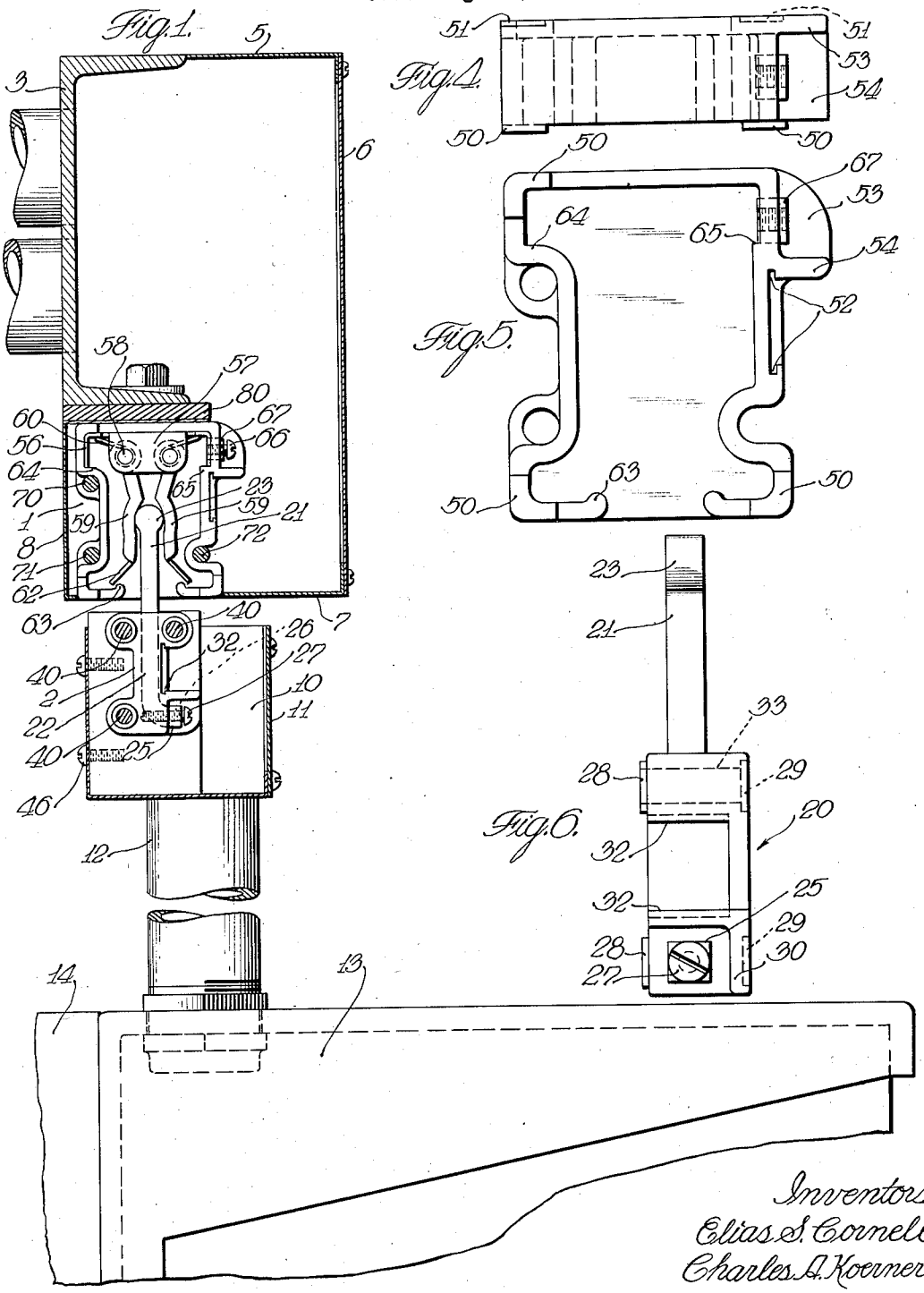
Oct. 1, 1935. E. S. CORNELL ET AL 2,015,710

SECONDARY PLUG SWITCH

Filed Aug. 14, 1933 2 Sheets-Sheet 1



Inventors
Elias S. Cornell
Charles A. Koerner

By Brown Jackson Boettcher Dienner
Attys.

Oct. 1, 1935. E. S. CORNELL ET AL 2,015,710

SECONDARY PLUG SWITCH

Filed Aug. 14, 1933 2 Sheets-Sheet 2

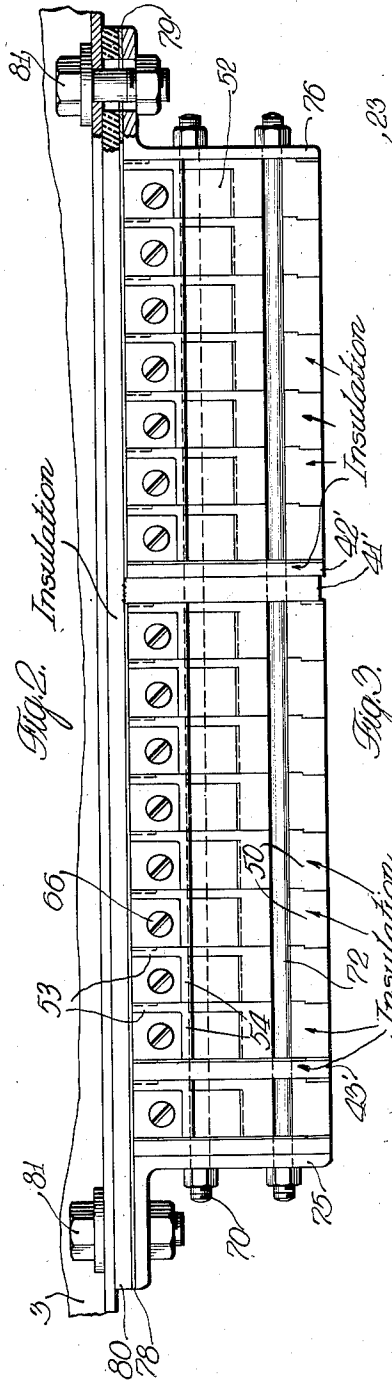


Fig. 2.

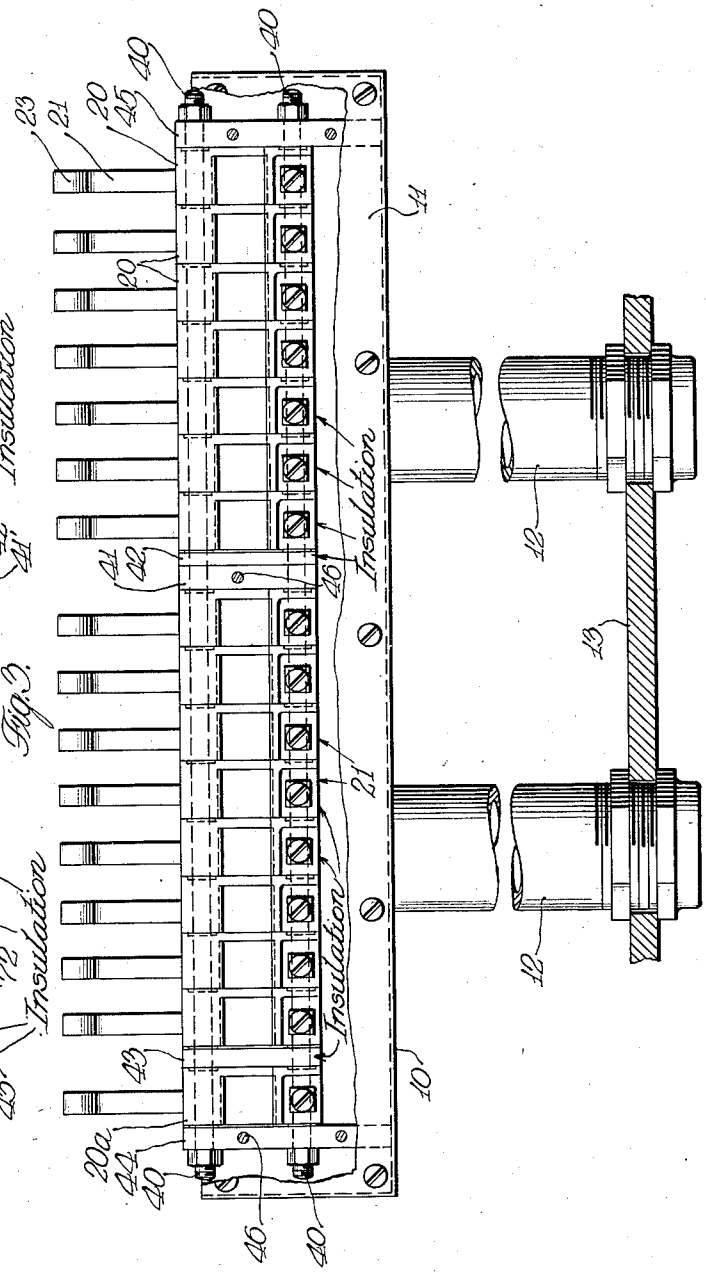


Fig. 3.

Inventors
Elias S. Cornell
Charles A. Koerner

By Brown Jackson Boettcher & Dienner
Attys.

Patented Oct. 1, 1935

2,015,710

UNITED STATES PATENT OFFICE

2,015,710

SECONDARY PLUG SWITCH

Elias S. Cornell, Evanston, and Charles A. Koerner, Chicago, Ill., assignors to The Delta-Star Electric Company, Chicago, Ill., a corporation of Illinois

Application August 14, 1933, Serial No. 685,047

12 Claims. (Cl. 173—332)

Certain types of electric power stations employ circuit breakers that are movable into and out of their normal operative positions. The movement may be either a horizontal movement or a vertical movement, depending upon the particular construction involved. In the systems wherein the horizontal movement is employed the breaker is mounted on a truck, or the like. In the systems wherein the vertical movement is employed, the breaker is mounted on an elevating or hoisting mechanism. Both of these systems include a stationary structure provided with switching means cooperating with switching means carried by the circuit breaker for establishing the power connections to the breaker when the breaker is moved into its normal operative position.

Circuit breakers of the above mentioned types are provided with operating and tripping means, generally arranged for remote control. Also, it is desirable to provide means for indicating, at a remote point, whether the breaker is in its operative position, whether it is closed or open, and to provide other signaling and metering arrangements. The control circuits extend from the control switch board to the stationary structure and are connected to the movable breaker through cooperating secondary switch members carried, respectively, on the breaker and on the stationary structure. It is with such secondary switch members that the present invention is concerned.

The number of secondary circuits that are established by the breaker when it is moved into its operative position differs in different installations, depending upon the extent of control and indication required by the customer. It is one of the objects of the present invention to provide a structure wherein the switching units comprising the secondary switch are of identical construction and may be assembled in any desired number to form the complete secondary switch. This affords a high degree of flexibility.

It is a further object of the present invention to provide a construction wherein each unit or pole of the secondary switch assembly cooperates with the adjacent units or poles to help maintain the units in alignment. This is accomplished, in the embodiment of our invention here illustrated, by providing cooperating slots and projections on adjacent units, so that the projections of one unit enter the slots of the adjacent unit and thus serve to lock the two units together.

It is a further object of the present invention to provide a structure which may be assembled in a simple and expedient manner. The respective units of the switch are provided with rod receiving openings, whereby any number of units may be strung on one or more rods which hold the assembly in place.

Each of the switching units is provided with means for receiving a tab for indicating the circuit to which that pole is connected. In order that the units or poles of the movable assembly shall cooperate with the corresponding poles of the stationary assembly, we provide a structural arrangement which will positively prevent the bringing together of the movable with the stationary parts in any but one definite relationship. The unit parts of each group are maintained in certain definite, spaced and aligned relation, and are dissymmetrically arranged from end to end of the assembly so that the two assemblies cannot be brought into electrical contact if one of the assemblies is reversed with respect to the other. In addition, one of the end units of the assemblies is spaced from its adjacent unit to prevent even a partial bringing together of the two coacting assemblies in relatively reversed relationship.

The attainment of the above and further objects of the present invention will be apparent from the following specification taken in conjunction with the accompanying drawings forming a part thereof.

In the drawings:

Figure 1 is a fragmentary view, in longitudinal section, illustrating our improved switch;

Figure 2 is a side view of the receptacle assembly;

Figure 3 is a side view of the plug assembly;

Figure 4 is a top view of the contact receptacle housing;

Figure 5 is a side view of the contact receptacle housing; and

Figure 6 is an enlarged view of one of the contact plug units.

Reference may now be had more particularly to Figure 1. The receptacle assembly is indicated in general at 1, and the plug assembly at 2. The receptacle assembly is mounted upon a stationary structure constituting a complete switching unit as shown, for instance, in the pending application of ourselves and Joseph A. Stoos, Serial No. 685,048, filed August 14, 1933. For the purpose of the present illustration it may be sufficient to point out that the receptacle assembly is mounted upon one of the flanges of a channel 3 of the stationary structure. The channel 3 is provided with a sheet metal upper extension 5 and a sheet mental front 6 to form a box which constitutes a

wiring gutter for wires to the receptacle assembly. The lower end of the gutter is closed by a bottom 7, and the rear of the gutter is closed by a rear wall 8.

The plug assembly 2 is mounted in a box 10 which is of sufficient size to allow wiring gutters on one side and on the bottom. The box is provided with a removable front cover plate 11 to permit access to the switching unit therein. The box 10 is supported by pipe nipples 12 which are attached at their lower ends to the top of the housing of the circuit breaker operating mechanism 13 that is secured to the head of a circuit breaker indicated at 14. The pipes 12 also act as conduits for the wires between the plug assembly 2 and the motor mechanism 13. The circuit breaker and its associated operating mechanism with the plug assembly mounted thereon are adapted to be raised or lowered in any preferred manner, such for instance, as is set forth in the above referred to application, in order to bring the circuit breaker to its operative position. At the same time the plug assembly is brought into cooperating relation with the receptacle assembly 1.

A description will now be given of the construction of the plug assembly. The plug assembly comprises a number of identical units indicated at 20. Each unit comprises a plug 21 and a body of insulation 22. The plug comprises an extruded brass conductor having a cylindrical knob 23 at its outer end. The lower end of the plug is bent to form a short L. The body of insulation 22 comprises a phenol condensation product, or the like, molded around the end of the plug by means of a suitable set of dies. The end 25 of the plug conductor 21 extends outside of the body of insulation and is drilled as indicated at 26. The control wire may be connected to the end of the plug by insertion into the drilled hole 26 and soldering therein. Any other means may be used for connecting the control wire to the end 25 of the plug conductor 21 as, for instance, tapping the hole 26 and providing a screw 27 to constitute a terminal for receiving the conductor.

It is to be noted that one face of the body of insulation 22 is provided with a number of projections 28—28, and the other face is provided with a similar number of recesses 29—29. The projections and recesses are provided to insure alignment of adjacent plugs. One side of the body of insulation 22 is provided with a barrier 30. When two plugs are assembled, this barrier in conjunction with the barrier on the adjacent plug forms a pocket completely isolating the end of the control wire that is connected to the plug conductor. Also, a recess 32 is formed in the molded insulation, this recess being provided for receiving a card designating the circuit to which the plug is connected. The body of insulation 22 is also provided with three parallel extending holes 33 for receiving rods on which the unit is assembled. Ample insulation is provided between the holes 33 and the plug conductor 21.

The plugs are assembled on rods 40 that are extended through the holes 33. The projections 28 on one plug unit enter the recesses 29 on the adjacent unit and thus assure proper alignment of the respective units. The plug is polarized by inserting an intermediate steel plate 41 and an insulating spacer 42. The plate 41 bears against a plug unit 20 along the face thereof that has the recesses 29. The insulating spacer is provided with over-sized holes into which the projections 28 of the abutting plug unit 20 extend. It is to be noted that the plate 41 and the insulating spacer 42 are not located centrally of the assembled units. This serves to polarize the assembly.

Between the end unit 20*a* and its adjacent unit there is interposed an insulating spacer 43 of a construction similar to that of the spacer 42. The plug of the end unit 20*a* is, therefore, spaced from the plug of the adjacent unit by an amount greater than the spacing between the other adjacent plugs. The purpose of this construction will be pointed out as this description proceeds. The entire unit is supported by steel end plates 44—45 through which the rods 40—40 extend, said rods being bolted in place by suitable nuts at their ends. The assembled unit is then placed in the steel box 10 and held in place by screws 46 that secure the end plates 44—45 to the end wall of the box 10. The intermediate steel plate 41 is also secured to the rear of the box 10 by means of a screw 46. This serves to reinforce the assembly intermediate its end and make it sufficiently strong against bending such as imposed thereon when it is pulled out of or inserted into the receptacle assembly.

It is to be noted that the plate 41 is of a shorter height than are the plates 44—45. This construction is provided in order to avoid obstructing the space below the plug assembly, and thus to afford a clear wiring gutter throughout the length of the box 10.

Each of the receptacle units consists of a contact assembly contained in a housing of "bakelite" or other suitable insulation. The housing is shown more particularly in Figures 4 and 5 and comprises a unitary body of molded insulation open at one side for the reception of the receptacle assembly, and closed at its opposite side. The top and bottom of the housing are provided at one side with projections 50, and at the other side with complementary recesses 51. The three projections and their adjacent recesses correspond, respectively, to the projection 28 and recesses 29 of the plug assembly, and assure alignment of the adjacent contact receptacle units. The contact receptacle is also provided with a card receiving recess 52 for receiving a card or other insignia to indicate the circuit to which the receptacle unit is connected. One end of the receptacle unit is also provided with a barrier 53 terminating in a bottom wall 54 which barrier, in conjunction with the barrier on an adjacent receptacle, forms a pocket for isolating the end of the control wire.

The contact assembly comprises an inverted U-shaped metal yoke 56 having end ears 57 between which extend pivot pins 58. Contact fingers 59 are pivoted on the pins 58 and urged toward one another by springs 60. The ends of the contact fingers 59 are outwardly flared, as indicated at 62, to form guides for the contact plugs. When the switch is in its open position, the guides 62 engage projections 63 in the receptacle, and prevent complete collapse of the contact fingers. The contact assembly is set in position in the housing, being inserted through the open end of the housing, with the legs of the yoke resting on projections 64—65 of the housing. The contact assembly is thus held in place by its own shape. In addition, a binding screw 66 is threaded through a metal insert 67, which is molded in the housing, and into the flange of the contact assembly. This serves to establish circuit connection to the contact assembly and also to hold the contact assembly firmly in place.

The receptacle units are assembled in much

the same manner as are the plug units. The respective units are assembled on three metallic rods 70, 71 and 72, of which the rods 70 and 71 extend through eyes in the body of insulation, whereas the rod 72 extends in an open recess in each of the units. In assembling the units on the rods the projections 50 of each unit extend into the corresponding recesses 51 of the adjacent unit and thus assure proper alignment of the units.

A steel plate 41' and one or more insulating spacers 42' are located intermediate the ends of the unit for a purpose similar to that of the plate 41 and the insulating spacer 42 of the plug assembly. Likewise, an insulating spacer 43', which corresponds to the spacer 43, is interposed between the end unit and its adjacent unit, and for the same purpose as that for which the spacer 43 is provided. The assembly is held between a pair of L-shaped end plates 75—75 through which the rods 70—71—72 extend. Insulating spacers 78 and 79 are located on the opposite sides of the plate 41' and between the receptacle unit and a metal plate 80, the plate 41' being welded to the plate 80. The entire assembly is bolted or otherwise rigidly secured to the lower flange of the channel member 3, as by means of bolts 81. The bolts 81 extend through oversized holes in the plate 80 and in the upper flanges of the end plates 75—76, so that the receptacle assembly can be lined up with the plug assembly in case of slight errors in the location of the mounting holes in the channel member 3.

Before the plug and socket units are finally assembled, respectively, on the circuit breaker and on the stationary structure, it is customary to test the assembly. In our improved construction this test cannot be performed with the plug assembly in reverse relation to the socket assembly. When the plug assembly is in reverse relation to the socket assembly it is impossible to bring about entrance of the plugs into the sockets, due to the polarizing spacers 43—43' and the spacers 41—41'. This assures a correct mounting of the assembly on the cubicle structure and on the circuit breaker, respectively.

From the above description it is apparent that we have invented a secondary switch which is particularly adapted for use in connection with a circuit breaker of the type that is removable from its cubicle. The units are of identical construction and can be assembled together in any desired quantity, thus giving an arrangement which is quite flexible as to the number of contacts provided. Also, the arrangement is such as to facilitate the making of the electrical connection with the respective units.

In compliance with the requirements of the patent statutes we have herein shown and described a preferred embodiment of our invention. It is, however, to be understood that the invention is not ilmited to the precise construction herein shown, the same being merely illustrative of the principles of our invention.

What we consider new and desire to secure by Letters Patent is:

1. A plug and socket connector comprising a pair of end supports, rods extending between the supports, a plurality of adjacent contact units strung on said rods, each of said units comprising a body of insulation carrying a projecting contact making member of the plug-in type and means carried by the adjacent units for interlocking the units with each other.

2. A plug connector assembly comprising a pair of end supports, rods extending between the supports, and a plurality of insulated contact units strung on said rods, each of said units comprising a body of insulation carrying a projecting contact making plug member and having means for receiving a lead wire, each body of insulation having an integral barrier of inverted L-shaped type at one end adjacent the lead wire receiving means, the barriers of adjacent units defining pockets for isolating the ends of the respective lead wires.

3. A plug connector assembly comprising a plurality of similar units in abutment, each unit comprising a body of insulation carrying a contact making member and having means for receiving a lead wire, each body of insulation having an integral barrier of inverted L-shape extending outwardly adjacent one end which, with the L-shaped barrier of the adjacent unit, defines a pocket for isolating the lead wire.

4. A plug and socket connector comprising a plurality of similar units in abutment, each unit comprising a body of insulation carrying a contact making member and having means for receiving a lead wire, each body of insulation having a barrier at one end which, with the barrier of the adjacent unit, defines a pocket for isolating the lead wire, and each of said units having a card receiving recess open at one end and terminating at a barrier at the other end whereby the terminating barrier of one unit closes the open end of the recess of the adjacent unit.

5. A plug contact unit comprising a plug of conducting material, and a body of insulation molded about one end of the plug with the other end of the plug extending outwardly of the body of insulation, the body of insulation having a plurality of parallel rod receiving openings therein, one side of the body of insulation having a projection extending therefrom and the opposite side having a complementary groove whereby the plug contact unit may be joined to an adjacent unit.

6. A plug and socket connector assembly comprising a pair of spaced end supports, supporting means extending therebetween, and a plurality of plug contact units, each of said units including a projecting plug contact making member carried by an insulating casing, said casing having interlocking means on adjacent surfaces thereof, said units being mounted in abutting alined engagement upon said supporting means.

7. A plug unit for a plug and socket connector assembly comprising an insulating supporting casing, a contact making member anchored therein and projecting from one end thereof, integral means extending normal to a lateral side wall of said casing for alining it with a similar adjacent casing, and integral barrier means comprising a top and side wall portion extending outwardly of said casing for isolating a lead wire connected to said contact making member.

8. A socket unit for a plug and socket connector assembly comprising an insulating open-faced housing having a recessed socket-receiving portion, a socket engaged within said housing and having resilient contact-engaging arms normally urged toward each other, means for limiting inward movement of said arms, and integral projecting means interlocking the open-faced side of said housing with the back of an adjacent corresponding housing to close said first housing, said limiting means defining a socket opening between said housings.

9. A socket unit for a plug and socket con-

nector assembly comprising an insulating housing, a socket mounted within said housing and having resilient contact-engaging arms normally urged toward each other, means in said housing for limiting inward movement of said arms, means for alining said housing with an adjacent corresponding housing for closing the same, and barrier means formed on said housing for isolating a lead wire connected to said socket, said limiting means defining, with said adjacent housing, an opening into the interior of said first housing aligned with said contact-engaging arms.

10. In combination, in a plug and socket connector assembly of the class described, a plurality of insulated plug units having projecting contact-making members, means on the adjacent surfaces of said units for interlocking them in alined position, rod means for supporting said units in alined position, means for dissymmetrically spacing said units on said rod means, a plurality of receptacle units enclosing a plurality of socket means adapted to receive said contact-making members, means for interlocking said receptacle units in alined position, means for supporting said units in alined position, and means for correspondingly dissymmetrically spacing said receptacle units on said supporting means.

11. A connector assembly comprising a pair of spaced end supports, a plurality of longitudinal supporting means extending therebetween, a pair of spacing members mounted on said supporting means intermediate said end supports, and a plurality of connector units comprising insulated body members supporting projecting contact-making members, said body members being dissymmetrically arranged on said supporting means on opposite sides of said spacing members and having cooperating integrally formed portions for interlocking said body members in alined position upon said supporting means.

12. A receptacle unit for a plug and socket connector of the class described comprising an insulating housing having an open-faced portion, a contact making member secured in said housing, means carried by said housing providing for connection of a lead wire to said member, a plurality of projecting interlocking means on one face of said housing adapted to cooperate with corresponding means in the abutting face of the next adjacent unit, and a plurality of recesses on the opposite face of said housing adapted to be engaged by a projection on the abutting face of the next adjacent unit, and a barrier member on said first-named housing projecting normally to said interlocking means for isolating the lead wire connection from said adjacent units.

ELIAS S. CORNELL.
CHARLES A. KOERNER.