slot,

said third element engaging said second element when said first and second members are in said mated position,

whereby said third element is held remote from said slot,

said third element being movable to a position of adjacency with said slot when said first and second members are in said separated position for engaging said roller and holding said roller in said slot.

5. A device as recited in claim 4 in which said coupling means is located at the central portions of said first and second members, and in which said electrical contact means are located on either side of said coupling means.

6. A device as recited in claim 4 in which said transverse recess is defined by a segment of a cylinder that is less than a semicylinder.

7. A device as recited in claim 4 in which said means for moving said retention member includes a member extending outwardly through said rearward end of said second member.

8. A device as recited in claim 4 in which

said first element includes a second elongated transverse recess,

said recesses being located in opposite portions of said first element,

said second element includes a second elongated transverse slot,

said slots being arranged in an opposed relationship,

a second roller in said second slot, and in which said retention member includes a second surface adjacent said second roller for holding said second roller in said second slot when said first and second members are in said mated position.

9. A device as recited in claim 4 in which

said retention member includes a second surface spaced laterally outwardly from said slot on said opposite side thereof,

said second surface being brought into adjacency with said slot when said retention member is so moved,

said third element holding said roller outwardly in adjacency with said second surface when said first and second members are in said separated position,

whereby said second surface cooperates with said third element in holding said roller in said slot.

10. A device as recited in claim 9 including in addition

resilient means biasing said retention member toward a position in which said first-mentioned surface thereof is adjacent said roller,

said retention member having a shoulder intermediate said second surface and said first-mentioned surface,

said resilient means biasing said shoulder against said roller when said third element engages said roller for holding said retention member in a retracted position.

11. A device as recited in claim 4 in which each of said first and second members includes a one-piece unit having a peripheral shell portion and an integral inner portion, said electrical contact means being in said inner portions.

12. A device as recited in claim 11 in which said coupling means is centrally located in each of said units with said inner portions being on either side of said coupling means.

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