April 21, 1959 J. E. CANDLIN, JR., ET AL 2,883,069

AUTOMATIC POWER TRAINLINE CONNECTOR

Filed March 26, 1956 9 Sheets-Sheet 1

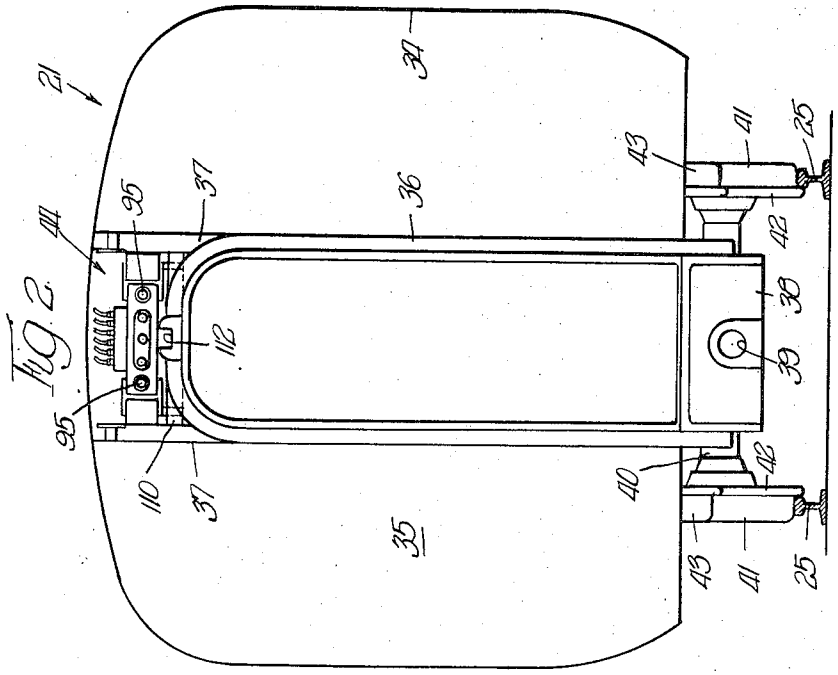


Fig. 2.

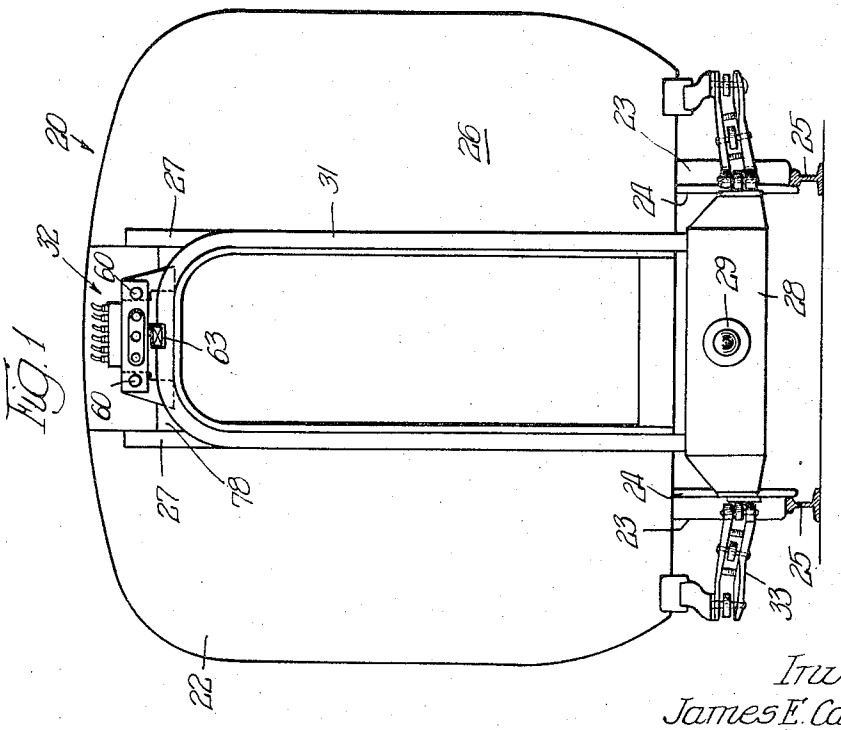


Fig. 1.

Inventors:
James E. Candlin, Jr.,
John I. Swarner,
By Cromwell, Greist & Wardrop
Attys

April 21, 1959 J. E. CANDLIN, JR., ET AL 2,883,069

AUTOMATIC POWER TRAINLINE CONNECTOR

Filed March 26, 1956 9 Sheets-Sheet 2

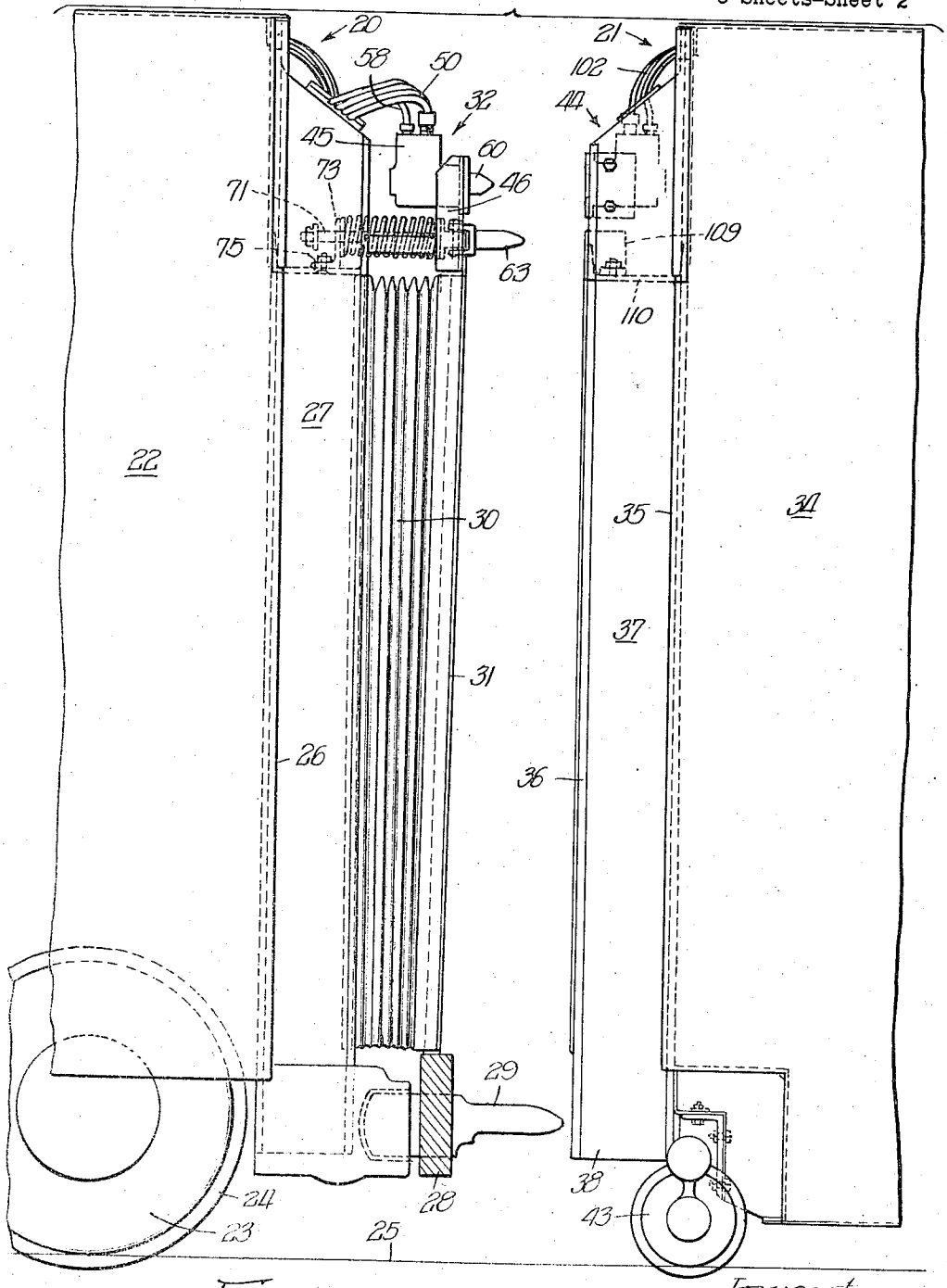


Fig. 3

Inventors:
James E. Candlin, Jr.,
John L. Swarner,
By Cromwell, Strist & Wardan
attys.

April 21, 1959 J. E. CANDLIN, JR., ET AL 2,883,069

AUTOMATIC POWER TRAINLINE CONNECTOR

Filed March 26, 1956 9 Sheets-Sheet 3

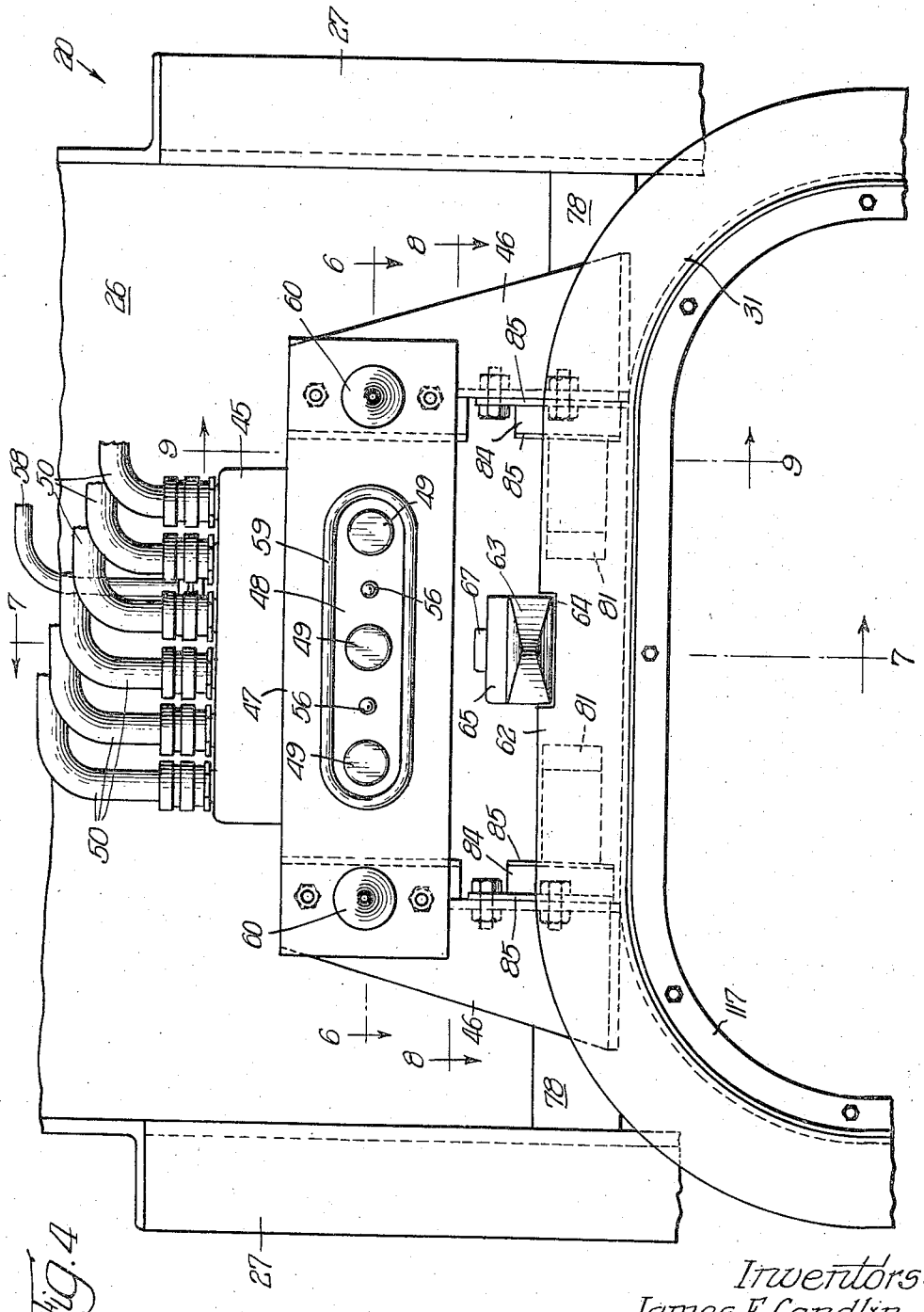


Fig. 4

Inventors:
James E. Candlin, Jr.,
John L. Swarner,
By Cromwell, Greist & Warden
Attys.

April 21, 1959 J. E. CANDLIN, JR., ET AL 2,883,069

AUTOMATIC POWER TRAINLINE CONNECTOR

Filed March 26, 1956

9 Sheets-Sheet 4

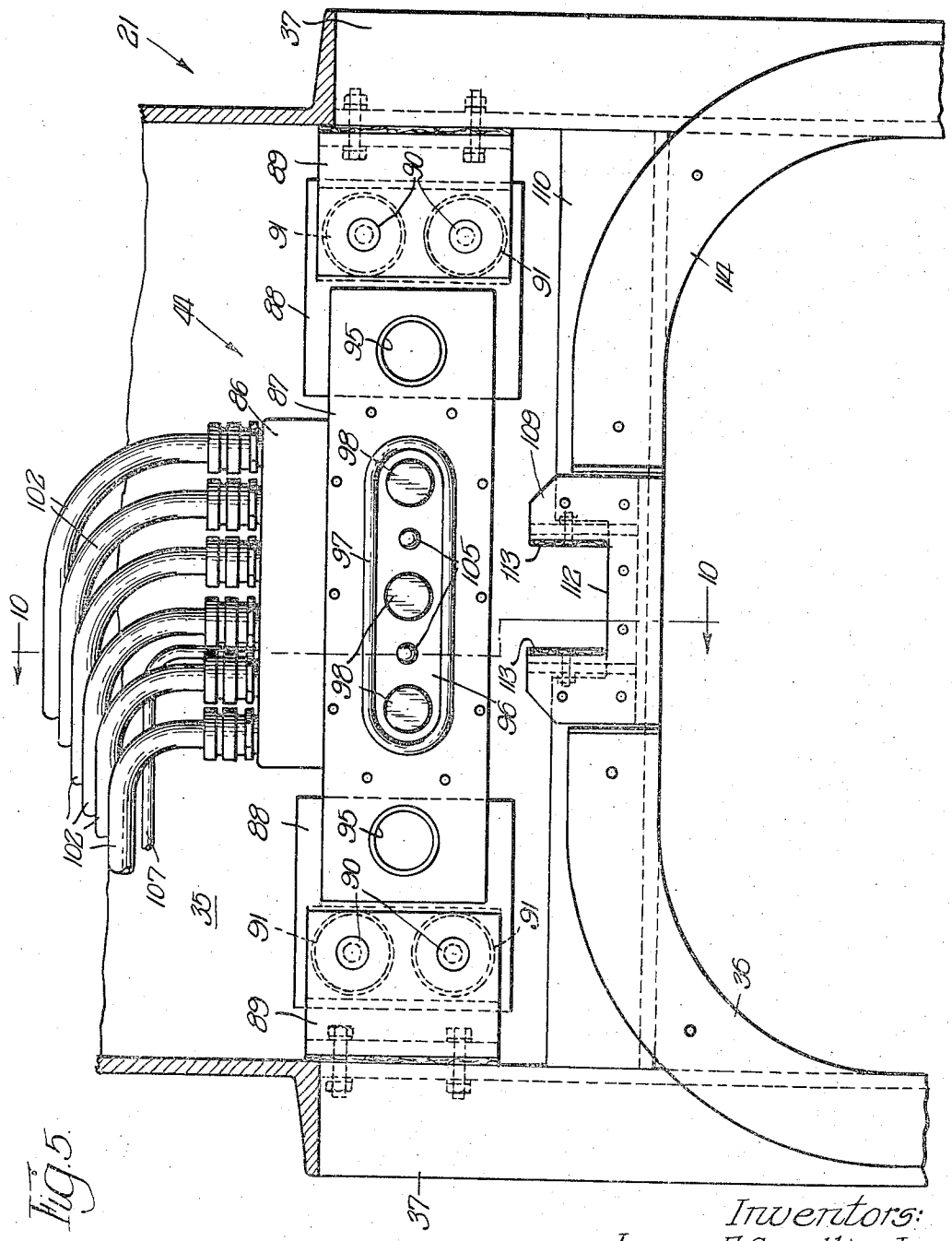


Fig. 5.

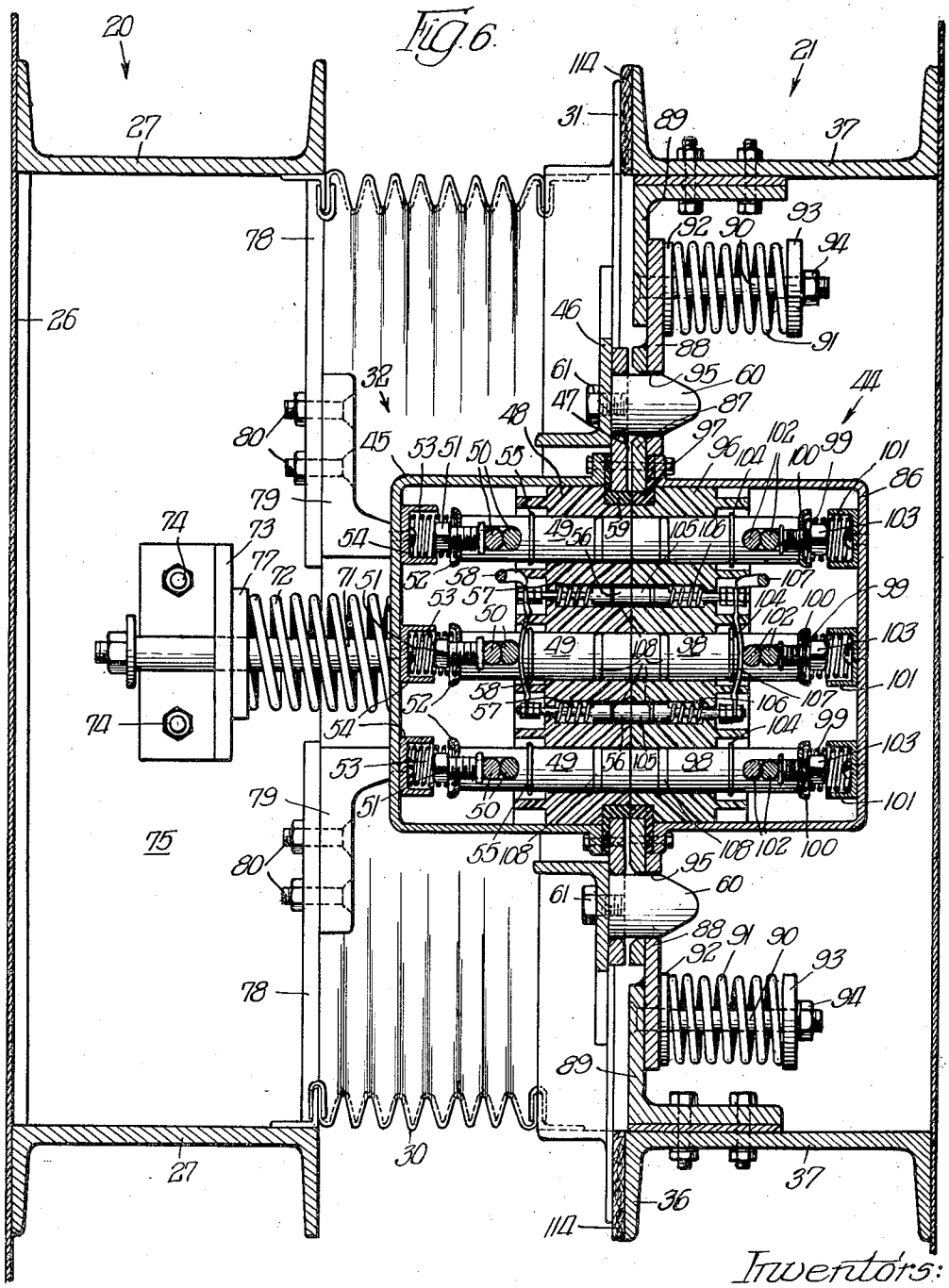
Inventors:
James E. Candlin, Jr.,
John L. Sivarner,
By Cromwell, Grist & Warden
Attys.

April 21, 1959 J. E. CANDLIN, JR., ET AL 2,883,069

AUTOMATIC POWER TRAINLINE CONNECTOR

Filed March 26, 1956 9 Sheets-Sheet 5

Fig. 6.



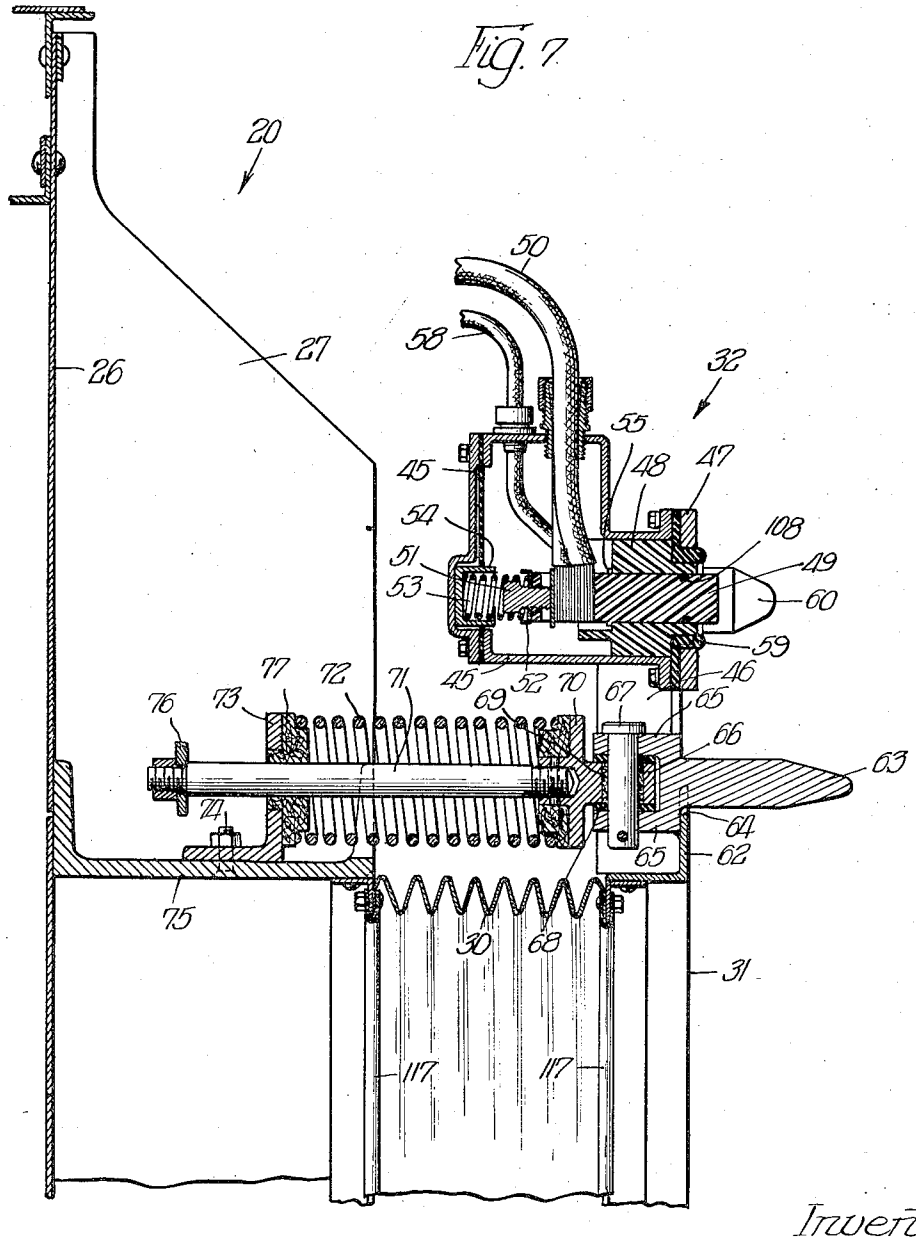
Inventors:
James E. Candlin, Jr.,
John L. Swarner,
By Cromwell, Grist & Warden
attys

April 21, 1959 J. E. CANDLIN, JR., ET AL 2,883,069

AUTOMATIC POWER TRAINLINE CONNECTOR

Filed March 26, 1956 9 Sheets-Sheet 6

Fig. 7



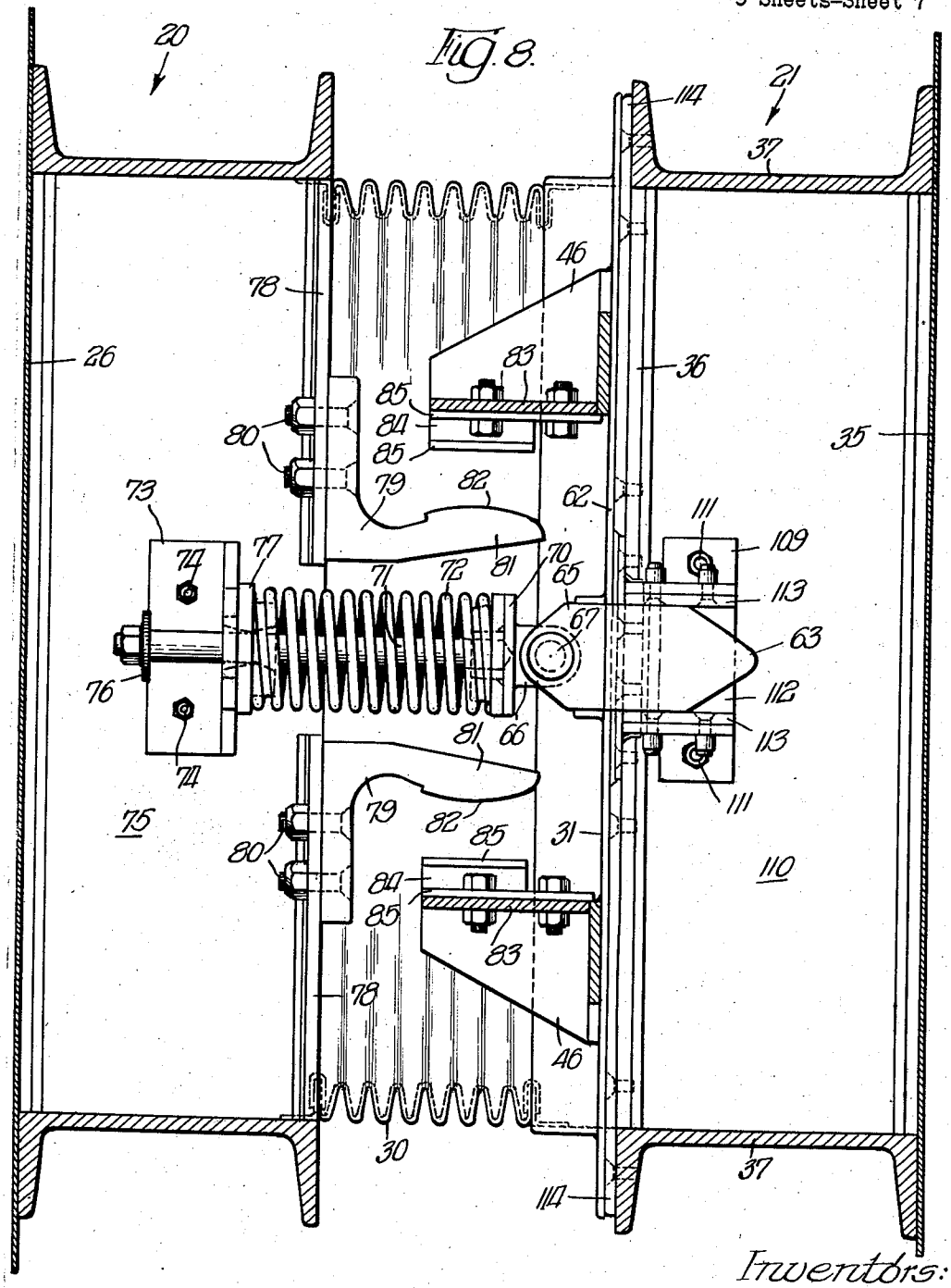
Inventors:
James E. Candlin, Jr.,
John L. Swarner,
By Cromwell, Greist & Warden
Attys.

April 21, 1959 J. E. CANDLIN, JR., ET AL 2,883,069

AUTOMATIC POWER TRAINLINE CONNECTOR

Filed March 26, 1956 9 Sheets-Sheet 7

Fig. 8.



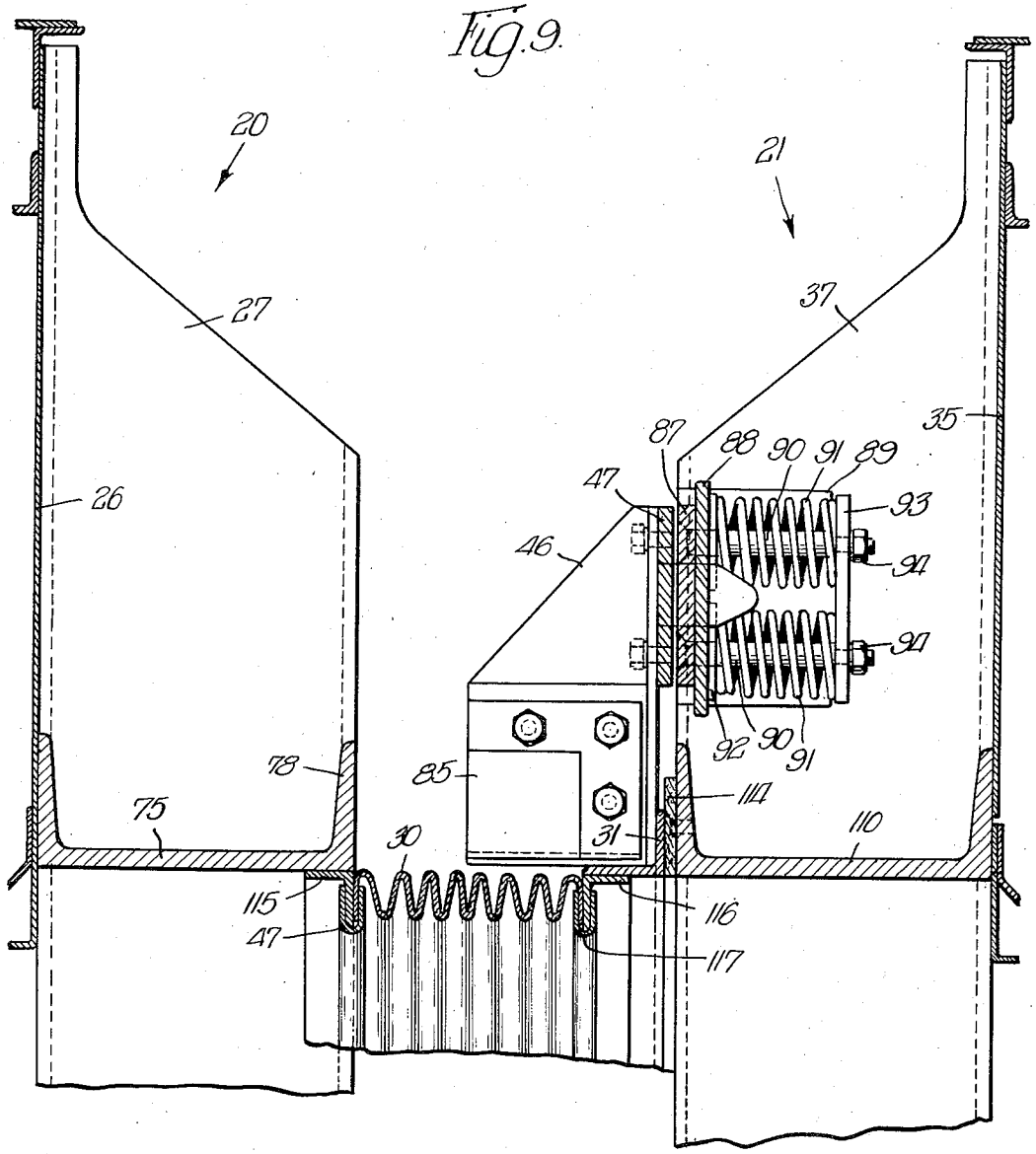
Inventors:
James E. Candlin, Jr.,
John L. Swarner,
By Cromwell, Greist & Warden
Attys

April 21, 1959 J. E. CANDLIN, JR., ET AL 2,883,069

AUTOMATIC POWER TRAINLINE CONNECTOR

Filed March 26, 1956 9 Sheets-Sheet 8

Fig. 9.



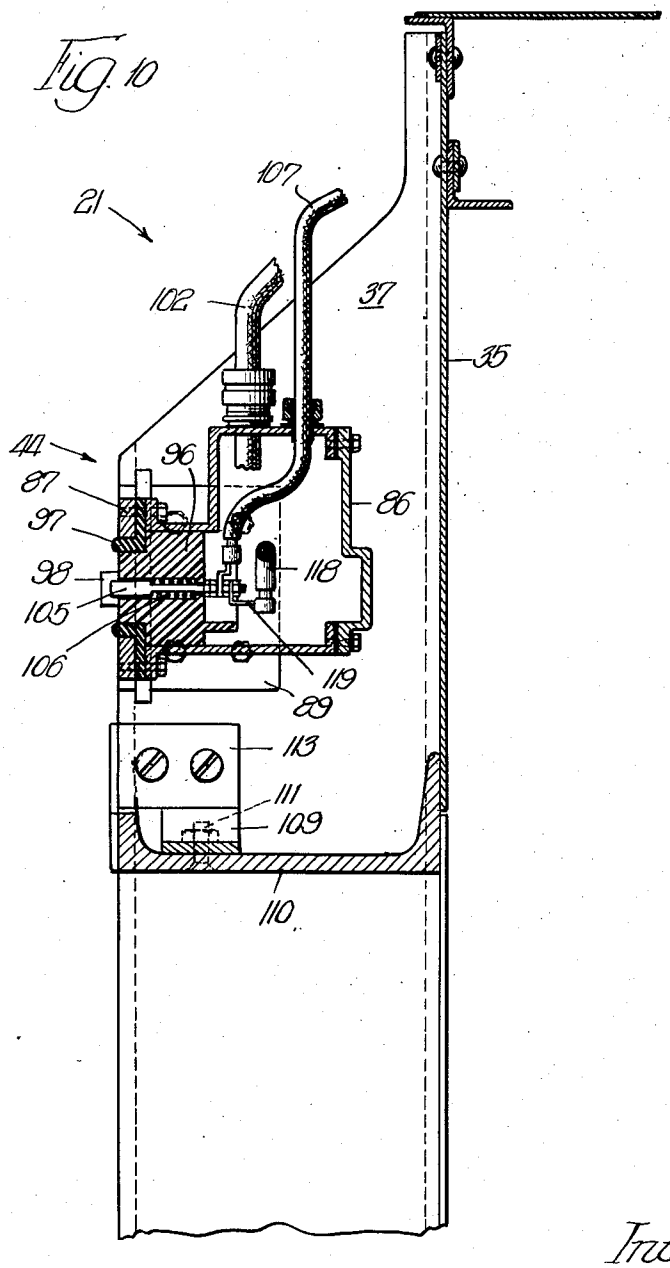
Inventors:
James E. Candlin, Jr.,
John L. Swarner,
By Cromwell, Grist & Warden
Attys

April 21, 1959 J. E. CANDLIN, JR., ET AL 2,883,069

AUTOMATIC POWER TRAINLINE CONNECTOR

Filed March 26, 1956 9 Sheets-Sheet 9

Fig. 10



Inventors.
James E. Candlin, Jr.,
John L. Swarner,
By Cromwell, Bristol & Warden
attys.

United States Patent Office

2,883,069

Patented Apr. 21, 1959

2,883,069

AUTOMATIC POWER TRAINLINE CONNECTOR

James E. Candlin, Jr., Lansing, Ill., and John L. Swarner, Valparaiso, Ind., assignors to Pullman-Standard Car Manufacturing Company, Chicago, Ill., a corporation of Delaware

Application March 26, 1956, Serial No. 573,584

16 Claims. (Cl. 213—1.3)

The present invention relates generally to new and improved forms of utility connectors particularly adapted for use in interconnecting utility lines between trailer-type vehicles as, for example, railway cars. More specifically, the present invention is directed to improved forms of mating power line connectors of the male-female variety which are provided with means which automatically center the connectors when moved toward one another into inter-engagement to allow the same to be automatically interconnected for the transmission of power from one vehicle to another. The improved connectors with their associated aligning means are particularly adapted for use within interconnected railway cars utilizing automatic car-couplers, as, for example, of the male and female variety, to allow adjacent cars to be automatically interconnected in coupled relation and simultaneously interconnected in utility or power transmitting relation.

In an effort to simplify train make-up procedures and reduce the need of skilled personnel, emphasis has been placed on the provision of self-coupling railway cars during the coupling of which it is necessary merely to move one end of a car toward an adjacent end of another car until automatic coupling of the cars occurs. The use of male-female coupling members in interconnecting railway cars has been found to meet the need for automatic coupling arrangements and efforts along these lines have been expanded in an attempt to provide automatic coupling of all inter-car elements such as the utility lines for power, air, air conditioning, etc.

It is an object of the present invention to provide new and improved forms of utility dispensing connectors which may be automatically interconnected by the use of means associated therewith without the necessity of utilizing specially trained personnel.

Another object is to provide an improved form of electrical connector having associated therewith cooperating male and female aligning means which bring about automatic interconnection of the separate units of the connector to allow the transmission of utilities, such as electrical power, from one vehicle to another in a safe and efficient manner.

Still another object is to provide improved forms of power line connectors which when carried by adjacent ends of interconnected vehicles provide for the automatic interconnection of the individual power lines of each vehicle, the automatic interconnection of the power line connectors being brought about by the provision of aligning means carried by each of the connectors which cooperatively function to first generally align the connectors and subsequently specifically align the connectors to obtain exacting interconnection between the same at all times without the necessity of relying on manual adjustment.

A further object in conjunction with the foregoing is to provide an automatically coupled inter-car power line connection which is particularly adapted for use in railway cars utilizing automatically coupled car interconnections, the power line connection being automatically

coupled in response to automatic inter-car coupling without the necessity of manual adjustment or implementation.

An additional object is to provide an improved form of inter-car power line connector which utilizes two units adapted for abutting engagement between yieldable power transmitting contacts carried thereby, each of the units being provided with cooperating power circuit control contacts which prevent arcing between or other improper functioning of the power contacts during the engagement or disengagement of the same upon the connecting or disconnecting of the units.

Still another object is to provide an improved form of interconnection between adjacent ends of railway cars, the interconnection including the use of mating car-coupling members, an inter-car passageway protective diaphragm and inter-car power line connectors, these elements cooperating with one another and being arranged with respect to one another to bring about automatic inter-car connection without the necessity of relying on manual adjustment or implementation.

Other objects not specifically set forth will become apparent from the following detailed description made in conjunction with the drawings wherein:

Fig. 1 is an end elevation of the male end of a single axle lightweight, high speed railway car having the male unit of the improved power line connector mounted thereon;

Fig. 2 is an end elevation of the female end of a single axle lightweight, high speed railway car having the female unit of the improved electrical connector mounted thereon;

Fig. 3 is an enlarged fragmentary view in side elevation of the male and female ends of the cars of Figs. 1 and 2 being moved into coupled relation;

Fig. 4 is an enlarged fragmentary elevation of the male end of the car of Fig. 1 illustrating the positioning of the male power line connector with respect thereto;

Fig. 5 is an enlarged fragmentary elevation of the female end of the railway car of Fig. 2 illustrating the positioning of the female power line connector with respect thereto;

Fig. 6 is a horizontal section of the male and female ends of interconnected cars similar to the cars shown in Figs. 1 and 2, illustrating the interconnection of the power line connectors carried thereby, the section of the power line connectors being taken generally along line 6—6 of Fig. 4;

Fig. 7 is a vertical section of the male connector taken generally along line 7—7 of Fig. 4;

Fig. 8 is a horizontal section of the interconnected ends of the cars of Figs. 1 and 2, this view being taken generally along line 8—8 of Fig. 4 illustrating the manner in which the male and female connectors are brought into and maintained in functional engagement;

Fig. 9 is a fragmentary vertical section of the interconnected ends of the cars of Figs. 1 and 2, illustrating the cooperative functioning of certain portions of the male and female power line connectors and being taken generally along line 9—9 of Fig. 4; and

Fig. 10 is a fragmentary vertical section of the female power line connector taken generally along line 10—10 of Fig. 5.

The accompanying drawings illustrate the use of the improved electrical connectors with single axle, lightweight, high speed railway cars utilizing mating car-coupling members for automatically interconnecting the same. The single axle railway cars illustrated are of the type which are provided with a wheel-supported end and a coupler-supported end, the coupler-supported end being

coupled with a wheel-supported end of an adjacent car in load-bearing support. It is with this type of railway car that the improved power line connectors are particularly adapted for use as the same are provided with means for automatically bringing about the interconnection of the power lines of each car simultaneously with the automatic coupling of the cars. While the following description will be limited to the use of the improved power line connectors with single axle railway cars of the type described, it should be understood that this specific use is merely illustrative and is not intended to be construed as limiting the scope of the present invention. The power line connectors are readily adapted for use with many different forms of interconnected trailer-type vehicles and a variety of uses of this nature are intended to fall within the scope of the present invention.

In Figs. 1–3, single axle, lightweight, high speed railway cars **20** and **21** are illustrated with respect to adjacent male and female ends of the same which carry the improved type of power line connecting units. Each of the cars **20** and **21** is standardized with respect to the coupling features to be described, the single axles of each of the cars being positioned near one of the ends thereof to provide a wheel-supported end, the remaining ends of the cars being coupler-supported by the use of male and female coupling members.

The car **20** is provided with a car body **22** supported at its nearest end as viewed by an axle carrying wheels **23** which, in turn, are provided with wheel flanges **24** aligned with the inner surfaces of spaced rails **25**. As shown in Figs. 1 and 3, the wheel-supported end of the car **20** is provided with a car body end sheet **26** which is provided with a central opening to define one end of an inter-car passageway extending between collision posts **27**. Below the car body **22** is a male coupling member **28** carrying an outwardly directed and outwardly tapered coupling pin **29**. Extending outwardly from the collision posts **27** is an inter-car passageway protective diaphragm **30** which is accordion pleated and formed from flexible material to allow the same to expand or contract in the known manner. The outermost end of the diaphragm **30** is provided with a diaphragm face plate or passageway frame **31** which moves with the diaphragm toward or away from the end sheet **26** of the car **20**. Carried above the diaphragm face plate **31** is a male utility connecting unit **32** and, as will subsequently be described, this unit is movable with the diaphragm face plate **31**. The male coupler **28**, as shown in Fig. 1, has attached to each of its ends a suitable axle steering mechanism **33** having parts thereof interconnected with the car body **22** and the axle carrying the wheels **23** to steer the same during the negotiation of a curve by the car **20**. The male coupler **28** is pivotally attached to the car **20** to allow the same to move relative with respect to the car **20** in response to relative movement beween interconnected cars as will be subsequently described. The axle steering mechanism **33** is arranged to translate the movement of the male coupler **28** with respect to the car **20** into steering forces applied to the axle carrying the wheels **23** to steer the wheels into and out of curves in the roadbed.

In Figs. 2 and 3, the coupler-supported end of car **21** is shown, it being understood that the remaining end of the car is the same as the wheel-supported end of the car **20**. The illustrated end of the car **21** is adapted for coupling with the wheel-supported end of the car **20** in load-supported relation therewith. The car **21** is provided with a car body **34** having an end sheet **35** defining a passageway opening which is surrounded by passageway frame **36** attached to collision posts **37**. Below the passageway frame **36** is positioned a female coupling member **38** which is provided with a centrally located female coupling recess **39** adapted to receive the male coupling pin **29** of the car **21**. The single axle **40** of the car **21** is positioned at its furthermost end as viewed and carries the wheels **41**. Wheel flanges **42** cooperate with the rails **25** in the known manner. The illustrated female end of the car **21** is provided with retractable dolly wheels **43** which may be lowered and brought into contact with the rails **25** to support the coupler-supported end of the car **21** when the car is detached from load-bearing support with the male end of the adjacent car **20**. Intermediate the collision posts **37** above the passageway frame **36** is positioned a female utility connecting unit **44**.

Both of the cars **20** and **21** are of standardized design in that each is provided with a male wheel-supported end, as shown in Fig. 1, and a female coupler-supported end, as shown in Fig. 2. As a result, interconnecting the cars **20** and **21** the male wheel-supported end of the car **20** is coupled with the female coupler-supported end of the car **21** in a manner which will subsequently be described in connection with Fig. 3.

Referring in particular to Figs. 4, 6 and 7, the male power line connector **32** includes a housing **45** which is mounted by brackets **46** to the top outer portion of the diaphragm face plate **31**. The housing **45** is provided with a front plate **47** which is generally aligned in the same vertical plane as the front surface of the diaphragm face plate **31**. The front plate **47** is centrally apertured and the housing **45** adjacent the central aperture is provided with a power contact mounting portion **48** formed from suitable insulating material, such as a plastic, which is provided with a series of laterally spaced apertures receiving therein yieldably mounted power contacts **49** in the form of pins which extend outwardly beyond the front surface of the plate **47**. Any number of contacts **49** may be carried by the housing **45** depending on the type of power transmitting line utilized in the car **20**. Each of the contacts **49** has associated therewith cables **50** clamped thereto by screws **51** and extending outwardly of the top of the housing **45** into connection with the electrical system of the car **20**. The inner ends of the contacts **49** are provided with cup-shaped members **52** which confine one end of a spring **53** carried within a spring-retaining member **54** attached to the inner surface of the rear wall of the housing **45**. As a result, the contacts **49** are constantly urged outwardly from the front surface of the plate **47** and each is provided with retaining rings **55** which abut the rear face of the insulation block **48** to limit the extent of protrusion outwardly of the front plate **47**.

Intermediate the contacts **49** and carried within the insulating block **48** are circuit-controlling contacts **56** which are spring urged outwardly of the front face of the plate **47** by springs **57** suitably retained within the contact-receiving apertures in the insulation block **48**. The circuit-controlling contacts **56** are provided with rearward extensions of reduced diameter which are suitably attached to electrical leads **58** which extend out of the housing **45** into association with a circuit-controlling element of known type. The central aperture in the face plate **47** surrounding the contacts **49** and **56** is enclosed by a resilient insulating ring **59** which serves as a seal in a manner to be described to completely enclose contacts **49** and **56** when the same are placed into operative abutment with similar contacts carried by the female connector **44**.

The endmost portions of the front plate **47** are provided with outwardly projecting alignment pins **60** which are provided with outwardly tapered ends for centering purposes. As shown in Fig. 6, the housing **45** carried by the face plate **47** is supported by the brackets **46** by screws **61**.

Referring in particular to Figs. 4 and 6–8, the top central portion of the diaphragm face plate **31** is provided with an upstanding flange **62** which carries centrally thereof an outwardly projecting alignment spear **63** fixedly attached thereto in a groove-like portion **64**. The rearmost portion of the spear **63** is provided with spaced ears **65** which receive therebetween an eye **66** carrying an aperture which is aligned with apertures in the ears **65** receiving a pin **67** therethrough. Intermediate the

opposed surfaces of the eye 66 and ears 65 are rubber bushing pads 68 and the pin 67 is provided with a rubber bushing 69 within the aperture of the eye 66.

The eye 66 is integral with a rod-retaining end portion 70 which centrally receives a threaded end of a rod 71 and which is provided with a radially flanged portion which serves as a retaining end of a spring 72. The remaining end of the spring 72 is retained by an upstanding bracket 73 attached by bolts 74 to a door frame header 75 which extends between the collision posts 27 and which is further attached to the end sheet 26. The upstanding flange portion of the bracket 73 is centrally apertured to receive therethrough the rod 71 and the remaining end of the rod 71 threadedly receives an abutment collar 76 which is adapted to abut with the rearmost surface of the upstanding flange portion of the bracket 73 when the spring 72 is allowed to move the spear 63 and associated diaphragm face plate 31 forwardly to an unlimited extent.

As particularly illustrated in Figs. 7 and 8, the aperture in the upstanding flange portion of the bracket 73 retains a bushing 77 of fiberized material having wear-resistant and yieldable properties which surrounds the rod 71 passing therethrough. The aperture in the bushing 77 is bevelled outwardly toward its ends to provide sufficient clearance between the same and the rod 71 to allow the latter to move laterally to a limited extent with respect to the bracket 73. As a result, the alignment spear 63 and diaphragm face plate 31 may move relative to the car body 22 when these elements are interconnected with the female end of the car 21 in response to movement of the car 21 relative to the car 20. The flexibility of the diaphragm 30 allows the face plate 31 to move relative to the car body 22 and the bushing 77 allows the alignment spear 63 to maintain its operative interconnection with the elements associated with the rod 71 while moving with the diaphragm face plate 31.

The door frame header 75 is provided with outwardly positioned upstanding flanges 78 which have mounted thereto abutment members 79 positioned on either side of the spring 72. The abutment members 79 are attached to the flanges 78 by bolts 80 and are provided with forwardly directed abutment portions 81 having convex outer surfaces 82. The brackets 46 carry rearwardly directed flanges 83 which have bolted thereto abutment stops formed from rubber cushions 84 bonded to inner and outer rigid plates 85. The convex surfaces 82 are adapted to abut the outer rigid plates 85 to limit the extent of relative body roll between the cars 20 and 21 when the same are in coupled relation thereby protecting the elements interconnecting the cars from damage. The inner rubber cushion 84 on each of the abutment stop members acts to cushion the force of contact between the abutting elements.

Referring in particular to Figs. 5, 6, 9 and 10, the female connector 44 is provided with a housing 86 suitably attached to a face plate 87 which in turn at its outermost edges is attached to mounting plates 88. Extending inwardly from the inner surfaces of the collision posts 37 are mounting brackets 89 each of which carry vertically spaced rods 90 extending through apertures in the end plates 88 and resiliently fixing the same with respect to the brackets 89 by springs 91. The foremost ends of each pair of springs 91 are held by a retaining means 92 against the rear face of the end plates 88 and the rearmost ends of the springs 91 are held by retaining means 93 urged against bolts 94 threadedly received on the ends of the rods 90. As shown in Figs. 5 and 9, the end plates 88 are resiliently urged against the rear surfaces of the inwardly directed portions of the brackets 89 by a pair of springs 91 and the retaining members 92 and 93 position the rods 90 and springs 91 in a vertical plane with respect to one another. As a result of the spring mounting of the female connector 44, the same is yieldable with respect to contact with the aligning members

of the male connector 32 in a manner to be described. The end plates 88 and front plates 87 are provided with aligned apertures 95 which receive therethrough the aligning pins 60 as particularly shown in Fig. 6.

The housing 86 of the female connector 44 has positioned therein an insulating contact mounting block 96 similar to the block 48 which is aligned with a central aperture in the front plate 87 as defined by an insulating and sealing ring 97. The block 96 is provided with a plurality of apertures through which extend power line contacts 98 which project forwardly from the front face of the female connector 44 and are yieldably mounted therein by springs 99 having their ends retained in cup-like members 100 and 101, the latter members being retained by the rear wall of the housing 86. The innermost ends of the contacts 98 are connected to electrical leads 102 clamped in place by screws 103. The contacts 98 are further provided with rings 104 which are adapted to abut the rear face of the insulating block 96 when the contacts 98 protrude outwardly of the front face of the plate 87 to their fullest extent.

Intermediate the contacts 98 and positioned within apertures carried by the insulating block 96 are circuit-control contacts 105 which are urged outwardly of the front surface of the plate 87 by springs 106 suitably retained within the insulation block 96. The rearmost ends of the contacts 105 are attached to electrical leads 107 which extend to a circuit breaker of a known type within the car 21.

As illustrated in Fig. 10, the power dispensing contacts 98 extend outwardly of the front surface of the female connector 44 a distance greater than the circuit-controlling contacts 105 when the same are in their unconnected positions. Similarly, the power contacts 49 of the male connector 32 extend outwardly from the front of the connector 32 a distance greater than the circuit-controlling contacts 56 when unconnected. As shown in Fig. 6, the male connector 45 and female connector 44 are in their interconnected positions and the outer ends of the power transmitting contacts 49 and 98 are in abutting relation forcing one another to recede into their respective housings against the resiliency of their spring mounts. The circuit-controlling contacts 56 and 105 are similarly shown in abutting relation in Fig. 6 and all of the contacts 49, 56, 98 and 105 are freely movable in the apertures carrying the same in their respective insulation blocks 48 and 96. To seal the interior of the housings 45 and 86 from the weather, each of the contacts are provided with sealing O-rings 108 which engage the inner surfaces of the apertures carrying the contacts while allowing the same to freely move therein.

As particularly shown in Figs. 5, 8 and 10, the top horizontally extending portion of the passageway frame 36 is provided with a centrally located female aligning member 109 partially carried by a horizontally extending door header 110 being attached thereto by bolts 111. The female aligning member 109 defines an upwardly opening U-shaped groove 112, the vertical side walls of which are provided with a fabric wear-resistant lining 113 suitably clamped to the inner surfaces thereof. As particularly shown in Fig. 8, the aligning spear 63 is received within the groove 112 and its side edges are maintained in close relation with the side wall linings 113. Referring still to Fig. 8, the outer surfaces of the radially flanged portions of the collision posts 37 are provided with fabric linings 114 which abut the outer surface of the diaphragm face plate 31 when the same is brought into engagement with the female end of the car 21. The linings 113 and 114 serve to prevent the transmission of operational noises into the car body 34 of the car 21 when the same is interconnected with the car 20. These linings not only function from an acoustic standpoint but further provide the interconnections with weather-proofing.

As shown in Fig. 9, an end margin of the diaphragm

30 is attached to a flange member 115 carried by the collision posts 27 and door header 75 and the remaining end margin is attached to a flange member 116 carried by the diaphragm face plate 31. The margins of the diaphragm 30 are attached by U-shaped clamping members 117. As a result, the diaphragm 30 is totally carried by the male end of the car 20 and is merely moved into engagement with the door frame 36 of the female end of the car 21. As further illustrated in Fig. 10, the circuit-controlling contacts 105 when moved rearwardly upon abutting engagement with the circuit-control contacts 56 of the male connector 32 operate a circuit breaker control 118 through a linkage 119 for a purpose to be described.

In describing the operation of the above, particular reference is made to Figs. 3, 6, 8 and 9. Assuming that the male end of the car 20 is advanced toward the female end of the car 21 for completely automatic coupling therewith, the tapering of the male coupling pin 29 and its pivotal connection with the car 20 will allow the same to center itself with respect to the female coupling aperture 39 of the female coupling member 38. As particularly illustrated in Fig. 3, the length of the male coupling pin 29 is such that it will contact the female coupling member 38 prior to contact between any of the other interconnecting parts of the adjacent ends of the cars 20 and 21. The diaphragm 30, being solely carried by the male end of the car 21, will have its bottom portion, which is suitably attached to the male coupling member 28, generally centered with respect to the bottom portion of the passageway frame 36 of the car 21 by the automatic alignment of the male coupling pin 29 with the female coupling aperture 39. The diaphragm 30, by reason of the resilient biasing of the spring 72 and the permanent interconnection between the diaphragm face plate 31 and the aligning spear 63, is urged outwardly away from the male end of the car 20 in fully extended condition. Other suitable resilient means may be supplied in different locations about the diaphragm 30 to urge the diaphragm face plate 31 away from the end of the car 20 to establish full expansion of the diaphragm 30 and maintain the same during automatic coupling of the cars 20 and 21.

Following alignment of the lower portion of the diaphragm face plate 31 with respect to the passageway frame 36, the aligning spear 63 comes into contact with the walls of the U-shaped groove 112 associated with the top portion of the passageway frame 36 of the car 21. The taper of the aligning spear 63 causes the same to automatically center itself with respect to the U-shaped groove 112 by reason of its pivot point defined by the pin 67 and, due to its attachment with the diaphragm face plate 31, the upper portion of the same will become aligned with the passageway frame 36. As a result, the diaphragm and its associated face plate 31 is automatically aligned with the passageway opening of the car 21 as defined by the passageway frame 36 and complete enclosing of the intercar passageway will automatically be brought about.

Upon completed alignment of the diaphragm face plate 31 with the passageway frame 36, the male connector 32 is brought into general alignment with the female connector 44 and completes the self-centering action by introduction of the aligning pins 60 in the female aligning apertures 95 carried by the face plate 87 of the female connector 44. The aligning pins 60 are tapered outwardly in an inwardly direction and this taper promotes a self-centering action when the pins are brought into general engagement with the edges of the apertures 95. The female connector 44 is yieldably mounted by the springs 91 and the yieldable nature of this mounting further aids in attaining proper alignment of the pins 60 within the apertures 95.

As will be particularly noted in Fig. 7, the alignment pins 60 project outwardly of the face plate 47 of the male connector 32 a distance greater than the power transmitting contacts 49. Still further, as particularly noted in Fig. 10, the power transmitting contacts 98 project outwardly of the face plate 87 of the female connector 44 a distance greater than the circuit-controlling contacts 105. The same is true of the male connector 32 in that the power transmitting contacts 49 project outwardly of the face plate 47 a distance greater than the circuit-controlling contacts 56. As a result, the end faces of the power transmitting contacts 49 and 98 will come into yielding abutting engagement prior to yielding abutting engagement between oppositely positioned circuit-controlling contacts 56 and 105. Consequently, full and complete functional contact will be made between the main power transmitting contacts prior to energization of the same thereby preventing arcing between the contacts as they enter into engagement with one another. The circuit-controlling contacts 56 and 105 must enter into yielding abutting engagement before the circuit breaker (not shown) operated thereby completes the main power connection to allow electrical energy to flow through the engaged power transmitting contacts 49 and 98 between the cars 20 and 21. The circuit-controlling contacts 56 and 105 are part of an electrically energized circuit which controls the operation of a magnetic contactor controlling the making and breaking of the main circuit. This controlling circuit must be completely intact before power is passed through the main trainline and, consequently, arcing prior to full and complete functional contact between the power line connectors will not occur.

In disconnecting the cars 20 and 21 and, as a result, disengaging the male and female connectors 32 and 44, the circuit-control contacts 56 and 105 will become disengaged prior to the breaking of the abutting engagement between the power transmitting contacts 49 and 98. Upon disengagement of the circuit-control contacts the main trainline becomes de-energized and disengagement of the main power transmitting contacts 49 and 98 will not result in arcing. Consequently, the electrical connection between adjacent cars may be made completely automatically without the necessity of relying on manual adjustment or implementation and further be brought about in a safe and efficient manner eliminating the commonly experienced dangers of interconnecting lines carrying high voltages.

During operation of the interconnected cars 20 and 21 the diaphragm face plate 31 will be continuously urged into engagement with the seal 114 carried by the outer surface of the passageway frame 36. As previously described the spring 72 is capable of continuously holding the upper portion of the diaphragm face plate 31 into engagement with the passageway frame 36 and the provision of other suitably positioned biasing or resilient means will operate to maintain tight sealing engagement between these elements at all times. If considered desirable, the abutting diaphragm face plate 31 and passageway frame 36 may be clamped in any suitable manner. Upon relative movement between the cars 20 and 21 during operation of the same, the diaphragm face plate 31 will, along with the male coupler 28 and male power line connector 32, follow the movement of the car 21. This is allowed by reason of the complete mounting of the male connector 32 on the diaphragm face plate 31 and the provision of slack in the power lines 50 and 58 leading from the car body 22 to the male connector 32. The only interconnection existing between the diaphragm face plate 31 and the elements fixed with respect to the car body 22 is that extending through the positioning rod 71 of the alignment spear 63. As previously described, the mounting plate 70 which carries the eye 66 and rod 71 is free to move relative to the mounting bracket 73 by reason of the fabric bushing 77 and the enlarged aperture carried thereby through which the rod 71 extends. Consequently, the elements inter-

connecting the bracket 73 with the aligning spear 63 may move relative to the bracket 73 to an adequate extent in any direction and follow movement of the car 21 relative to the car 20.

To prevent excessive lateral movement between the cars 20 and 21 such as that caused by the rolling of one car relative to another so that the interconnecting elements of the power line connectors will not be damaged or disconnected thereby interrupting service between the cars, the abutment means 79 and abutment plates carried by the flanges 83 are provided. Referring particularly to Fig. 8, the abutment brackets 79 are mounted to either side of the spring-carrying rod 71 and are fixed with respect to the car 20 so as to move therewith relative to the car 21. The abutment stops formed by the laminated plates 85 and rubber cushion 84 are positioned outwardly of each of the abutment flanges 81 and fixedly carried by the car 21 to move therewith relative to the car 20. As a result, upon excessive lateral roll between the cars 20 and 21 one of the curved outer surfaces 82 of the abutment flanges 81 will contact a yieldably mounted rigid plate 85 and ultimately limit the lateral relative movement occurring between the cars 20 and 21. Consequently, the rod 71 may not be moved laterally with respect to its mounting brackets 73 to an extent that damage is caused to the interconnected elements thereof.

As a result of the use of the automatically coupled power line connectors described above, the dangers normally accompanying the manual interconnection of high voltage train-lines is eliminated and the need for skilled personnel in bringing about such an interconnection is no longer necessary. A train consist may be powered from a central source such as a locomotive and any number of cars of the type described may be automatically coupled to the same in such a manner that each of the newly added cars is immediately placed into complete operation with respect to the total consist and such operation is automatically accomplished.

While the structural features and operational use of the automatic power line connectors of the present invention have been described in connection with specially designed single axle, lightweight railway cars adapted for coupling by the use of male and female coupling members in load-bearing relation, it should be understood that the improved electrical connectors may be advantageously used with any form of trailer-type vehicle where it is desired to interconnect the electrical system of one vehicle with another. The alignment spear 63 constitutes a primary aligning means which promotes general alignment between the connectors and the aligning pins 60 constitute secondary aligning means which promotes specific alignment between the connectors just immediately prior to power transmission abutting engagement between the contacts carried thereby. In order to make full use of the advantages of the connectors and the aligning means associated therewith, it is necessary merely to advance one connector toward another or advance the connectors toward one another both at the same time in such a manner that general and specific alignment is brought about to insure proper power transmitting interconnection between the same.

Obviously many modifications and variations of the invention as hereinbefore set forth may be made without departing from the spirit and scope thereof, and therefore only such limitations should be imposed as are indicated in the appended claims.

We claim:

1. Utility connectors adapted for use with trailer-type vehicles to interconnect utility services therebetween, said connectors having primary and secondary aligning means structurally related thereto and automatically aligning said connectors in operative interconnected relation, said primary aligning means including mating means for initial contact with cooperating mating means providing general alignment of said connectors, said secondary aligning means including mating means for subsequent contact with cooperating mating means providing specific alignment of said connectors, each of said connectors having contacting yieldable abutment means dispensing utilities therebetween, one of said connectors being provided with male mating members, the other of said connectors being provided with female mating members, said male and female mating members constituting said primary and secondary aligning means, said yieldable abutment means being substantially flat end surface contacts projecting outwardly of front plates of each of said connectors and being spring mounted with respect thereto.

2. Utility connectors adapted for use with trailer-type vehicles to interconnect utility services therebetween, said connectors having primary and secondary aligning means structurally related thereto and automatically aligning said connectors in operative interconnected relation, said primary aligning means including mating means for initial contact with cooperating mating means providing general alignment of said connectors, said secondary aligning means including mating means for subsequent contact with cooperating mating means providing specific alignment of said connectors, each of said connectors having contacting yieldable abutment means dispensing utilities therebetween, one of said connectors being provided with male mating members, the other of said connectors being provided with female mating members, said male and female mating members constituting said primary and secondary aligning means, said yieldable abutment means being substantially flat end surface contacts projecting outwardly of front plates of each of said connectors and being spring mounted with respect thereto, the male and female members of said secondary aligning means being carried by said plates in spaced relation near the ends thereof, said contacts being positioned intermediate the secondary aligning means of each plate.

3. Utility connectors adapted for use with trailer-type vehicles to interconnect utility services therebetween, said connectors having primary and secondary aligning means structurally related thereto and automatically aligning said connectors in operative interconnected relation, said primary aligning means including mating means for initial contact with cooperating mating means providing general alignment of said connectors, said secondary aligning means including mating means for subsequent contact with cooperating mating means providing specific alignment of said connectors, each of said connectors having contacting yieldable abutment means dispensing utilities therebetween, one of said connectors being provided with male mating members, the other of said connectors being provided with female mating members, said male and female mating members constituting said primary and secondary aligning means, said yieldable abutment means being substantially flat end surface contacts projecting outwardly of front plates of each of said connectors and being spring mounted with respect thereto, the male and female members of said secondary aligning means being carried by said plate in spaced relation near the ends thereof, said contacts being positioned intermediate the secondary aligning means of each plate, and a sealing member carried by said plates and sealing said contacts in the functional interconnected relation of said connectors.

4. Utility connectors adapted for use with trailer-type vehicles to interconnect utility services therebetween, said connectors having primary and secondary aligning means structurally related thereto and automatically aligning said connectors in operative interconnected relation, said primary aligning means including mating means for initial contact with cooperating mating means providing general alignment of said connectors, said secondary aligning means including mating means for subsequent contact with cooperating mating means providing specific alignment of said connectors, each of said connectors

having contacting yieldable abutment means dispensing utilities therebetween, one of said connectors being provided with male mating members, the other of said connectors being provided with female mating members, said male and female mating members constituting said primary and secondary aligning means, said yieldable abutment means being substantially flat end surface contacts projecting outwardly of front plates of each of said connectors and being spring mounted with respect thereto, the male and female members of said secondary alignment means being carried by said plates in spaced relation near the ends thereof, said contacts being positioned intermediate the secondary alignment means of each plate, the plate carrying said female members being yieldably mounted to cooperate with the male members of said secondary aligning means to provide specific alignment of said connectors, and a sealing member carried by said plates and sealing said contacts in the functional interconnected relation of said connectors.

5. A pair of utility connectors adapted for use with trailer-type vehicles to interconnect utility services therebetween, each of said connectors being provided with yieldable utility dispensing contacts in abutment with opposed dispensing contacts with said connectors in face-to-face engagment, primary and secondary aligning means structurally related with said connectors and automatically aligning said connectors in operative interconnected relation, said primary aligning means including mating means for initial contact with cooperating mating means providing general alignment of said connectors, said secondary aligning means including mating means for subsequent contact with cooperating mating means providing specific alignment of said connectors, and further abutment means carried by each of said connectors in contact with one another subsequent to abutment between said dispensing contacts and arranged for disengagement from one another prior to disengagement of said dispensing contacts, said further abutment means controlling the flow of media through which the utility services are provided through said dispensing contacts between said vehicles.

6. A pair of utility connectors adapted for use with trailer-type vehicles to interconnect utility services therebetween, each of said connectors being provided with yieldable utility dispensing contacts in abutment with opposed dispensing contacts with said connectors in face-to-face engagement, primary and secondary aligning means structurally related with said connectors and automatically aligning said connectors in operative interconnected relation, said primary aligning means including mating means for initial contact with cooperating mating means providing general alignment of said connectors, said secondary aligning means including mating means for subsequent contact with cooperating mating means providing specific alignment of said connectors, one of said connectors being provided with male mating members, the other of said connectors being provided with female mating members, said male and female mating members constituting said primary and secondary aligning means, said dispensing contacts having substantially flat end surfaces projecting outwardly of front plates of each of said connectors and being spring mounted with respect thereto, and further abutment means carried by each of said connectors in contact with one another subsequent to abutment between said dispensing contacts and arranged for disengagement from one another prior to disengagement of said dispensing contacts, said further abutment means controlling the flow of media through which the utility services are provided through said dispensing contacts between said vehicles.

7. A pair of utility connectors adapted for use with trailer-type vehicles to interconnect utility services therebetween, each of said connectors being provided with yieldable utility dispensing contacts in abutment with opposed dispensing contacts with said connectors in face-to-face engagement, primary and secondary aligning means structurally related with said connectors and automatically aligning said connectors in operative interconnected relation, said primary aligning means including mating means for initial contact with cooperating mating means providing general alignment of said connectors, said secondary aligning means including mating means for subsequent contact with cooperating mating means providing specific alignment of said connectors, one of said connectors being provided with male mating members, the other of said connectors being provided with female mating members, said male and female mating members constituting said primary and secondary aligning means, said dispensing contacts having substantially flat end surfaces projecting outwardly of front plates of each of said connectors and being spring mounted with respect thereto, the male and female members of said secondary aligning means being carried by said plates in spaced relation near the ends thereof, and further abutment means carried by each of said connectors in contact with one another subsequent to abutment between said dispensing contacts and arranged for disengagement from one another prior to disengagement of said dispensing contacts, said further abutment means controlling the flow of media through which the utility services are provided through said dispensing contacts between said vehicles, said dispensing contacts and said further abutment means being positioned intermediate the secondary aligning means of each plate.

8. A pair of utility connectors adapted for use with trailer-type vehicles to interconnect utility services therebetween, each of said connectors being provided with yieldable utility dispensing contacts in abutment with opposed dispensing contacts with said connectors in face-to-face engagement, primary and secondary aligning means structurally related with said connectors and automatically aligning said connectors in operative interconnected relation, said primary aligning means including mating means for initial contact with cooperating mating means providing general alignment of said connectors, said secondary aligning means including mating means for subsequent contact with cooperating mating means providing specific alignment of said connectors, one of said connectors being provided with male mating members, the other of said connectors being provided with female mating members, said male and female mating members constituting said primary and secondary aligning means, said dispensing contacts having substantially flat end surfaces projecting outwardly of front plates of each of said connectors and being spring mounted with respect thereto, the male and female members of said secondary aligning means being carried by said plates in spaced relation near the ends thereof, further abutment means carried by each of said connectors in contact with one another subsequent to abutment between said dispensing contacts and arranged for disengagement from one another prior to disengagement of said dispensing contacts, said further abutment means controlling the flow of media through which the utility services are provided through said dispensing contacts between said vehicles, said dispensing contacts and said further abutment means being positioned intermediate the secondary alignment means of each plate, and a sealing member carried by said plates and sealing said dispensing contacts and said further abutment means in the functional interconnected relation of said connectors.

9. A pair of utility connectors adapted for use with trailer-type vehicles to interconnect utility services therebetween, each of said connectors being provided with yieldable utility dispensing contacts in abutment with opposed dispensing contacts with said connectors in face-to-face engagement, primary and secondary aligning means structurally related with said connectors and automatically aligning said connectors in operative interconnected relation, said primary aligning means including mating means for initial contact with cooperating mating means

providing general alignment of said connectors, said secondary aligning means including mating means for subsequent contact with cooperating mating means providing specific alignment of said connectors, one of said connectors being provided with male mating members, the other of said connectors being provided with female mating members, said male and female mating members constituting said primary and secondary aligning means, said dispensing contacts having substantially flat end surfaces projecting outwardly of front plates of each of said connectors and being spring mounted with respect thereto, the male and female members of said secondary aligning means being carried by said plates in spaced relation near the ends thereof, further abutment means carried by each of said connectors in contact with one another subsequent to abutment between said dispensing contacts and arranged for disengagement from one another prior to disengagement of said dispensing contacts, said further abutment means controlling the flow of media through which the utility services are provided through said dispensing contacts between said vehicles, said dispensing contacts and said further abutment means being positioned intermediate the secondary aligning means of each plate, the plate carrying said female members being yieldably mounted to cooperate with the male members of said secondary alignment means to provide specific alignment of said connectors, and a sealing member carried by said plates and sealing said dispensing contacts and said further abutment means in the functional interconnected relation of said connectors.

10. A pair of railway cars having adjacent ends interconnected, one of said ends being provided with a male power line connector and the other of said ends being provided with a female power line connector interconnected with one another, the interconnection of said cars being further established by mating car-coupling members cooperating with one another to provide self-coupling of the cars when said adjacent ends are brought together, and an inter-car passageway protective diaphragm carried by said one end and expanded toward said other end, said diaphragm including a movable free end defined by a passageway frame, said male connector being carried by said frame above the top thereof and movable therewith toward said other end, said female connector being carried by said other end and positioned to intercept said male connector for interconnection therewith when said adjacent ends are brought together, said connectors each being provided with front plates carrying spring mounted power contacts projecting outwardly therefrom in abutting engagement to transmit power between said cars, engaged spring mounted circuit control contacts carried by said plates, said control contacts projecting outwardly of said plates a distance less than said power contacts to be brought into abutting engagement subsequent to the engaging of said power contacts and out of abutting engagement prior to disengagement of said power contacts, said male and female connectors including self-aligning means to provide self-interconnection of the same simultaneous with the self-coupling of said cars, said aligning means including a male primary aligning member carried by said frame cooperating with a female primary aligning member carried by said other end to generally align said frame and said male connector carried thereby with said other end and said female connector, and secondary male aligning members carried by the plate of said male connector near the ends thereof cooperating with secondary female aligning members carried by the plate of said female connector near the ends thereof to specifically align said connectors, said frame being attached to said other end and movable therewith relative to said first end to maintain interconnection of said connectors during relative movement between said cars.

11. A pair of railway cars having adjacent ends interconnected, one of said ends being provided with male car-coupling and power line connecting members, the other of said ends being provided with female car-coupling and power line connecting members, said one end being further provided with an inter-car passageway protective diaphragm expanded toward and into engagement with said other end, said diaphragm including a movable free end defined by a passageway frame connected to said other end for movement therewith relative to said one end during operation of said interconnected cars, said male power line connecting member being carried by said frame and movable therewith toward and with said other end, said female power line connecting member being carried by said other end and positioned to intercept said male power line connecting member for interconnection therewith, a male primary aligning means carried by said frame near the top thereof in mating engagement with a female primary aligning means carried by said other end, said male power line connecting member being provided with secondary male aligning means in mating engagement with secondary female aligning means carried by said female power line connecting member, said male car-coupling member projecting from said first end a distance greater than said primary and secondary male aligning means to provide initial contact with said female car-coupling member carried by said other end to align the bottom portion of said frame with said other end, said primary male aligning means projecting outwardly from said first end a distance greater than said secondary male aligning means to contact said female primary aligning means and align the top portion of said frame with said other end prior to contact between said power line connecting members, said secondary aligning means cooperatively mating subsequent to the mating of said car-coupling members and said primary aligning means to provide specific interconnecting alignment between said power line connecting members, and yieldable power transmitting contacts carried by each of said power line connecting members in abutment to transmit power between said cars.

12. A pair of railway cars having adjacent ends interconnected, one of said ends being provided with a male power line connector and the other of said ends being provided with a female power line connector interconnected with one another, the interconnection of said cars being further established by mating car-coupling members carried by each of said ends and cooperating with one another to provide self-coupling of the cars when said adjacent ends are brought together, and an inter-car passageway protective diaphragm structure carried by said one end and expanded toward said other end, said diaphragm structure including a free end defined by a passageway frame which is supported by the car-coupling member of said one end and is connected to said other end for movement therewith relative to said one end during operation of said interconnected cars, said male connector being carried by said frame and movable therewith and with said other end relative to said one end, said female connector being carried by said other end and being positioned thereon to intercept said male connector for self-alignment and self-interconnection therewith when said adjacent ends are brought together.

13. A pair of railway cars having adjacent ends interconnected, one of said ends being provided with a male power line connector and the other of said ends being provided with a female power line connector interconnected with one another, the interconnection of said cars being further established by mating car-coupling members carried by each of said ends and cooperating with one another to provide self-coupling of the cars when said adjacent ends are brought together, and an inter-car passageway protective diaphragm structure carried by said one end and expanded toward said other end, said diaphragm structure including a free end defined by a passageway frame which is supported by the car-coupling member of said one end and is connected to said other end for movement therewith relative to said one

end during operation of said interconnected cars, said male connector being carried by said frame and movable therewith and with said other end relative to said one end, said female connector being carried by said other end and being positioned thereon to intercept said male connector for interconnection therewith when said adjacent ends are brought together, said male and female connectors including self-aligning means to provide self-interconnection of the same simultaneous with the self-coupling of said cars.

14. A pair of railway cars having adjacent ends interconnected, one of said ends being provided with a male power line connector and the other of said ends being provided with a female power line connector interconnected with one another, the interconnection of said ends of said cars being further established by mating car-coupling members carried by each of said ends and cooperating with one another to provide self-coupling of the cars when said adjacent ends are brought together, and an inter-car passageway protective diaphragm structure carried by said one end and expanded toward and into fixed engagement with said other end, said diaphragm structure including a free end defined by a passageway frame which is supported by the car-coupling member of said one end and is connected to said other end for movement therewith relative to said one end during operation of said interconnected cars, said male connector being carried by said frame and movable therewith and with said other end relative to said one end, said female connector being fixedly carried by said other end and being positioned thereon to intercept said male connector for interconnection therewith when said adjacent ends are brought together, said connectors each being provided with front plates carrying spring mounted power contacts projecting outwardly therefrom in abutting engagement to transmit power between said cars, and engaged spring mounted circuit control contacts carried by said plates, said control contacts projecting outwardly of said plates a distance less than said power contacts to be brought into abutting engagement subsequent to the engaging of said power contacts and out of abutting engagement prior to disengagement of said power contacts.

15. A pair of railway cars having adjacent ends interconnected, one of said ends being provided with a male power line connector and the other of said ends being provided with a female power line connector interconnected with one another, the interconnection of said cars being further established by mating car-coupling members carried by each of said ends and cooperating with one another to provide self-coupling of the cars when said adjacent ends are brought together, and an intercar passageway protective diaphragm structure carried by said one end and expanded toward said other end, said diaphragm structure including a free end defined by a passageway frame which is supported by the car-coupling member of said one end and is connected to said other end for movement therewith relative to said one end during operation of said interconnected cars, said male connector being carried by said frame and movable therewith and, with said other end relative to said one end, said female connector being carried by said other end and being positioned thereon to intercept said male connector for interconnection therewith when said adjacent ends are brought together, said connectors each being provided with front plates carrying spring mounted power contacts projecting outwardly therefrom in abutting engagement to transmit power between said cars, and engaged spring mounted circuit control contacts carried by said plates, said control contacts projecting outwardly of said plates a distance less than said power contacts to be brought into abutting engagement subsequent to the engaging of said power contacts and out of abutting engagement prior to disengagement of said power contacts, said male and female connectors including self-aligning means to provide self-interconnection of the same simultaneous with the self-coupling of said cars.

16. A pair of railway cars having adjacent ends interconnected, one of said ends being provided with a male power line connector and the other of said ends being provided with a female power line connector interconnected with one another, the interconnection of said cars being further established by mating car-coupling members carried by each of said ends and cooperating with one another to provide self-coupling of the cars when said adjacent ends are brought together, and an inter-car passageway protective diaphragm structure carried by said one end and expanded toward said other end, said diaphragm structure including a free end defined by a passageway frame which is supported by the car-coupling member of said one end and is connected to said other end for movement therewith relative to said one end during operation of said interconnected cars, said male connector being carried by said frame and movable therewith and with said other end relative to said one end, said female connector being carried by said other end and being positioned thereon to intercept said male connector for interconnection therewith when said adjacent ends are brought together, said male and female connectors including self-aligning means to provide self-interconnection of the same simultaneous with the self-coupling of member carried by said frame and cooperating with a said cars, said aligning means including a male aligning female aligning member carried by said other end to align said frame and said male connector carried thereby with said other end and said female connector.

References Cited in the file of this patent

UNITED STATES PATENTS

1,726,508	Van Dorn	Aug. 27, 1929
2,056,227	Mussey et al.	Oct. 6, 1939
2,422,355	Knapp	June 17, 1947