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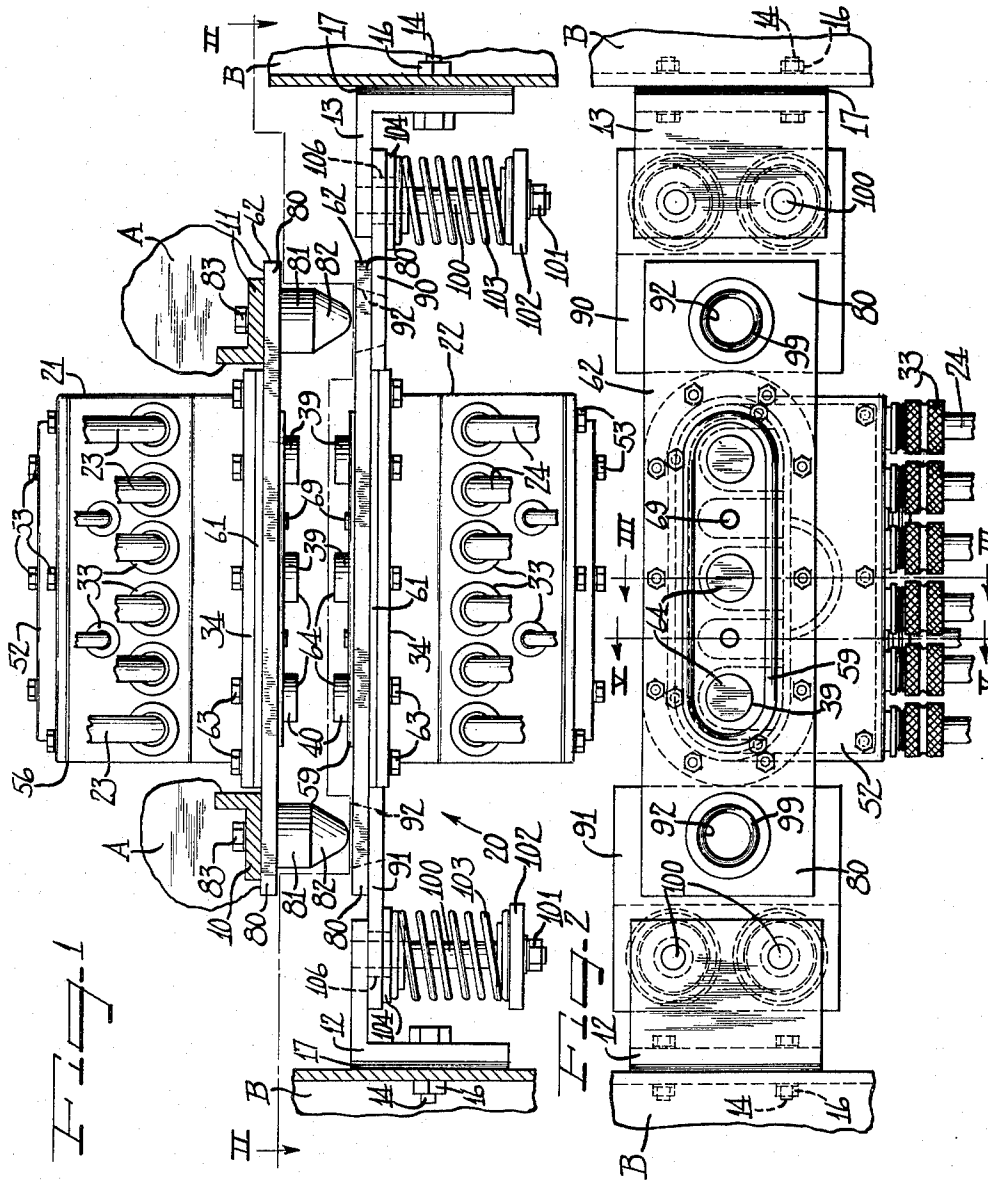
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AUTOMATIC TRAIN LINE CONNECTOR

Filed July 13, 1956

3 Sheets-Sheet 1



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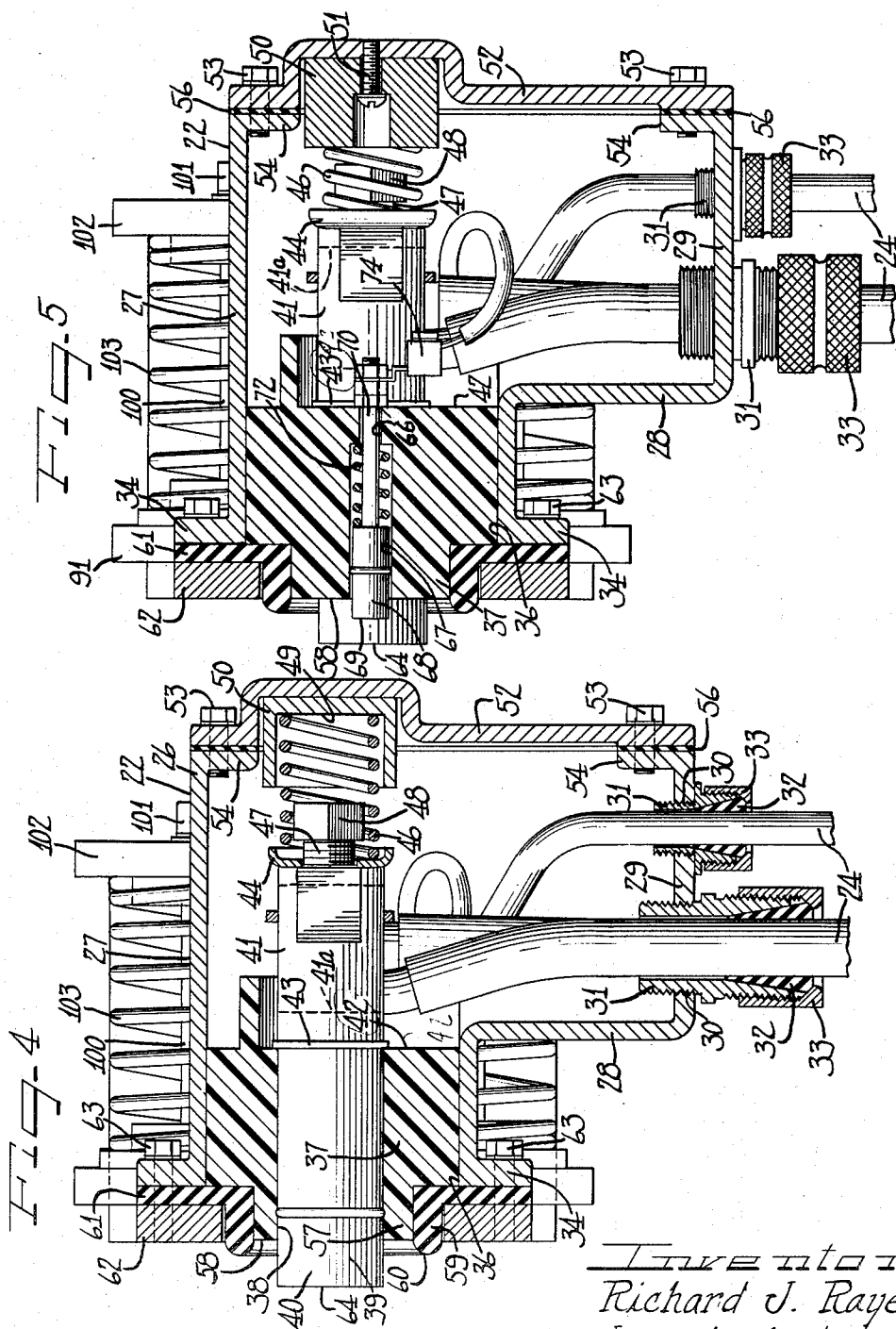
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## AUTOMATIC TRAIN LINE CONNECTOR

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This invention relates generally to electrical connectors and more particularly to means for effecting mechanical coupling and retention of axially separable electrical connector parts.

Although of general utility, the present invention is particularly adapted for use in establishing a line connection between two separable vehicular units, for example, separate cars of a railway train. Thus, an operating environment is provided wherein articulated cars each carry a connector part of a separable electric connector and because of the mechanical separability of the cars, the electrical connector components are subjected to unusual displacement forces which interfere with the efficient operation of the connector in developing its electrical function. For example, if the electrical contact members of the separable electrical connector parts are subjected to lateral displacement forces, unusual wear conditions will prevail and it is also possible that the adjoining abutment surfaces of the contacts will be so misaligned as to break the electrical connection. If mechanical coupling means are provided which rigidly interconnect the contact members, serious damage to equipment is likely to ensue because of the great mechanical forces applied to the connector parts by the train cars.

It is an object of the present invention, therefore, to provide a line connector which can be employed between articulated train cars wherein the electrical contacts are readily and conveniently guided into proper mating relationship and are thereafter retained against lateral displacement forces.

Another object of the present invention is to provide a floating mounting for one part of an axially separable two part electrical connector with guide means between the parts to guide the parts into mated relation and to lock the parts when joined against lateral displacement.

Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and the accompanying sheets of drawings in which a preferred structural embodiment of the principles of the present invention is shown by way of example.

On the drawings:

Figure 1 is an exploded top plan view;

Figure 2 is a view taken generally on line II—II of Figure 1;

Figure 3 is a cross-sectional view showing the components of the connector in coupled-together relation and taken generally on the plane of line III—III of Figure 2;

Figure 4 is similar to Figure 3 but shows only one of the connector parts, thereby demonstrating the components of the part as being moved to a different position; and

Figure 5 is a cross-sectional view taken generally on line V—V of Figure 2.

As shown on the drawings:

The connector apparatus of the present invention is particularly adapted for use between articulated units

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of a railway train and can be, for example, mounted in an overhead position outside the diaphragm between two car units. Structural components of a first car diaphragm face plate are shown for a car unit indicated at A and include a pair of laterally spaced angles 10 and 11, respectively. The structural components for a second car unit B include a second pair of posts as indicated at 12 and 13 connected to the crash posts of the second car unit B by a plurality of fasteners such as the bolts 14 and the nuts 16, the lateral spacing dimension being adjusted by the insertion of one or more shims 17.

It will be understood that two car units A and B are coupled together by the usual coupling mechanism, thereby providing an articulated vehicle assembly locked together for movement in a longitudinal direction but capable of limited movement with respect to one another as confined by the coupling means.

According to the principles of the present invention, means are provided to electrically interconnect the circuit means of each respective car unit A and B without requiring connector parts other than the connector units permanently attached to each respective car unit. Moreover, the connector of the present invention is particularly characterized by guide means which guide the contact members into properly aligned mating position and operate, when the connectors are joined together, to lock the connector parts against relative lateral displacement while transmitting any displacement forces imposed upon the parts through yieldable connections afforded in a floating mounting carrying one of the connector parts on a corresponding car unit. As shown in the drawings, the connector affording such advantages is indicated generally by the reference numeral 20 and includes axially or longitudinally separable first and second connector parts indicated at 21 and 22. The connector parts 21 and 22 are structurally and functionally similar in many respects and accordingly, for all such similar aspects, only one description will be given, common reference numerals being applied to both parts where appropriate.

As is clearly shown in Figure 1, the car unit A has associated therewith circuit means including a plurality of conductor wires or cables 23, while the car unit B has associated therewith a similar and corresponding plurality of conductor wires 24. Electrical interconnection between the respective circuit means is effected by the electrical contacts of the connector 20.

Referring more particularly to Figures 3, 4 and 5, each of the connectors 22 and 21 has a generally L-shaped housing 26 including an end wall 27 and a depending leg portion 28 which terminates in an end wall 29 apertured as at 30 to receive in threaded assembly therewith a bushing 31 forming a passage for the corresponding conductor wire, such as the conductor wires 24.

A rubber sealing grommet 32 is received in the end of the bushing 31 and is compressed by a cap member 33 threaded on the end of the bushing 31 to form a tight seal along the length of the conductor wires 24, the grommet 32 snugly engaging against the outer peripheral surface of the sheath of insulation material on the conductor wires or cables 24.

The housing 26 is flanged as at 34, the flange 34 surrounding an opening 36 in which is received a contact retainer member 37 made of a suitable electrically non-conductive material. The retainer 37 is provided with a plurality of laterally spaced through openings 38 slidably supporting a corresponding plurality of contact members 39. Each contact member 39 has a front portion 40 and a rear portion 41. The rear portion 41 projects beyond an end wall extremity 42 of the retainer 37 and a stop shoulder 43, formed as an annular rib on the contact member 39, limits relative axial movement between the contact member 39 and the retainer 37.

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The projecting end 41 of the contact member 39 has a flanged spring retaining member 44 bottoming one end of a coil spring 46. A cap screw 47 fastened in the end of the contact member 39 centers the flanged member 44 in position and provides means for clamping conductor wires 24 inserted in an appropriate opening 41a in rear portion 41 of contact member 39.

The opposite end of the coil spring 46 is received and bottomed in a cup-shaped recess 49 provided by a spring retaining member 50 secured by a plurality of fasteners such as indicated at 51 (Figure 5) to a cover 52. The cover 52, in turn, extends across the back of the housing 26 and is fastened in firm assembly therewith by a plurality of fasteners 53 threaded into the correspondingly threaded apertures of an inwardly extending flange indicated at 54. A sealing gasket 56 is interposed between the flange 54 and the cover 52.

The contact retainer 37 has an axially projecting portion 57 which extends forwardly of the face on the flange 34 and which is reduced with respect to the size of the opening 36, thereby to provide a face 58. The reduced projecting portion 57 of the retainer is completely surrounded by an axially extending rib 59 made of a yieldable electrically non-conductive material. As shown in the drawings, the rib 59 has an abutment surface 60 which projects axially beyond the face 58, thereby to insure engagement with the adjoining contact face 60 on a mating connector part. The rib 59 is flanged as at 61 which flange 61 is received against the face of the flange 34 and is clamped thereagainst by a locking member 62 retained in assembly with the housing 26 by a plurality of fasteners 63, thus providing a seal between housing 26 and locking member 62.

The forward end 40 of the contact member 39 is particularly characterized by the formation thereon of an end surface or abutment surface 64 normally positioned by the bias of the coil spring 46 axially outwardly of the rib 59 for electrical contact engagement with the corresponding contact face or abutment surface 64 of an adjoining contact member 39 of a second connector.

It will be understood that it is desirable the electrical switching action occurring upon joining and separation of the abutment surfaces 64, 64 of the respective contact members 39 of the connectors 21 and 22 will be effected during a no-load condition, thereby avoiding the undesirable effects of arcing. Accordingly, it is contemplated according to the principles of the present invention to provide relay contacts associated with appropriate relay means to unload the contact members 39 in a proper timing sequence. As shown in Figure 5, the contact face 58 of the retainer 37 has a bore 66 formed therein counterbored at 67 to receive a contact member 68 having an abutment surface 69 at one end, and a reduced extension 70 at its opposite end passing through the bore 66 for cooperation with relay contact means indicated generally at 71. A coil spring 72 surrounds reduced extension 70 and is bottomed at one end against the contact member 68 and bottomed at the other end by a shoulder formed between the counterbore 67 and the bore 66. The spring 72 biases the contact member 68 outwardly, but the contact face 69 is aligned axially inwardly of the associated contact faces 64 on the contact members 39. Thus, when the connector parts 21 and 22 are moved toward one another, as shown in Figure 1, it will be understood that the contact members 39 are under no-load conditions and the contact faces 64 will be engaged before the opposed contact faces 69 of the relay contacts 68 abut against one another. Likewise, when the connector parts 21 and 22 are separated, the relay contact 68 will be separated and actuate the relay contact means 71, thereby electrically unloading the contact members 39 before the abutting contact faces or surfaces 64 are separated.

In Figures 3, the parts 21 and 22 are shown joined

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together. It will be noted that the contact surfaces 64 are in firm engagement with one another and the contact members 39 have been moved axially in the openings 36 so that the shoulders 43, 43 are spaced away from the end surfaces 42 and the springs 46 are under compression. Furthermore, the abutment surfaces 60 of the yieldable ribs 59 are in tight engagement with one another and it will be noted that the deformable rib of each connector 21 and 22 is compressed to afford a good seal at the outer periphery of the adjoining faces 58, 58.

As will be noted upon referring to the drawings, the retainer 62 constitutes a mounting plate which extends laterally outwardly of the face 58 on opposite sides of the housing 26, thereby to provide oppositely spaced wing portions 80 each carrying a pin means such as a pilot or guide pin 81 having a tapered finding portion 82. The guide pins 81 are welded to plate 62 which is attached to angles 10 and 11 by fastening means 83, for example, cap screws threading into mounting plate 62 through angles 10 and 11. Thus, it will be noted that the connector part 21 is rigidly interconnected with the car unit A, being firmly assembled to the angles 10 and 11 which are attached to the diaphragm face plate, of car A.

The connector part 22 is not only provided with the retainer 62 which functions as a mounting plate, but has attached thereto oppositely extending supplemental mounting plates 90 and 91 which are firmly assembled to the wing portions 80 and which project laterally outwardly of the wing portions 80.

As shown in the drawings, the mounting plate 62 on the connector 22 and the supplemental mounting plates 90 and 91 are apertured as at 92, thereby to form finding apertures cooperating with the guide pins 81. Thus, when car A is moved towards car B for coupling purposes, the finder portions 82 of the guide pins 81 will cooperate with the finder apertures 92 and guide the connector parts 21 and 22 into properly aligned relation, thereby facilitating mating engagement between the contact faces 64 and 69 of the contact members 39 and the relay contact members 68.

In order to accommodate the stresses and strains which are transmitted through the parts 21 and 22 of the electrical connector by virtue of the forces which are applied to the connector by the car units A and B, the present invention contemplates a floating mounting for the connector part 22.

To provide the floating mounting for the connector part 22, each of the posts 12 and 13 has projecting therefrom in axial direction a stud or pin 100 threaded at the end to receive a nut 101 and retaining a bottoming plate 102 against which is bottomed one end of a coil spring 103. The opposite end of the coil spring 103 is bottomed against a bearing plate 104 on the outermost portion of the supplemental mounting plate 91 and the supplemental mounting plate 90.

An enlarged aperture 106 is formed in each of the supplemental mounting plates 91 and 90 to pass a corresponding stud or pin 100 with a sufficient amount of clearance to facilitate the floating relation required between the connector part 22 and the stationary posts 12 and 13. Thus, the springs 103, 103 normally urge the supplemental mounting plates 90 and 91 against the posts 12 and 13, but the connector part 22 is longitudinally or axially displaceable against the bias of the springs 103, 103 in response to abnormal displacement forces exceeding the biasing force of the springs.

As shown in Figure 2, to further facilitate the guiding action, the finder apertures 92 may be tapered as at 99.

Furthermore, as shown in Figure 2, two springs 103 may be provided on each side of the connector apparatus, thereby facilitating tilting displacement. It is important to note that all displacement forces are readily accommodated at the flexible connecting means afforded by the

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floating mount of the connector part 22 because the guide pin means 81 securely lock the connector parts 21 and 22 against relative movement, thereby preventing wiping of the joined together contact surfaces 64 and 69 and thus eliminating wear at such surface. Thus, the present invention locks the contact members against lateral displacement while accommodating limited displacements which occur between the car units A and B in the region of the electrical connector 20.

Although various minor modifications might be suggested by those versed in the art, it will be understood and we wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of our contribution to the art and as measured by the appended claims.

We claim as our invention:

1. A connector comprising first and second parts separable on an axis of movement, each of said parts having means forming a contact face extending transversely of said axis, each part having an axially projecting rib extending away from said contact face and made of yieldable electrically non-conductive material and being engageable with the corresponding rib of the other part, and a plurality of contact members inwardly of said rib each having a contact surface projecting axially of said contact face, a coil spring for each contact member and engaging against the corresponding contact member to urge said contact surface into axially projecting relation with respect to the contact face, each respective contact member being engageable with a corresponding contact member at the contact surface, and a pair of mounting members for said parts each extending generally transversely of said axis, one of said mounting members being connected in firm assembly with a corresponding one of said parts and having pin means projecting axially towards the other mounting member, the other of said mounting members being connected in firm assembly with the other of said parts and having recess means extending axially to receive said pin means in mated relation therewith, one of said mounting members having an axially yieldable floating connection spaced laterally outwardly of said pin means on each side of the corresponding connector part, said pin and recess means locking said first and second parts against relative transverse or lateral displacement at said contact surfaces while retaining said parts in alignment to transmit displacement forces through said mounting members to said floating connection.

2. A connector comprising first and second axially separable parts each including a housing, a contact-retainer in said housing having a plurality of contact apertures extending axially therethrough at laterally spaced apart points, a slidable contact member in each contact aperture and having a rear portion extending outwardly of said contact retainer inside of said housing, a coil spring for each contact member bottomed at one end against said rear portion and bottomed at its other end against an adjoining wall of said housing, thereby biasing said contact member to urge a front portion of said contact member outwardly for spring-biased abutting engagement with the corresponding front portion of an adjoining contact member, first and second support means for the respective first and second part, one of said support means having a plurality of axially extending pins spaced laterally outwardly of said parts, each of said pins having a coil spring thereon, a first mounting plate on one of said parts having a corresponding plurality of apertures for said pins, each of said apertures being large enough to pass a corresponding pin with clearance, one end of each said spring being bottomed against said mounting plate and yielding to afford longitudinal movement, thereby floatingly mounting the mounting plate and the corresponding part associated therewith, and a second mounting plate with the other of said parts, said first and second mounting plates having mated pin and recess

means formed therebetween guiding the parts upon longitudinal movement of the parts into connected position and locking the parts when joined against lateral displacement while effecting transmittal of forces to said springs for relative longitudinal movement.

3. A connector as defined in claim 2, and spring-biased relay contact members in said contact retainer having a contact surface initially positioned inwardly of adjacent contact surfaces on said contact members in the corresponding first and second parts and being engageable at said contact surface with a corresponding adjoining relay contact member, thereby to insure the electrical unloading of said contact members during a switching operation.

4. In combination, a support means having axially extending pins thereon, a coil spring on each of said pins, a mounting plate having enlarged pin apertures for the corresponding pins and being mounted in floating spring-biased relation to said support means, said apertures passing said pins with sufficient clearance to afford a full floating action, and an axially separable two-part electrical connector having cooperating spring-biased contact members presenting interengaging transversely extending contact surfaces, one of said parts being carried by said mounting plate, the other of said parts being movable into position to load said mounting plate against said springs, and guide pin and recess means between said other of said parts and said mounting plate to guide the contact surfaces into mated relation and to lock the first and second parts when joined against lateral displacement.

5. A train line connector comprising first and second axially separable connector parts and together having multiple contact surfaces in abutting register with one another, one of said connector parts having a mounting plate extending laterally outwardly of said contact surfaces on opposite sides thereof and forming wing portions, a pin on each wing portion having a tapered finding part, the other of said connector parts having a mounting plate extending laterally outwardly on opposite sides thereof and forming wing portions apertured to form finding apertures for receiving a corresponding one of said pins, thereby to guide the connector parts together, supplemental mounting plates connected to opposite sides of one of said connector parts, and a pair of posts each having an axially projecting stud-like pin, said supplemental mounting plates each having an enlarged aperture formed therein to receive a corresponding one of said stud-like pins in projecting relationship therethrough and with clearance, a bottoming plate retained on the end of each said stud-like pin, and a coil spring bottomed on each bottoming plate and against a corresponding supplemental mounting plate, thereby to provide a floating mount for said one of said connector parts, wherein said coil springs will accommodate axially transmitted displacement forces, while said pin and apertured wing portions will prevent lateral displacement of the connector parts.

6. A train line connector as defined in claim 5, said finding apertures in said wing portions each being tapered to cooperate with said tapered finding parts on said pins to facilitate the guiding action.

7. An electrical train line connector for use between two mechanically coupled longitudinally separable vehicular units of an articulated train comprising first and second longitudinally separable connector parts, each said part having a longitudinally projecting rib made of yieldable electrically non-conductive material circumscribing the confronting face portions of said parts when connected, each connector part having a plurality of spring-biased contact members and each contact member having an end surface positioned longitudinally outwardly of a corresponding rib for electrical conductive engagement with a corresponding end surface of an adjoining contact member of the other connector part, each of said

connector parts having wing portions extending laterally outwardly of said rib, one of said connector parts having each of its said wing portions carrying a guide pin having a tapered finding portion projecting longitudinally towards the wing portions of the other of said connector parts, the other of said connector parts having each of its said wing portions formed with finding apertures therein receiving said guide pins, one of said connector parts having means for rigidly fastening the same to a vehicular unit, the other of said connector parts having supplemental apertured mounting plates outwardly of said wing portions, post portions for connection to another vehicular unit and having mounting pins projecting in a longitudinal direction through said apertured supplemental mounting plates, a bottoming plate on the end of each said mounting pin and a coil spring bottomed at one end against said bottoming plate and at its opposite end against a corresponding supplemental mounting plate, thereby to accommodate longitudinal displacements between the connector parts while said guide pins prevent wiping of the joined-together contact end surfaces.

8. An electrical train line connector as defined in claim 7, said connector parts having relay means providing relay contacts to electrically unload the contact members in a proper timing sequence upon relative longitudinal movement of the connector parts.

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