

July 5, 1938.

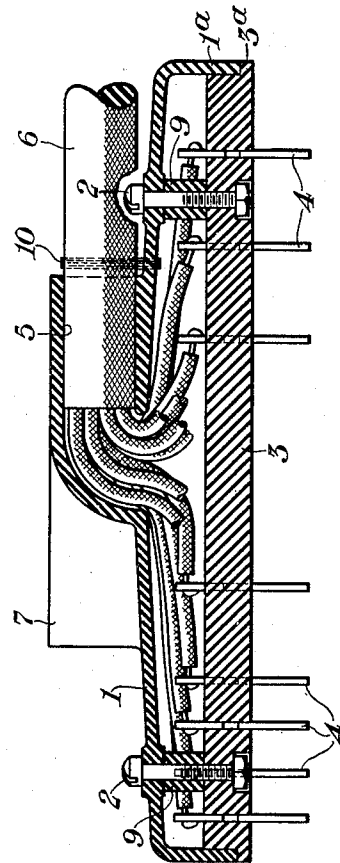
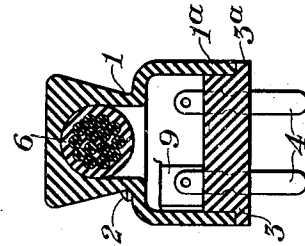
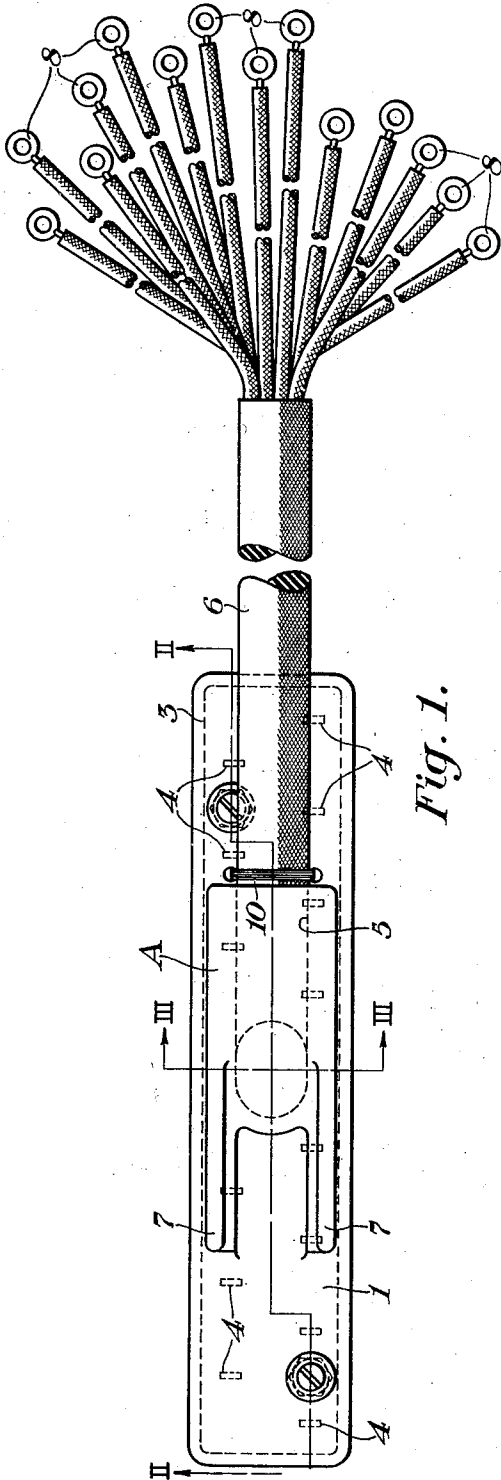
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2,122,819

ELECTRICAL CONNECTER

Filed June 19, 1936

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

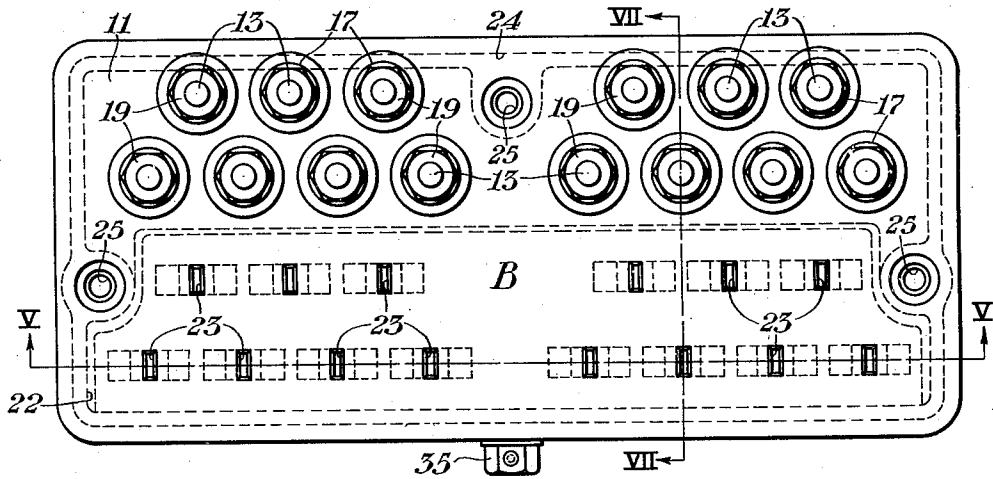


Fig. 4.

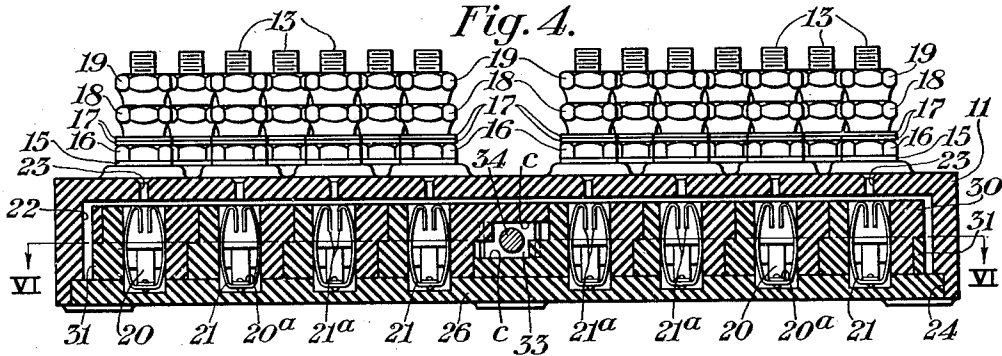


Fig. 5.

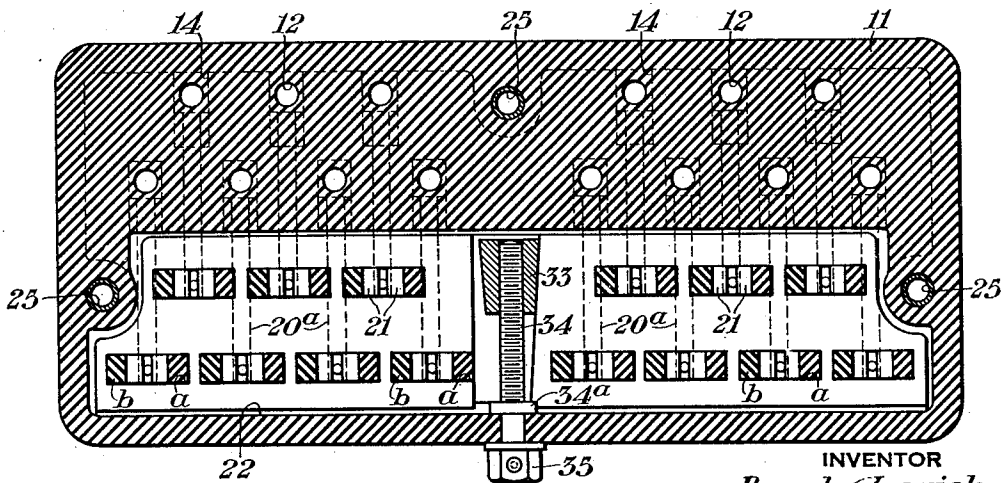


Fig. 6.

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4 Sheets-Sheet 3

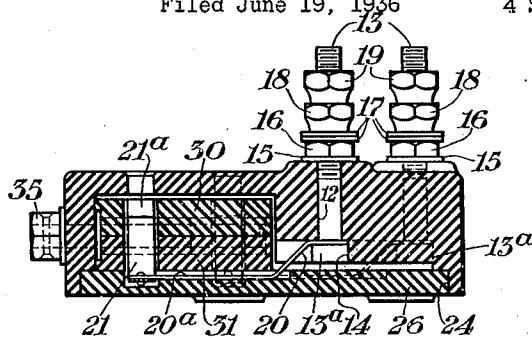


Fig. 7.

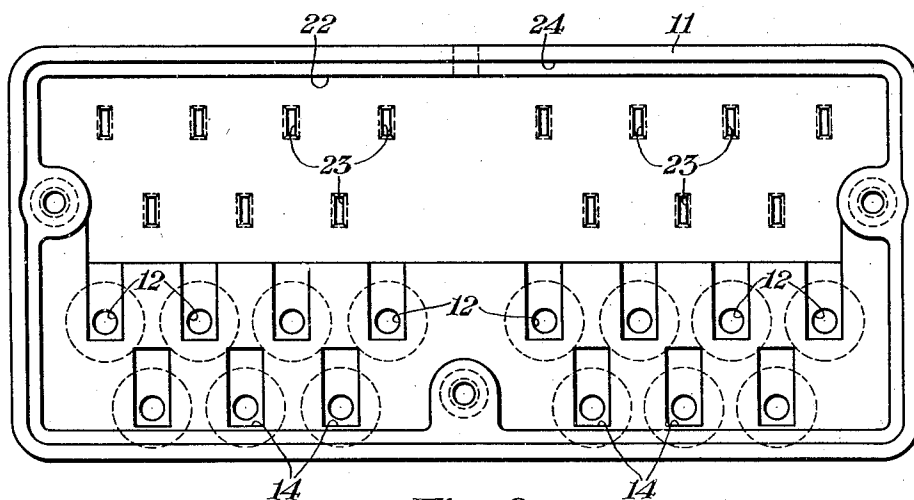


Fig. 8.

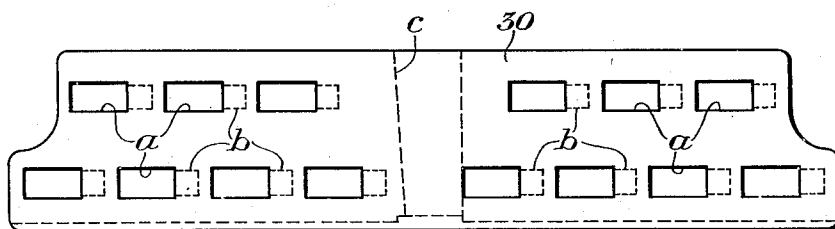


Fig. 9.

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4 Sheets-Sheet 4

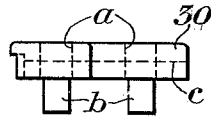


Fig. 10.

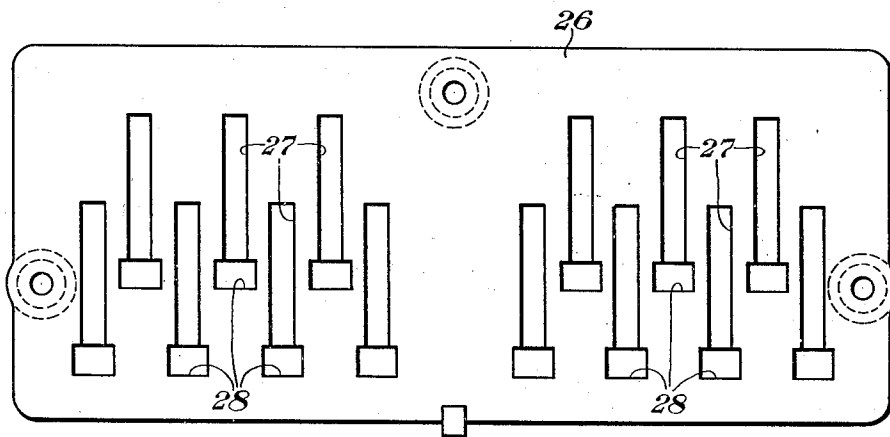


Fig. 11.

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UNITED STATES PATENT OFFICE

2,122,819

ELECTRICAL CONNECTER

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Application June 19, 1936, Serial No. 86,088

9 Claims. (Cl. 173—328)

My invention relates to electrical connectors, and particularly to electrical connectors comprising a plug receptacle having a relatively large number of contact members, and a cooperating plug having a correspondingly large number of contact members which are adapted to make electrical contact with the contact members of the plug receptacle.

One object of my invention is to provide an electrical connector of the type described which is particularly suitable for, although in no way limited to, use in railway signaling systems to facilitate the rapid replacement of signaling devices, such for example, as electrical relays, which form an integral part of the system, and which require a relatively large number of connections with circuit conductors.

Another object of my invention is to provide an electrical connector which will insure good electrical contact between all of the cooperating contact elements, and which at the same time will permit ready separation of the plug and plug receptacle.

A further object of my invention is to provide an electrical connector which can be readily manufactured, and which at the same time employs, insofar as it is possible to do so, parts which are standard in the railway signaling field.

I will describe one form of electrical connectors embodying my invention, and will then point out the novel features thereof in claims.

In the accompanying drawings, Fig. 1 is a top plan view of a plug forming part of an electrical connector embodying my invention. Figs. 2 and 3 are sectional views taken substantially on the lines II—II and III—III, respectively, of Fig. 1. Fig. 4 is a top plan view showing the plug receptacle of an electrical connector embodying my invention. Fig. 5 is a longitudinal sectional view taken on the line V—V of Fig. 4. Fig. 6 is a sectional view taken on the line VI—VI of Fig. 5. Fig. 7 is a sectional view taken on the line VII—VII of Fig. 4. Fig. 8 is a bottom view of the top plate 11 forming part of the plug receptacle shown in Figs. 4 and 5. Figs. 9 and 10 are top plan and right hand end views, respectively, of the clamping plate 30 forming part of the plug receptacle shown in Fig. 4. Fig. 11 is a top plan view of the bottom plate 26 forming part of the plug receptacle shown in Figs. 4, 5 and 6.

Similar reference characters refer to similar parts in each of the several views.

Referring to the drawings, an electrical connector embodying my invention comprises a plug A shown in Figs. 1 and 2, and a plug receptacle B

shown in Figs. 4, 5, 6, and 7, which plug receptacle is adapted to cooperate with the plug A. The plug A in the form illustrated comprises an insulating cover 1 secured, by means of suitable bolts 2, to an insulating plate 3 in which a plurality of contact fingers 4 are mounted, preferably by molding the fingers directly into the plate. The cover 1 completely surrounds the upper part of the insulating plate 3, and is provided with a depending flange 1^a which cooperates at its lower end with a laterally projecting flange 3^a formed on the insulating plate 3 to vertically position the cover with respect to the insulating plate. The length of the flange 1^a is such, and the parts are so proportioned, that the cover 1 forms with the insulating plate a chamber which houses the upper ends of the contact fingers 4 with some clearance, and extending into this chamber through a tubular portion 5 of the cover is a multi-wire cable 6, the individual wires of which are each soldered at their inner ends to a different one of the contact fingers 4. The tubular portion 5 of the cover acts to protect the cable 6 at the point where it enters the cover, and also acts, together with two wings 7 which are formed on the cover adjacent the closed end of the tubular portion, to form a handle which may be grasped to facilitate connecting the plug with, and disconnecting it from, the plug receptacle in a manner which will become apparent as the description proceeds. The outer ends of the wires of the cables 6 are each preferably provided with an eyelet 8 to facilitate fastening these wires to the terminal posts of a relay or other similar device. To prevent the inner exposed ends of the cable wires from coming into contact with the bolts 2, the portion of each bolt which is disposed between the underside of the cover 1 and the top of the insulating plate 3 is surrounded by an insulating sleeve 9, which sleeve also acts to prevent undue strain on the cover when the bolts 2 are tightened. The cable where it leaves the portion 5 of the cover is secured to the cover by means of waxed manila cord 10 or the like, which cord extends through holes in the cover and is wrapped around the cover and firmly tied in place.

The plug receptacle B in the form illustrated in the drawings comprises a top plate 11, the rear portion of which is provided with a plurality of vertical holes 12, each of which receives a terminal post 13. The terminal posts 13 are of the type which have been adopted as standard in the railway signaling field, and are provided at their lower ends with square heads 13^a (see Fig. 7) which fit in rectangular recesses 14 formed in the

underside of the top plate 11 at the lower ends of the holes 12, whereby the terminal posts are prevented from turning relative to the top plate 11. The upper end of each terminal post 13 is provided with a washer 15, a nut 16 which secures the terminal post to the top plate, two washers 17 between which the end of a circuit conductor is adapted to be clamped, a nut 18 for clamping a circuit conductor between the washers 17, and a lock nut 19. A conducting strip 20 is clamped at one end between the head of each terminal post 13 and the underside of the top plate, and each of these conducting strips is provided with a downwardly offset forwardly projecting portion 20^a to which a substantially U-shaped spring clip or jack 21 is riveted. The spring clips or jacks 21 are disposed within a relatively large recess 22 which is formed in the underside of the top plate in front of the terminal posts, and each clip is provided at its upper end with spaced confronting return bends 21^a (see Fig. 5) which are adapted to be clamped into engagement with the opposite sides of an associated one of the plug fingers 4, by means which I will describe hereinafter. Formed in the top plate 11 directly above each spring clip is an opening 23 for the reception of a plug finger, the parts being so arranged that each opening will align with a different one of the plug fingers when and only when the plug and plug receptacle occupy predetermined relative positions. The underside of the top plate is formed with a rabbet groove 24, and secured to the underside of the top plate by means of hollow eyelets 25 is a bottom plate 26, the edges of which engage the top plate within the rabbet groove. The bottom plate 26 serves to enclose the conducting strips and spring clips, thus precluding the danger of short circuits, while the eyelets 25 serve as openings for the reception of bolts, screws, or the like, by means of which the plug receptacle may be secured to any suitable support. The upper side of the bottom plate is formed with longitudinal grooves 27 (see Fig. 11) which receive the offset portions 20^a of the conducting strips 20, and with rectangular recesses 28 which receive the lower ends of the spring clips 21, whereby the bottom plate assists in holding the conducting strips and spring clips in the desired parallel spaced relation.

The means referred to hereinbefore for clamping the spring clips into engagement with the contact fingers of the plug A comprises two clamping plates 30 and 31 which fit within the recess 22 in the top plate 11 in superposed relation in such manner that a limited amount of relative longitudinal movement of these clamping plates is permitted. The clamping plates 30 and 31 are alike, and as will be apparent from an inspection of Figs. 9 and 10, in which the plate 30 is shown in detail, each of these plates is provided with a plurality of rectangular holes *a*, one for receiving each spring clip 21, and with a plurality of lugs *b* one of which projects away from the plate adjacent one end of each of the holes *a*. The plates 30 and 31 are so disposed that the holes in the two plates align vertically with each other, and receive the upper ends of the spring clips 21, and that the lugs *b* on the plate 30 each extend downwardly into the right-hand end of a different one of the holes *a* of the lower plate 31, as viewed in Fig. 6, while the lugs *b* on the plate 31 each extend into the left-hand end of one of the holes *a* in the upper plate 30, as viewed in Fig. 6. It will be seen, therefore, that one of the lugs *b* on the upper plate 30 is disposed at one side of each spring clip, while one of the lugs *b* on the lower plate is dis-

posed on the other side of each spring clip, and that, as a result, if the two plates 30 and 31 are moved relative to each other in the proper directions, the lugs will act to simultaneously force the two arms of each clip toward each other.

The two clamping plates are arranged to be moved relative to each other in the proper manner to move the arms of the spring clips toward each other to finger engaging positions, or permit the arms to move away from each other due to an inherent bias to their normal positions in which they are shown in the drawings, by means of a wedge-shaped nut 33 which is screwed onto the inner end of a locking screw 34, and which is slidably mounted in a transversely extending channel formed by grooves *c* which are provided in the confronting faces of the plates 30 and 31. The right-hand side of the groove *c* in the upper plate 30, as viewed in Fig. 5, and the left-hand side of the groove *c* in the lower plate 31, each extend at right angles to the longitudinal axis of the associated clamping plate, whereas the other side of each of these grooves is sloped or inclined in such manner that movement of the wedge-shaped nut toward the front of the plug receptacle will force the upper clamping plate 30 toward the left and the lower clamping plate 31 toward the right, but that, movement of the wedge-shaped nut 33 away from the front of the plug receptacle will permit the upper clamping plate to move toward the right and the lower clamping plate toward the left. The locking screw 34 is rotatably mounted adjacent its outer end in the forward wall of the top plate 11, and is provided at its outer end with a hexagonal nut 35 which is pinned to the locking screw, and which, together with a shoulder 34^a that is formed on the screw within the recess 22 on the inside of the top plate wall acts to prevent longitudinal movement of the screw. The nut 35 also facilitates rotation of the screw. The parts are so arranged that the wedging nut 33 will be moved toward or away from the front of the plug receptacle according as the locking screw is rotated in a clockwise or a counter-clockwise direction, and it will be apparent, therefore, that the arms of the spring clips may be moved toward each other to their clamping positions by rotating the locking screw in a clockwise direction, and that the arms of the spring clips may be permitted to move away from each other to their released positions by rotating the locking screw in the opposite direction.

In utilizing an electrical connector embodying my invention, the terminal posts of the plug are connected to an electrical device such as a relay which is adapted to form a part of a signaling system or the like, and the terminal posts of the plug receptacle are permanently connected to the circuit conductors of the system. When it is desired to connect the relay with the system, the nut 35 is rotated to the position in which the spring clips occupy their released positions, and the fingers of the plugs are then inserted through the openings 23 in the top plate of the plug receptacle, after which the nut 35 is rotated in a clockwise direction to a position in which the arms of the clips are firmly clamped into engagement with the plug fingers. When it is desired to disconnect the relay from the system, the nut 35 is rotated in a counter-clockwise direction to a position in which the arms of the clips are permitted to return to their released positions, and the plug is then disengaged from the plug receptacle. The parts are so proportioned that when the clip arms occupy their released positions, the plug fingers will slip

into place between the return bends of the clips with substantially no resistance, and it will be seen, therefore, that a connector embodying my invention permits an electrical control device such as an electrical relay to be readily connected with or disconnected from any circuit in which it is used, and at the same time insures a low resistance connection between the cooperating contact members of the plug and plug receptacle when the plug is coupled with the plug receptacle in the intended manner.

Although I have herein shown and described only one form of apparatus embodying my invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of my invention.

Having thus described my invention, what I claim is:

1. An electrical connector comprising a plug provided with a plurality of projecting contact fingers, and a plug receptacle comprising an insulating plate provided with a recess in its underside and with a plurality of holes through which the fingers of said plug are adapted to extend into said recess, a plurality of terminal posts secured to said insulating plate, a plurality of spring clips one disposed in said recess in a position to engage each finger of said plug and each electrically connected with a different one of said terminal posts, and means for forcing the clips into engagement with the finger comprising two insulating clamping plates movable longitudinally in opposite directions and means for moving the plates.

2. A plug receptacle comprising an insulating plate provided with a recess in its underside and with a plurality of holes through which the contact fingers of a cooperating plug are adapted to be inserted into said recess, a U-shaped clip mounted in said recess below each hole in said insulating plate and provided at its upper ends with means for engaging the opposite side of an associated plug contact finger, two longitudinally movable insulating clamping plates mounted in said recess in superposed relation and provided with aligned holes which receive said clips and with means responsive to relative longitudinal movement of said clamping plates for simultaneously forcing the two arms of each clip toward each other to cause the clip to engage an associated plug contact finger, and means for moving said clamping plates relative to each other.

3. A plug receptacle comprising an insulating plate provided with a recess in its underside and with a plurality of holes through which the contact fingers of a cooperating plug are adapted to be inserted into said recess, a U-shaped clip mounted in said recess below each hole in said insulating plate and provided at its upper ends with means for engaging the opposite side of an associated plug contact finger, two longitudinally movable insulating clamping plates mounted in said recess in superposed relation and provided with aligned holes which receive said clips and with means responsive to relative longitudinal movement of said clamping plates for simultaneously forcing the two arms of each clip toward each other to cause the clip to engage an associated plug contact finger, said clamping plates being provided with confronting transversely extending grooves which together form a channel, each said groove being provided with a straight side and a slanting side so disposed that

the slanting side of the two grooves are located on opposite sides of the grooves, a wedge-shaped member slidably mounted in the channel formed by said grooves and cooperating therewith in such manner that longitudinal movement of said member in said channel will cause relative longitudinal movement of said clamping plates, and means for moving said wedge-shaped member.

4. A plug receptacle comprising an insulating plate provided with a recess in its underside and with a plurality of holes through which the contact fingers of a cooperating plug are adapted to be inserted into said recess, a U-shaped clip mounted in said recess below each hole in said insulating plate and provided at its upper ends with means for engaging the opposite side of an associated plug contact finger, two longitudinally movable insulating clamping plates mounted in said recess in superposed relation and provided with aligned holes which receive said clips and with means responsive to relative longitudinal movement of said clamping plates for simultaneously forcing the two arms of each clip toward each other to cause the clip to engage an associated plug contact finger, said clamping plates being provided with confronting transversely extending grooves which together form a channel, each said groove being provided with a straight side and a slanting side so disposed that the slanting side of the two grooves are located on opposite sides of the grooves, a wedge-shaped nut slidably mounted in the channel formed by said grooves and cooperating therewith in such manner that longitudinal movement of said nut in said channel will cause relative longitudinal movement of said clamping plates, and a locking screw rotatably mounted in a wall of said insulating plate and extending into said channel and cooperating with said nut in such manner that rotation of said screw will cause longitudinal movement of said nut in said channel.

5. A plug receptacle comprising an insulating plate provided with a recess in its underside and with a plurality of holes through which the contact fingers of a cooperating plug are adapted to be inserted into said recess, a plurality of terminal posts mounted on said insulating plate at one side of said recess, a U-shaped clip mounted in said recess below each hole in said insulating plate by means of a conducting strip which is secured to and electrically connects the clip with a corresponding terminal post, each said clip being provided at its upper end with means for engaging the opposite sides of an associated plug contact finger, two similar longitudinally movable insulating clamping plates mounted in said recess in superposed relation and provided with aligned holes which receive said clips and with a lug adjacent one end of each hole which extends into the aligned hole in the other clamping plate in such manner that a lug of one clamping plate is disposed on one side of each clip and a lug of the other clamping plate is disposed on the other side of each clip and that relative movement of the clamping plates in one direction will act through the lugs to force the two arms of each clip toward each other to cause the clips to engage an associated plug contact finger, and means for moving said clamping plates relative to each other.

6. A plug receptacle comprising an insulating plate provided with a recess in its underside and with a plurality of holes through which the contact fingers of a cooperating plug are adapted to be inserted into said recess, a plurality of terminal posts mounted on said insulating plate at one

side of said recess, a U-shaped clip mounted in said recess below each hole in said insulating plate by means of a conducting strip which is secured to and electrically connects the clip with a corresponding terminal post, each said clip being provided at its upper end with means for engaging the opposite sides of an associated plug contact finger, two similar longitudinally movable insulating clamping plates mounted in said recess in superposed relation and provided with aligned holes which receive said clips and with a lug adjacent one end of each hole which extends into the aligned hole in the other clamping plate in such manner that a lug of one clamping plate is disposed on one side of each clip and a lug of the other clamping plate is disposed on the other side of each clip and that relative movement of the clamping plates in one direction will act through the lugs to force the two arms of each clip toward each other to cause the clips to engage an associated plug contact finger, said clamping plates being provided with confronting transversely extending grooves which together form a channel, each said groove being provided with a straight side and a slanting side so disposed that the slanting side of the two grooves are located on opposite sides of the grooves, a wedge-shaped member slidably mounted in the channel formed by said grooves and cooperating therewith in such manner that longitudinal movement of said member in said channel will cause relative longitudinal movement of said clamping plates, and means for moving said wedge-shaped member.

7. A plug receptacle comprising an insulating plate provided with a recess in its underside and with a plurality of holes through which the contact fingers of a cooperating plug are adapted to be inserted into said recess, a plurality of terminal posts mounted on said insulating plate at one side of said recess, a U-shaped clip mounted in said recess below each hole in said insulating plate by means of a conducting strip which is secured to and electrically connects the clip with a corresponding terminal post, each said clip being provided at its upper end with means for engaging the opposite sides of an associated plug contact finger, two similar longitudinally movable insulating clamping plates mounted in said recess in superposed relation and provided with aligned holes which receive said clips and with a lug adjacent one end of each hole which extends into the aligned hole in the other clamping plate in such manner that a lug of one clamping plate is disposed on one side of each clip and a lug of the other clamping plate is disposed on the other side of each clip and that relative movement of the clamping plates in one direction will act through the lugs to force the two arms of each clip toward each other to cause the clips to engage an associated plug contact finger, said clamping plates being provided with confronting transversely extending grooves which together form a channel, each said groove being provided with a straight side and a slanting side so disposed that the slanting side of the two grooves are located on opposite sides of the grooves, a

wedge-shaped nut slidably mounted in said channel and cooperating therewith in such manner that longitudinal movement of said nut in said channel will cause relative longitudinal movement of said clamping plates, and a locking screw rotatably mounted in a wall of said insulating plate and extending into said channel and cooperating with said nut in such manner that rotation of said screw will cause longitudinal movement of said nut in said channel.

8. A plug receptacle comprising an insulating plate provided with a recess in its underside and with a plurality of holes through which the contact fingers of a cooperating plug are adapted to be inserted into said recess, a plurality of terminal posts mounted on said insulating plate at one side of said recess, a U-shaped clip mounted in said recess below each hole in said insulating plate by means of a conducting strip which is secured to and electrically connects the clip with a corresponding terminal post, each said clip being provided at its upper end with means for engaging the opposite sides of an associated plug contact finger, two similar longitudinally movable insulating clamping plates mounted in said recess in superposed relation and provided with aligned holes which receive said clips and with a lug adjacent one end of each hole which extends into the aligned hole in the other clamping plate in such manner that a lug of one clamping plate is disposed on one side of each clip and a lug of the other clamping plate is disposed on the other side of each clip and that relative movement of the clamping plates in one direction will act through the lugs to force the two arms of each clip toward each other to cause the clips to engage an associated plug contact finger, means for moving said clamping plates relative to each other, and a bottom plate of insulating material secured by means of hollow eyelets to the underside of said insulating plate and enclosing said clips and said conducting strips and provided in its upper surface with rectangular recesses which cooperate with the clips and with longitudinal grooves which cooperate with the conducting strips to maintain the clips and strips in predetermined positions.

9. An electrical connector comprising a plug provided with a plurality of projecting contact fingers, and a plug receptacle comprising an insulating plate provided with a recess in its underside and with a plurality of holes through which the fingers of said plug are adapted to extend into said recess, said fingers and said holes being so disposed that said fingers can be inserted into said holes when and only when said plug and said plug receptacle occupy one relative position, a plurality of terminal posts secured to said insulating plate, a plurality of spring clips one disposed in said recess in a position to engage each finger of said plug and each electrically connected with a different one of said terminal posts, and means for forcing the clips into engagement with the fingers comprising two clamping plates movable longitudinally in opposite directions and means for moving the plates.

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