July 13, 1943. F. J. FAULKNER 2,324,144

MULTIPLE CONNECTOR PLUG

Filed April 3, 1941

Fig. 1.

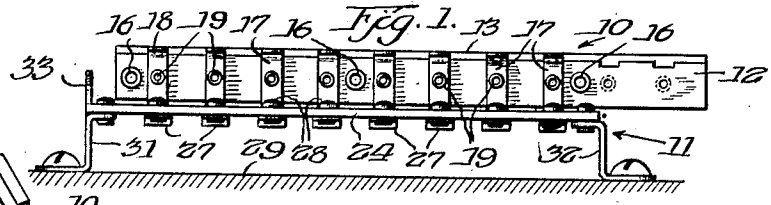


Fig. 2.

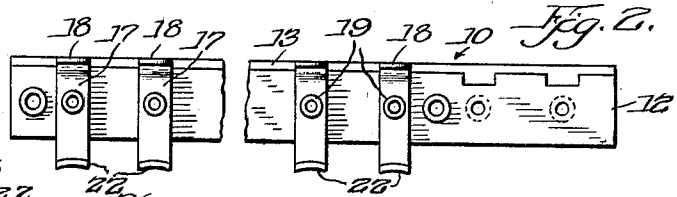


Fig. 3.

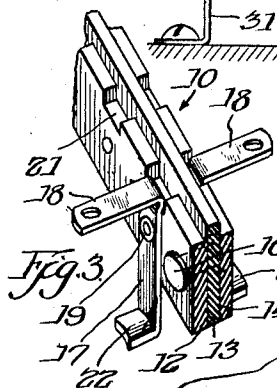


Fig. 4.

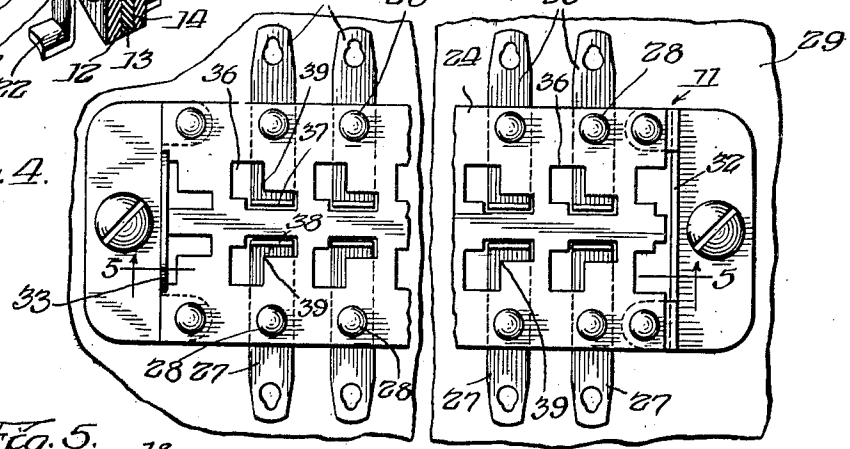


Fig. 5.

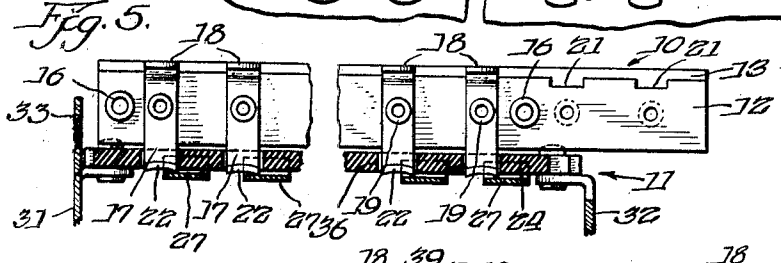


Fig. 6.

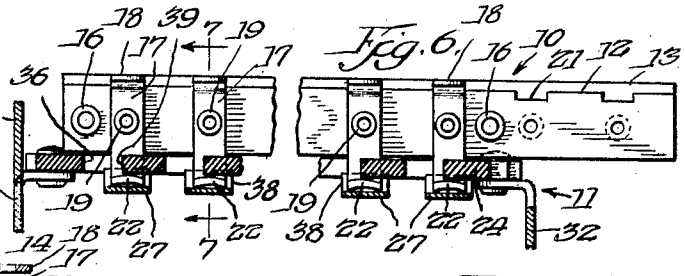
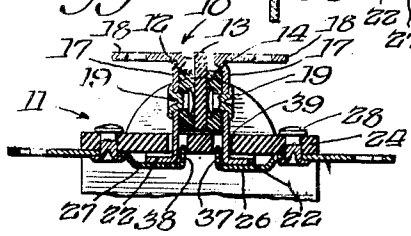


Fig. 7.



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UNITED STATES PATENT OFFICE

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MULTIPLE CONNECTOR PLUG

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Application April 3, 1941, Serial No. 386,673

15 Claims. (Cl. 173—328)

My invention relates to multiple connector plugs.

Multiple connector plugs, conventionally of the so-called plug and jack type, are used in many locations where there is a number of lines running to a piece of apparatus or interconnecting two different sections of a single installation, such as in an amusement device or the like, the purpose being to permit easy removal of all or a portion of the apparatus for repair, replacement, servicing or the like. Connector plugs of this general type are required to be relatively inexpensive, they must assure a good contact, and preferably they must utilize a construction which will be standard substantially independently of the number of connections for which provision is made. A desired feature of this type of connector plug is ruggedness, that is to say, the provision of a plug which is not easily broken under ordinary conditions of use. This presents a rather difficult problem in connector plugs which are required to be relatively inexpensive and, in general, relatively light in weight. With most conventional plug and jack arrangements, breakage can very easily occur in either the act of connecting or disconnecting the plug and jack parts.

The principal object of my invention is the provision of an improved multiple connector plug construction.

A further object is the provision of a multiple connector plug construction which has all of the advantageous features of previously known connector plugs but which overcomes problems such as those outlined hereinabove.

A further object is the provision of a connector plug which is relatively inexpensive to manufacture, in which the contacts are readily connected or disconnected without possibility of breakage, and wherein a clean and good electrical connection is provided at all times.

In carrying out my invention, I provide one connector member with spaced pairs of generally L-shaped contact members mounted on an insulating support. The first-mentioned connector member cooperates with a second connector member comprising an insulating support and pairs of spaced contact members carried by the support, said contact members having portions held under spring tension substantially parallel to and only slightly out of contact with a flat surface of the insulating member. This insulating member is provided with apertures spaced to correspond with the positions of the L-shaped contact members on the first connector member and partially overlapping the contact members on the second connector member so that, when the first connector member is placed over the second connector member with the L-shaped contact members in said apertures, relative longitudinal movement of the connector members will cause the transverse legs of the L-shaped contact members to ride between the contact members and insulating support of the second connector member, thereby forming a firm contact between the cooperating contact members as required to complete the several circuits of which the contact members may form a part.

Other specific features and objects of the invention will be apparent from a consideration of the following detailed description, taken with the accompanying drawing, wherein

Fig. 1 is a side elevational view of a multiple connector plug constructed in accordance with my invention, the plug being shown as mounted on a base;

Fig. 2 is an enlarged fragmentary side elevational view of the plug portion of the connector plug;

Fig. 3 is a fragmentary enlarged perspective view looking at the end thereof showing details of construction of the connector member of Fig. 2;

Fig. 4 is an enlarged fragmentary plan view showing the jack portion;

Fig. 5 is a fragmentary sectional view taken on the line 5—5 of Fig. 4 looking in the direction of the arrows, the plug connector member being added to this sectional view and shown in elevation in order to more clearly show the relationship of the parts;

Fig. 6 is a view similar to Fig. 5 but showing the parts in modified position; and

Fig. 7 is an enlarged transverse sectional view taken on the line 7—7 of Fig. 6 looking in the direction of the arrows.

The multiple connector plug of my invention comprises a pair of connector members, these connector members being a plug carrying member 10 and a jack carrying member 11. I employ the terms "plug" and "jack" in identifying these two members in order to make it clear to those skilled in the art the relationship of the parts with respect to ordinary plug and jack assemblies. The specific description will make the fact clear, however, that I do not employ the conventional plug and jack construction.

Referring now first to the construction of the plug carrying member 10, I utilize three strips of insulating material 12, 13 and 14, secured together by means of rivets 16 to form a composite insulating body portion carrying contact mem-

ers 17 and 18. These contact members 17 and 18 perform the function of the plugs of the usual plug and jack structures, and they are accordingly arranged in pairs, the separate pairs being spaced from each other and adapted to be connected to opposite lines of a single circuit. Rivets 19 mount these contact members to a single insulating strip 12 or 14, as the case may be, and, as shown clearly in Fig. 7, these rivets, while in line with each other, are spaced and held out of electrical contact by the insulating strip 13. It will be noted also that the rivets 16 are spaced from the contact members 17 and 18 and also from the rivets 19, so that there is no possibility of a short circuit through the rivets 16. In order to increase the rigidity of the contact members on the insulating body, the strips 12 and 14 are provided with upper edge notches 21 just wide enough to accommodate the contact members 17 and 18, which, as shown in Fig. 7, are formed to extend slightly into the recess provided by these notches. This prevents the contact members from swiveling about the rivets 19. The upper part of the contact members is shaped to facilitate attachment of the usual connnecting wires (not shown). The main body portion of the contact members 17 and 18 projects below the insulating body portion comprising the members 12, 13 and 14, and the lower ends 22 are shaped to form an L-construction, the lower leg of which in each instance is given a slightly arcuate shape by a suitable tooling operation for a purpose which will be described.

The jack portion 11 comprises an insulating strip 24, on opposite sides of which are secured pairs of contact members 26 and 27, rivets 28 being employed to mount contact members in position on the insulating strip. The insulating strip 24 may comprise a main body portion, but, in the drawing, I show an additional base mem-member 29 to which the insulating strip 24 is secured by means of brackets 31 and 32. A portion 33 of bracket 31 extends vertically in line with the insulating body portion of the plug carrying connector member and serves a function which will be described.

The contact members 26 and 27 are, in general, in the form of relatively flat strips and have one of their ends in each instance extending beyond the area defined by the insulating strip 24 and finished to facilitate attachment of wires to establish the necessary circuits. The opposite ends of the contact members 26 and 27 are brought into engagement with the portions 22 of the contact members 17 and 18, as will be shown.

The insulating strip 24 is provided with a series of openings 36 arranged in pairs and in part overlapping the ends of the contact strips 26 and 27. These openings, in the specific embodiment shown, have a shape which would be produced by overlapping two rectangles at their corners, one rectangle being a square having a cross sectional area slightly greater than the cross sectional area of the leg portions 22 of the plug contact members, and the other having a length approximately equal to the width of the contact strips 26 and 27 and a width slightly in excess of twice the thickness thereof. The contact strips 26 and 27 have upturned ends 37 and 38, respectively, which, as shown clearly in Fig. 7, extend up into the openings 36 and lie against a vertical surface of the insulating strip 24. Between the upturned portions 37 and 38 and the rivets 28, the contact strips 26 and 27 are formed slightly downwardly to facilitate insertion of the leg portions 22 between these strips and the insulating strip 24. The strips 26 and 27 nevertheless have a spring action, the upturned ends 37 and 38 having a greater or lesser area of contact with the vertical surface of the insulating strips 24, depending upon whether the legs 22 are engaged or disengaged from the contact strips 26 and 27. Turning up of the contact strips 26 and 27 serves several functions, an important one being to provide an additional support whereby to prevent tendency of these strips to swivel about the rivets 28. Looking again to the openings 36, it will be seen that there is one portion, in the form of a square, which permits vertical passage of the legs 22, and another portion of narrower cross section housing the upturned ends 37 and 38 and adapted to permit longitudinal movement of the main shank portion of the contact members 17 and 18, with the result that the legs 22 are wedged under a corner portion 39 of the insulating strip 24 and above and in electrical contact with the contiguous portion of the contact strips 26 and 27.

In using the multiple connector plug of my invention, the connector member 10 is set down over the connector member 11 with the legs 22 extending through the vertically functioning portion of the holes 36 so that the legs rest upon the several portions of the contact strips 26 and 27 which overlap the openings 36. The parts are then in the position shown in Fig. 5, and, in this position, a suitable electrical contact has not yet been made. The connector member 10 is then moved longitudinally to the right, as Fig. 5 is viewed, and the legs 22 then become wedged between the insulating strip 24 and the contact strips of the connector member 11. This establishes good electrical contact, with the parts in the position shown in Fig. 6. The arcuate shape of the legs 22 facilitates their entering the relatively shallow space above the contact strips, they serve to provide increased tension in the contact strips 26 and 27 thereby providing for better electrical contact, and they also provide a wiping action whereby to keep the engaging surfaces clean.

The insulating strips 12, 13 and 14 comprising the main body portion of the connector member 10 may be extended beyond the connector member 11, as shown in the drawing, to provide a handle-like portion whereby to facilitate engagement and disengagement of the two connector members. The opposite ends of this strip project only far enough to act as a guide, with the upturned portion 33, whereby the position at which the parts are engaged is readily determined.

There are several advantages of my invention from the standpoint of simplicity and inexpensiveness of manufacture. All of the current carrying portions can be made of readily available strip stock and produced in large quantities by means of automatic or semi-automatically operated machines carrying suitable forming dies. The strips 12 and 14 are identical, not only with each other but throughout their lengths, so that standard strips may be produced and these strips cut to the length required to accommodate the desired number of contacts. The device, as shown, has eight pairs of contacts, and, to produce a device having a greater or lesser number of contacts, it would be necessary only to vary the length of the strips 12 and 14. In manufacture, the strips 12 and 14 are separately assembled with their contact members as subassemblies,

and the connector portion 10 is completed by taking two such sub-assemblies and assembling them with the intermediate strip 13.

What is said of the production of the connector portion 10 is equally true of the production of the connector member 11. The insulating strip 24 is standard throughout its length and all that is necessary to provide a suitable number of contacts is to cut this strip to the length required. Looking at Fig. 4, it will be seen that, at the two ends, the strip contains portions of the openings 36 which result from merely cutting a length from a standard strip in such a way that the end cut is through a pair of openings 36. All of the insulating members can be cut by stamping or other suitable operations from sheets of fiber or like material of standard thickness. Thus, with the construction employed, it is not necessary to tool up for each multiple connector plug produced, but multiple connector plugs having varying numbers of contacts can be produced from standard, relatively inexpensive tools from standard, readily available materials.

One of the principal objects of my invention is the simplicity and effectiveness with which the plug portion and jack portion may be brought together. When the parts are first brought to the position shown in Fig. 5, only a relatively slight amount of effort is required to move the two parts relative to each other to the position shown in Fig. 6. If more than this effort seems to be required, the operator knows at once that the parts are not in suitable position so that there is little or no likelihood of his using more than the necessary amount of pressure and breaking or bending any of the contacts. Furthermore, all of the contacts are, of necessity, made and broken at the same time and the operator is not apt to break the insulating supporting body by applying unequal pressure in either connecting or disconnecting the parts.

While the details of construction employed offer certain advantages both from a manufacturing and use standpoint, I wish it understood that my invention is not limited to specific details, except insofar as such details are included within the scope of the appended claims.

What I claim as new and desire to protect by Letters Patent of the United States is:

1. In a multiple connector of the character described, a plug member having a body portion and a plurality of pairs of contact members carried thereby, said contact members being regularly spaced and projecting uniformly from the body portion, and a jack portion comprising an insulating body member and contact members carried thereby with a portion spaced slightly from said body member, said body member provided with openings corresponding in position to the contact members on the plug member, and communicating with the contact members on the jack member, whereby said plug contact members may be extended into said openings and the plug and jack members moved relatively to each other in a straight line to wedge said plug contact members between said jack contact members and their supporting body, said contact members comprising a plurality of pairs, and the body portion of the plug member comprising three insulating strips, two of which carry a row of contact members and one of which comprises an insulating spacer.

2. In a multiple connector of the character described, a plug member having a body portion and a plurality of pairs of contact members carried thereby, said contact members being regularly spaced and projecting uniformly from the body portion and comprising a main body portion and a lower portion at an angle thereto, and a jack portion comprising an insulating body member and contact members carried thereby with a portion spaced slightly from said body member, said body member provided with openings corresponding in position to the contact members on the plug member, and communicating with the contact members on the jack member, whereby said plug contact members may be extended into said openings and the plug and jack members moved relatively to each other in a straight line to wedge the lower angle portion of said plug contact members between said jack contact members and their supporting body.

3. In a multiple connector of the character described, a plug member having a body portion and a plurality of pairs of contact members carried thereby, said contact members being regularly spaced and projecting uniformly from the body portion and having a lower portion of slightly curved cross section, and a jack portion comprising an insulating body member and contact members carried thereby with a portion spaced slightly from said body member, said body member provided with openings corresponding in position to the position of the contact members on the plug member, and communicating with the contact members on the jack member, whereby said plug contact members may be extended into said openings and the plug and jack members moved relatively to each other in a straight line to wedge the lower slightly curved portion of said plug contact members between said jack contact members and their supporting body.

4. In a multiple connector of the character described, cooperating plug and jack members adapted to be moved longitudinally relatively to each other to effect connection of electrical contact members carried thereby, said jack member comprising an insulating strip provided with a plurality of regularly spaced openings, and a plurality of spaced contact members contiguous to said openings, and said plug member comprising a body portion and a plurality of generally L-shaped contact members carried thereby, said L-shaped contact members having a main body portion and a lower leg generally at right angles thereto, the said lower legs of all of said L-shaped contact members lying substantially in the same plane and adapted to be extended into said openings in the jack member, the contact members being so constructed and arranged that relative straight line movement of the plug and jack members, when said lower legs are in said openings, will cause said lower legs to wedge between the contact members and insulating strip of the jack member.

5. In a multiple connector of the character described, cooperating plug and jack members adapted to be moved longitudinally relatively to each other to effect connection of electrical contact members carried thereby, said jack member comprising an insulating strip provided with a plurality of regularly spaced openings, and a plurality of spaced contact members contiguous to said openings, and said plug member comprising a body portion and a plurality of generally L-shaped contact members carried thereby, said L-shaped contact members having a main body portion and a lower leg portion generally at right angles thereto, but transversely slightly curved, the said lower legs of all of said L-shaped con-

tact members lying substantially in the same plane and adapted to be extended into said openings in the jack member, the contact members being so constructed and arranged that relative straight line movement of the plug and jack members, when said lower legs are in said openings, will cause said lower legs to wedge between the contact members and insulating strip of the jack member.

6. In a multiple connector of the character described, cooperating plug and jack members adapted to be moved longitudinally relatively to each other to effect connection of electrical contact members carried thereby, said jack member comprising an insulating strip provided with a plurality of regularly spaced openings, and a plurality of spaced contact members contiguous to said openings, and said plug member comprising a body portion and a plurality of generally L-shaped contact members carried thereby, said L-shaped contact members having a main body portion and a lower leg portion generally at right angles thereto, but transversely slightly curved, the said lower legs of all of said L-shaped contact members lying substantially in the same plane and adapted to be extended into said openings in the jack member, the contact members being so constructed and arranged that relative straight line movement of the plug and jack members, when said lower legs are in said openings, will cause said lower legs to wedge between the contact members and insulating strip of the jack member, the curvature of the said lower legs being in a direction whereby to place the concavity thereof in contact with contact members of the jack member.

7. In a multiple connector of the character described, cooperating plug and jack members adapted to be moved longitudinally relatively to each other to effect connection of electrical contact members carried thereby, said jack member comprising an insulating strip provided with a plurality of regularly spaced openings, and a plurality of spaced contact members contiguous to said openings and lying against a lower surface of said strip, said contact members slightly overlapping said openings, and said plug member comprising a body portion and a plurality of generally L-shaped contact members carried thereby, one of the legs of each of said contact members adapted to be extended into said openings in the jack member so as to rest on a portion of a contact member on the jack member, the contact members being so constructed and arranged that relative straight line movement of the plug and jack members, when said legs are in said openings and resting on said jack contact members, will cause said legs to wedge between the contact members and insulating strip of the said jack member.

8. In a multiple connector of the character described, cooperating plug and jack members adapted to be moved longitudinally relatively to each other to effect connection of electrical contact members carried thereby, said jack member comprising an insulating strip provided with a plurality of regularly spaced openings, and a plurality of spaced contact members contiguous to said openings, and said plug member comprising a body portion formed of three strips of insulating material in face-to-face relation, each of two of said strips carrying a line of generally L-shaped contact members and one strip comprising a spacer, one of the legs of each of said contact members lying substantially in a plane at right angles to the plane of said strips and adapted to be extended into said openings in the jack member, the contact members being so constructed and arranged that relative movement of the plug and jack members, when said legs are in said openings, will cause said legs to wedge between the contact members and insulating strip of the jack member.

9. In a multiple connector of the character described, a jack member comprising a flat insulating strip provided with a plurality of pairs of holes, each hole shaped as two rectangles joined at their corners, contact members, one for each such hole, secured to an under side of said insulating strip, each of said contact members overlapping a portion of one rectangle and substantially all of the second rectangle of its associated hole and being generally parallel to but spaced slightly from the insulating strip, and a plug member comprising an insulating body carrying a plurality of L-shaped contact members, each L-shaped contact member having a leg generally vertical to said jack contact and a lower leg generally parallel thereto, said L-shaped contact members being adapted for insertion in said holes through one rectangular portion thereof whereby said lower leg portions wedge between the insulating strip and contacts of said jack member and said vertical legs lie in said second rectangular portion of said holes.

10. In a multiple connector of the character described, a jack member comprising a flat insulating strip provided with a plurality of pairs of holes, each hole shaped as two rectangles joined at their corners, contact members, one for each such hole, secured to an under side of said insulating strip, each of said contact members overlapping a portion of one rectangle and substantially all of the second rectangle of its associated hole and being generally parallel to but spaced slightly from the insulating strip, and a plug member comprising an insulating body carrying a plurality of L-shaped contact members, each L-shaped contact member having a leg generally vertical to said jack contact and a lower leg generally parallel thereto, said L-shaped contact members being adapted for insertion in said holes through one rectangular portion thereof whereby said lower leg portions wedge between the insulating strip and contacts of said jack member and said vertical legs lie in said second rectangular portion of said holes, said lower legs being slightly curved and having a concave portion facing the said contact members on the jack member.

11. In a multiple connector of the character described, a plug member having a body portion and a plurality of pairs of contact members carried thereby, said contact members being spaced in a straight line longitudinally of said body portion and projecting uniformly from the body portion, and a jack portion comprising an insulating body member and contact members carried thereby with a portion spaced slightly from said body member, said body member being provided with openings arranged in a straight line longitudinally of said insulating body member and corresponding in position to the contact members on the plug member and communicating with the contact members on the jack member, whereby said plug contact members may be extended into said openings and the plug and jack members moved in a straight line longitudinally of each other to wedge said plug contact members between said jack contact members and

their supporting body, said contact members comprising a plurality of pairs, and the body portion of the plug member comprising inner and outer insulating strips, the two outer of which carry a row of contact members and the inner of which comprises an insulating spacer.

12. In a multiple connector of the character described, a plug member having a body portion and a plurality of pairs of of contact members carried thereby, said contact members being spaced in a straight line longitudinally of said body portion and projecting uniformly from the body portion and having a lower portion of slightly curved cross section, and a jack portion comprising an insulating body member and contact members carried thereby with a portion spaced slightly from said body member, said body member being provided with openings arranged in a straight line longitudinally of said insulating body member and corresponding in position to the position of the contact members on the plug member, and communicating with the contact members on the jack member, whereby said plug contact members may be extended into said openings and the plug and jack members moved relatively to each other in a straight line to wedge the lower slightly curved portion of said plug contact members between said jack contact members and their supporting body.

13. In a multiple connector of the character described, a jack member comprising a flat insulating strip provided with a plurality of oppositely disposed spaced pairs of holes, each hole shaped as two rectangles joined at their corners, each of said oppositely disposed pairs of holes being arranged in a straight line longitudinally of said insulating strips, contact members, one for each such hole, secured to an under side of said insulating strip, each of said contact members overlapping a portion of one rectangle and substantially all of the second rectangle of its associated hole and being generally parallel to but spaced slightly from the insulating strip, and a plug member comprising an insulating body carrying a plurality of L-shaped contact members, each L-shaped contact member having a leg generally vertical to said jack contact and a lower leg generally parallel thereto, said L-shaped contact members being adapted for insertion in said holes though one rectangular portion thereof whereby, on movement of said jack and plug members longitudinally of each other, said lower leg portions wedge between the insulating strip and contacts of said jack member and said vertical legs lie in said second rectangular portion of said holes, said lower legs being slightly curved and having a concave portion facing the said contact members on the jack member.

14. In a multiple connector of the character described, a jack member comprising a flat insulating strip provided with a plurality of oppositely disposed spaced pairs of holes, each hole shaped as two rectangles joined at their corners, each of said oppositely disposed pairs of holes being arranged in a straight line longitudinally of said insulating strip, contact members, one for each such hole, secured to an under side of said insulating strip, each of said contact members overlapping a portion of one rectangle and substantially all of the second rectangle of its associated hole and being generally parallel to but spaced slightly from the insulating strip, and a plug member comprising an insulating body carrying a plurality of L-shaped contact members, each L-shaped contact member having a leg generally vertical to said jack contact and a lower leg generally parallel thereto, said L-shaped contact members being adapted for insertion in said holes through one rectangular portion thereof whereby, on movement of said jack and plug members longitudinally of each other, said lower leg portions wedge between the insulating strip and contacts of said jack member and said vertical legs lie in said second rectangular portion of said holes.

15. In a multiple connector of the character described, a jack member comprising a generally flat insulating strip provided with a plurality of spaced holes, each hole shaped as two rectangles joined at their corners, said holes being arranged in a straight line longitudinally of said insulating strip, contact members, one for each such hole, secured to an under side of said insulating strip, each of said contact members overlapping a portion of one rectangle and substantially all of the second rectangle of its associated hole and being generally parallel to but spaced slightly from the insulating strip, and a plug member comprising an insulating body carrying a plurality of generally L-shaped contact members, each L-shaped contact member having a leg generally vertical to said jack contact and a lower leg generally parallel thereto, said L-shaped contact members being adapted for insertion in said holes through one rectangular portion thereof whereby, on movement of said jack and plug members longitudinally of each other, said lower leg portions wedge between the insulating strip and contacts of said jack member and said vertical legs lie in said second rectangular portion of said holes.

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