The present invention relates to electric connectors for industrial uses, and more particularly to a connector of the kind comprising a plug and a receptacle each of which parts may be movable or stationary.

Connectors for industrial uses carry frequently rather heavy currents and high voltages so that any accidental or willful contact with a current carrying component is highly dangerous and an accidental separation of the two connector parts may cause damage to the equipment connected by and to the connector.

Several connector designs are known for the purpose of preventing accidental or willful contact with current carrying components. However, guards as hitherto known do not positively guard against access to current carrying components, at least not against willful access past the guard, for instance, for the purpose of testing whether a receptacle is under current.

Accordingly, the principal object of the present invention is to provide a novel and improved connector of the general kind above referred to, which affords the combined advantage of preventing accidental separation of the connector parts and positively guarding against accidental or willful contact with any current carrying component of the connector.

The invention provides a novel and improved connector in which the contact elements of the plug and the receptacle are locked to each other by turning these two parts relative to each other, and the receptacle of which includes safety means which positively block accidental or willful contact to any of the load current carrying contact elements of the connector.

The invention also provides a novel and improved connector receptacle, the contact elements of which are positively shielded or blocked unless and until the plug is inserted and locked to the receptacle, and are automatically re-blocked when the plug is withdrawn. Such safety means eliminates all possibility of accidental or willful contact with current carrying components.

The invention further provides a novel and improved connector receptacle in which the wires carrying the load current and leading to the receptacle are disconnected from the contact elements of the receptacle unless and until the plug is inserted, and are again automatically disconnected when the plug is withdrawn. Such connection and disconnection of the receptacle wires by the insertion and withdrawal respectively of the plug also effectively preclude all possibility of accidental or willful contact with the current carrying components.

Other and further features and advantages of the invention will become apparent from the drawings and the following description.
be more fully described hereinafter. The different shape of contact shoe 8 also provides polarity identity. Each of the contact shoes is fitted in longitudinal grooves provided for this purpose in posts 4 and 5 and also extending through the disc proper. The grooves for the three contact shoes of equal size are designated by 9 and the groove for the ground contact shoe 8 is designated by 10. The shoes may be secured in the grooves by any suitable means; they may be for instance directly molded in the posts.

In this connection it should be pointed out that while four contact shoes are shown, a smaller or larger number may also be provided. The tails 7' and 7'' of each contact shoe rearwardly protruding from disc 3 are accommodated in the grooves of post 5 which also serves to accommodate binding screws 11, 12, and 13. The top of the post material between each two grooves accommodating the binding screws may be tapered as is shown at 14 to facilitate the connection of the lead wires to the binding screws.

The spade-shaped portion of each contact shoe has an upper radial edge 15 and 16 respectively. The edges of all four contact shoes are disposed at the same distance from the flat face 17 of the disc 3 for a purpose which will become more fully apparent from the subsequent description. The subassembly formed by disc 3, post 4, and 5 and the contact shoes mounted thereon is fitted in a metal shell or casing 20. This shell which is shown in the form of a deep cup has through its bottom an opening 21 for the insertion of a cable or cord 22 to be connected to the plug. Shell 20 also houses an insulating liner 23, the configuration of which matches the inner contour of the shell. Liner 23 is inserted in the shell with a tight fit. To prevent rotation of disc 3 and the parts mounted thereon relative to the liner, the disc and the liner engage each other by means of circumferentially spaced locating notches 24 and corresponding noses 25 extending from the liner. Notches 24 may be unevenly spaced, or may have different circumferential widths or axial depths to enforce insertion of the sub-assembly in a fixed rotational position relative to shell 20.

Disc 3 may be secured within the shell by any suitable fastening means. There are shown short screws 26 which are threaded through holes in disc 3 into suitably threaded holes formed in shell 20. Instead of the short screws, long screws may also be extended through disc 3 and the side wall of liner 23 into the base of shell 20.

To secure cable 22 to the plug, a cable clamp 30 is provided. The cable clamp comprises two generally L-shaped elements 31 and 32. Each of these elements has a flat arm extending through opening 21 and clamped between the base of shell 20 and the base of liner 23. The other arm of each element protrudes from opening 21 and has a curved cross-section substantially matching the curvature of cable 22. Screws 33 pass through ears 31' and 32' extending from clamping elements 31 and 32 and serve to tighten the clamp against cable 22. As is evident, cable clamps of different design may be readily employed and in certain instances, special clamping means may be entirely omitted. The stripped ends of lead wires are secured to the respective contact shoes by means of the binding screws, as is clearly shown in Fig. 1 for binding screw 12 and contact shoe 7.

As has been previously stated, contact shoe 8 serves as a ground contact. To this end, a contact strip or tongue 35 extends from contact tail 8', substantially parallel to the inner face of the shell, as shown at 35' in Fig. 12, which thus serves as ground. Liner 23 may be slightly notched at the circumferential point at which strip or tongue 35 passes between the disc and the liner.

Disc 3 constitutes a closure for shell 20 so that the same is closed except for opening 21 when the plug is reassembled after the connection of the lead wires. To protect the interior of the plug against the ingress of dust, dirt and moisture, a sealing pad 36 may be interposed between the face of post 5 and the bottom wall of liner 23. The pad may be located in the liner by means of a recess 37 formed in the bottom wall thereof. The pad may be a relatively thin soft rubbery material. It has a central opening 38 through which the end of cable 22 is forced so that a sealing is formed effectively sealing opening 21 when the plug is fully assembled.

Receptacle 2 comprises a comparatively heavy block 40 of insulation material. As the receptacle is shown in the form of a wall receptacle, block 40 may have a generally rectangular outline. It may be mounted in the wall by any suitable means, as shown for mounting bridges 41 and 42, which are fitted in cutouts 43 and secured to block 40 by mounting screws 44 extending through the entire thickness of block 40. The block has a central bore or opening 45 extending through the block from front to rear and having longitudinal recesses 46 in its wall. There are provided four recesses 46 one for each of the four contact shoes on the plug. The recesses serve to receive the contact shoes so as to permit a longitudinal movement of the contact shoes in the receptacle during the insertion of the plug and also a rotational movement of the contact shoes as limited by the side walls of the recesses. To provide space for such rotational movement, the circumferential width of the recesses is in excess of the circumferential width of the shoes. Three of the recesses have the same circumferential width whereas the recess for receiving the wider ground contact shoe 8 is of greater circumferential width.

The four recesses in conjunction with the wall material of block 40 between each two recesses define in the end face 47 a plug entrance opening 45' which corresponds to the peripheral outline of post 4 and the spades of the four contact shoes radially extending therefrom. This opening 45' includes four notches or recesses 6', 7'', 8'', and 8'' to receive the four contact shoes. However, each of the four recesses ends short of the block face 47 to form four shoulders 48. Within each recess 46 and exposed through the open side thereof is placed a resilient metal contact spring or blade 50. The contact blades are retained in the block for instance by having extensions recessed in suitable cutouts, and are retained in such cutouts by an insulation cover plate 51. Each contact blade has an extension strip or tongue 52 fitted in a recess 53 except the contact blade coating with ground contact shoe 8. A binding screw 54 is threaded into each one of extension strips 52, but the contact blade coating with ground contact shoe 8 is connected by an extension strip to a metal cover plate 55 which thus serves as ground. Insulation plate 51 and metal plate 55 are also secured to block 40 by screws 44. It is of course also possible to provide a binding screw for the contact blade coating with ground contact shoe 8, but such binding screw is seldom used, as a wire is usually unnecessary for a ground contact. An auxiliary tensioning spring 60 is disposed between the rear side of each contact blade 50 and the adjacent wall of recess 46. Each of these tensioning springs has a base of resilient metal located in the lower end and is bent slightly out of the plane of the body of the spring to increase the tensioning thereof. Each of the springs rests upon the bottom of the respective recess 46, or more specifically upon insulation plate 51.

The function of the connector as hereinbefore described.

Post 4 and the contact shoes thereon, the combined peripheral outline of which corresponds to the peripheral outline of receptacle bore 45 at the receiving end thereof, are pushed into the bore until face 17 of the plug and face 47 of the receptacle are very close to each other or in direct abutment. In this position of the plug the contact shoes thereon engage the respective contact springs 50 and
are held in intimate contact therewith by the action of the auxiliary tensioning springs 60. This is the position of Fig. 9. The plug is now turned relative to the receptacle to the position shown in Figs. 10 and 12, until the edges 15 and 16 of the contact shoes underlie shoulders 48 in the receptacle thereby positively preventing a separation of the plug and the receptacle, and the plug is returned into its position of rotation in which the contact shoes clear shoulders 48. The contacts 50 are wide enough so that the edges 7, 7a, and 8 engage them as the plug is inserted in the receptacle in the position of Fig. 9. Thus, maintaining this electrical contact while the plug is turned to the locking position of Fig. 10.

The greater width of contact shoe 5 assures that the plug can be inserted only in a definite rotational position relative to the receptacle, in which position ground contact shoe 5 engages the ground contact spring 50.

Turning now to the safety means which include a slider 65 made of an insulating plastic such as Bakelite, a pin 66 and a spring 47, these safety means serve a dual purpose, to wit, to secure the contact shoes of the plug and the contact springs of the receptacle in contact engagement so that the two connector parts cannot become accidentally separated and to prevent accidental or even willful access to the contact springs 50 which carry the load current when the receptacle is connected.

Pin or center post 66 of the safety means is secured to cover plate 55 by any suitable means such as a rivet 68 and a collar 69, and supports the spring 47. The spring urges slider 65 downward toward the receiving end of bore 45 by means of a cam 70. Slider 65 is restrained within the bore near the receiving end thereof by abutment with one or preferably several circumferentially spaced shoulders 71. As is evident, the slider can and is intended to be depressed in the bore against the action of spring 47 by pressing against thereto by the face of post 4, but it can also be depressed by any other force, for instance, by hand or by means of a tool such as a screwdriver. Depressor of the slider, say for instance by means of a screwdriver exerts the current carrying contact springs 50, thus endangering a person using or rather misunderstanding the receptacle by forcing down the slider in a manner not intended.

To prevent misuse of the receptacle in the aforesaid indicated or a similar manner, slider 65 is positively releasably locked in its uppermost or guard position shown in Fig. 1 and also in Fig. 2. To attain such positive releasable locking of the slider, the slider has a central opening 72 through which protrudes the upper end of post 66 and also a cylindrical portion 70 of cam 70. The cam is slidable on post 66 and also relative to slider 65. The cylindrical cam portion 70 is continued in an outwardly tapered camming surface 70′ which ends in a peripheral locking area or surface 70″. The cam is also formed with a shoulder 70α against which abuts spring 47. Camming surface 70″ coacts with slider 65 and also with locking pins 73, preferably made of insulating material such as nylon. The locking pins are slidable in holes through slider 65 extending transversely of the axis of the post 66 and hence of bore 45. Several circumferentially spaced locking pins are preferably provided. The end of each pin opposite the end coacting with cam 70 protrudes into a longitudinal recess 74 formed in insulating body 40. The bottom 74α of each recess is downwardly and inwardly inclined to form a cam surface coacting with the respective protruding end of the locking pins. The circumferential width of each recess 74 is preferably slightly in excess of the diameter of the locking pins to facilitate up and down displacement of the pins in the recesses. For the same purpose the outer or rear wall of each recess may also be longitudinally curved to match the rounded tips of the locking pins.

Cam 70 is actuated by a sleeve 75 protruding from the face of post 4. Sleeve 75 may be made, for instance, of steel and molded in the post.

The safety means performs its dual function as follows: When and as long as the receptacle is separated from the plug, all the components are in the position shown in Figs. 1 and 2, that is, slider 65 is pressed by tensioned spring 47 into the position in which it abuts against shoulder 71 thereby keeping access to current carrying contact springs 50. The locking area or surface 70′ of the cam abuts against the locking pins thereby retaining the same in the position in which they extend into recesses 74. As a result an accidental or even willful depression of slider 65 by applying pressure thereto is prevented, locking pins 73 locking such depression.

Let it now be assumed that it is intended to insert the plug. When the plug is applied to the receptacle, sleeve 75 will first engage the cylindrical portion 70′ of cam 70 thereby depressing the latter. As a result the locking pins are freed from engagement with the locking surface 70″. Fig. 3 shows this stage of the operation. As the plug is deeper depressed and the face of plug post 4 engages slider 65 the locking pins are inwardly guided by the slanted surface 74α of recesses 74 until all the locking pins leave the recesses. Fig. 4 shows the stage of the operation in which the locking pins are just clear of the recesses. By pushing the plug deeper into the bore and finally turning the plug relative to the receptacle, the contact shoes of the plug are first brought into engagement with the contact springs 50 and then retained in this position by edge 15 and 16 and underlying shoulders 48 as previously described. At the same time, slider 65 is depressed deeper into the bore and now strongly loaded spring 47 presses the contact shoes against shoulder 48, thus preventing an accidental or casual release of the plug.

Slider 65 may have on its face ridges 76 engageable with corresponding grooves 76′ in the face of plug post 4, to impose further a casual or accidental release of the plug by turning the same into the position in which its contact shoes clear shoulders 48.

To release the plug the same is returned into the position in which the contact shoes are free of shoulders 48. As a result the spring pressure now released will force upwardly slider 65 and with it the entire plug. During this upward movement cam surface 70″ will exert a radially outward pressure upon locking pins 73. When the cam has again reached the position of Fig. 4, the locking pins will begin to move into the recesses 74 until all components finally re-occupy the position of Fig. 2, in which the slider is again positively locked.

As is apparent from the previous description, slider 65 is positively locked unless and until the plug is inserted. It is automatically unlocked by such insertion and is also automatically relocked by the withdrawal of the plug.

In the aforesaid embodiment of the invention, sleeve 75 protrudes from the face of the plug and cam portion 70′ is flush with the face of slider 65. When the plug is or may be subjected to rough usage, the protruding sleeve 75 may be damaged. Fig. 5 shows an arrangement which is particularly advantageous when rough usage of the plug may be expected. According to this figure the cylindrical portion 70α is extended beyond the face of slider 65 so that it will be engaged and the cam will be depressed in the first stage of the operation during the application of the plug to the slider as previously described. As the plug, or more specifically the post 4 of the plug, is made of insulating material, it is advisable to protect the insulating material by fitting in a bore 80 for receiving the protruding tip of post 66 a metal bushing 81 flush with the face of the plug post.

The function of the connector according to Fig. 5 is apparent from the previous description. However, as the upper portion of the sleeve 70b is exposed, it is possible that it be grasped or depressed by an instrument, such as a screw driver, but as it is a relatively small mem-
ber and the portion exposed is not large, the chances of anyone so operating the device are small. The embodiment of the invention as described, access to the current carrying contact springs is directly and physically blocked until and unless the plug is inserted. According to a further development of the invention the same safety feature of preventing accidental or even willful access to the contact springs is attained by disconnecting the contact springs from the lead wires carrying the load current unless and until the plug is inserted, and receptacles of this kind are shown in Figs. 6 and 7.

Turning to Fig. 6: the plug of the connector shown in this figure is the same as shown in Fig. 1, except that the tubular extension 75 is omitted. The receptacle of Fig. 6 is also in principle the same as the receptacle of Fig. 1 as to the insertion of the plug in bore 45 of the receptacle, the engagement of the plug contact elements with the receptacle contact elements and the releasable retention of the plug in the receptacle in contact making position by the engagement of the contact shoes of the plug with shoulders 48 when the plug has been turned relative to the receptacle. Accordingly, the same reference numerals are used to designate corresponding components.

Slider 65 of Fig. 1 which is positively locked in the structure according to this figure unless the plug is inserted is replaced by an insulation disc 80 which is slidable in bore 45 irrespective of whether the plug is inserted. The disc is urged by spring 67 into the closure position of Fig. 6 in which it is restrained by overhanging portions of insulating block 40. As previously mentioned, the outline of the receiving opening of bore 45 matches the peripheral outline of plug post 4 and the contact shoes mounted thereon, whereas the outline of slider 80 is circular. The slider has a central opening through which slidable protrudes a guide pin 81.

It is apparent the omission of the positive locking means of Fig. 1 permits an accidental or willful depression of slider 80, and hence access to contact springs 50 which carry the load current and high voltage for which connectors of the kind here shown are normally used. The safety means according to Fig. 6 while not preventing physical access to the contact springs by an accidental or willful depression of theslider 80 are designed to render such access harmless. This purpose is achieved by disconnecting the contact springs from the load current and high voltage carrying wires when and as long as the plug is not inserted.

The safety means of Fig. 6 comprise an electromagnet switch 82 which controls the connections of the load current carrying the wires 83, 84 and 85 of a cable 86 to the corresponding three contact springs 50, the fourth wire 87 being connected directly to the contact spring 58 carrying with ground contact shoe 8 of the plug. Switch 82 has an armature 88 mounting three contacts 89, 90 and 91. These movable contacts connect with stationary contacts 92, 93 and 94 which in turn are connected with the three corresponding contact springs 50. The connection of contact 92 with binding screw 54 of one of the corresponding modifications is shown. The two other connections and also the direct connection through wire 87 are indicated by arrowed lines. The switch is biased, for instance by gravity, into its open position when it is deenergized. The energization of the solenoid coil of the switch is controlled by a second switch, or electrical contacts of which are connected to the solenoid coil as shown. Switch 95 has a movable, preferably springy switch arm 96 which is biased by a spring 97 into the open position. The closing of switch 95 is controlled by pin 81 which for this purpose is axially slidable in bore 45. The tip of pin 81 is guided to slide in the aforementioned central opening of slider 80 and the lower end of the tip extends through an opening in an insulation disc 98 defining a compartment in the receptacle separating contact springs 50 from switch 95 thereby rendering the latter inaccessible even if slider 80 is accidentally or willfully depressed. Partition 98 also serves as the lower abutment for spring 67, the other end of which abuts against the preferably recessed slider 80 thereby urging the said partitions into the illustrated closure position. An insulation button 99 is preferably interposed between pin 81 and switch arm 96.

As is apparent from Fig. 6, contact springs 50 are disconnected from the load current in the position of the components as shown. Accordingly a willful or accidental contact with contact springs 50 does not present any danger.

When the plug is now inserted in the receptacle, engagement of the face of plug post 4 will depress slider 80 against the action of spring 67 and also pin 81 against the action of spring 97 as it engages flange 81' on this pin. As a result, switch 95 closes the energizing circuit for switch 82 which now connects the load current carrying cable wires to contact springs 50. At the same time, the partial insertion of the plug in the receptacle renders impossible access to the contact springs which are now under current.

The insertion of the plug is completed as previously described by pushing the plug fully into the receptacle and turning the plug to lock the same in the receptacle. When the plug is withdrawn, pin 81 follows the plug and reopens switch 95 just before the plug leaves the receptacle thereby automatically disconnecting springs 50 from the cable wires.

The connector according to Fig. 7 combines the safety features of Figs. 1 and 6. Of course, pin 66, cam 70 and sleeve 75 may be modified in the manner shown in Fig. 5.

Accordingly the receptacle of Fig. 7 is equipped with the positive locking means for the slider 65 according to Fig. 1 and the switch controlled connections of Fig. 6. The operation of the arrangement of Fig. 7 is evident from the previous description. It suffices to state that the insertion and withdrawal of the plug control the combined action of the safety means. Engagement of the tubular sleeve 75 of the plug will depress cam 70 thereby unlocking the slider and engagement of flange 81' on pin 81 with the base of tubular sleeve 75 will displace pin 81 thereby effecting closing of switch 95.

In addition to the previously mentioned advantages, the arrangement of Fig. 7 affords the advantage of protecting contact springs 50 from damage by willful or accidental access when disc 80 is depressed by preventing depression of the disc except by the insertion of the plug.

The entire switching unit 82 indicated in Figs. 6 and 7 by a dashed rectangle 100 may be mounted in a box structurally or otherwise secured to the receptacle, or may be mounted in a separate housing which is installed remote from the receptacle.

While the invention has been described in detail with respect to certain now preferred examples and embodiments of the invention it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

Having thus set forth the nature of my invention, I claim:

1. An electric connector including a receptacle comprising an insulating body having a bore including an entrance opening at one side of the body, current carrying contact elements mounted within said bore, a plug mounting contact elements insertable into said bore for engagement with the receptacle contact elements, retaining means for releasably locking the plug in the bore of the receptacle, and releasable safety means associated with the receptacle for preventing access to the contact elements in the receptacle bore-com-
prising a closure member for the entrance opening of the bore movable between closed and open positions, releasable locking means including a locking member for locking the closure in the closed position, means including a movable actuating member for releasing said locking means operable by insertion of the plug into the entrance opening of the bore to permit opening of the closure and insertion of the plug into the receptacle, and means for automatically returning the closure to the locked position on removal of the plug.

2. A connector according to claim 1 wherein said safety means comprise a closure member movable between a guard position closing the plug receiving end of said bore to block access to the contact elements therein and an open position, yieldable means preferably spring means biasing said closure member into its guard position, and locking means positively locking the closure member in said guard position, and said locking means being releasable by engagement with the plug thereby freeing the closure member for movement into its release position by engagement with the plug upon insertion thereof into the receptacle bore.

3. A connector according to claim 1 wherein said locking means comprise a locking member movable between a locking position engaging said closure member and said insulation body and a release position withdrawn from either the closure member or the insulation body, and a movable actuating member for retaining said locking member in its locking position or releasing it for movement into its release position, said actuating member being moved into its release effect position by engagement with the plug upon application thereof to the receptacle.

4. A connector according to claim 3 wherein said actuating member is retained by the plug in its position releasing the locking member and while the plug is inserted and locked to the receptacle, and return means effecting return of the locking member into its locking position upon release and withdrawal of the plug.

5. A connector according to claim 1 wherein said locking member is yieldable within the closure member between the locking position in which the locking member protrudes into a recess in the insulation body to lock the closure member to the insulation body and the release position in which the locking member is withdrawn from the insulation body, said return means including cam surfaces on the actuating member and in the recess which guide the locking member out of and into its locking position upon insertion and withdrawal respectively of the plug.

6. A connector according to claim 5 wherein said closure member and said actuating member are slidable in said bore and guided by a guide post therein, the yieldable means urging the actuating member toward its position retaining the locking member in its locking position.

7. A connector according to claim 6 wherein a tubular member fitting said guide post protrudes either from the plug or the actuating member to effect engagement between the actuating member and the plug for moving the actuating member into its position releasing the locking member upon insertion of the plug into the receptacle.

8. A connector according to claim 1 wherein circumferentially elongated shoulders are formed in the bore of the insulation body, said contact elements on the plug when in engagement with the contact elements in the receptacle bore being movable into a position underlying said shoulders by rotating the plug and the receptacle relative to each other whereby the plug is positively locked to the receptacle and released by rotation into the opposite direction.

9. A connector according to claim 8 whereby said safety means press the plug contact elements against said shoulders, thereby securing the plug in the locked position.

10. A connector according to claim 1 wherein said safety means comprise switching means included in load current carrying wires leading to the contact elements in the receptacle, said switching means being biased into the open position and closable by the insertion of the plug and held closed when the plug is inserted whereby the receptacle contact elements carry load current only when and while the plug is inserted and locked to the receptacle.

11. A connector according to claim 10 wherein said switching means are electro-magnetic switching means, the switch contacts of which control the connections of the load current carrying wires to the receptacle contact elements, the energizing circuit for said switching means including a second switching means spring biased into the open position but closed by the insertion of the plug, energization of the electro-magnetic switching means effecting closing of the switch contacts thereof.

12. A connector according to claim 10 wherein said safety means comprise a closure member movable between a position closing the plug receiving end of the receptacle bore and a position exposing the receptacle contact elements, said switching means being shielded by said closure member, the insertion of the plug moving the closure member into the receptacle contact elements exposing position and causing closing of the switching means for connecting the load current carrying wires to the receptacle contact elements, the closure member and the switching means being spring biased to return into the closing position and the open position respectively upon withdrawal of the plug.

13. A connector according to claim 10 wherein said plug is retained in its position holding the closure member in the open position and the switching means in the contact closing position by the plug contact elements underlying shoulders formed in the receptacle bore, the plug being movable into and out of said retained position by rotating the plug into one or the other direction when inserted in the receptacle bore and engaged with the contact elements therein.

14. A container according to claim 11 wherein said bore is divided into two compartments separated from each other by a transverse partition wall, the outer one of said compartments housing the contact elements and being closable by said closure member and the inner one housing said second switching means, and wherein an actuating member for the second switching means is slidably extended from the outer compartment into the inner compartment, said actuating member moving the second switching means into the closed position by engagement of the actuating member with the plug upon insertion of the latter.

15. A connector according to claim 14 wherein said actuating member is in the form of a pin axially displaceable in the bore coaxially therewith, said pin constituting also a guide for guiding the displacement of the closure member in the bore.

16. A connector according to claim 12 wherein said safety means further comprise locking means positively but releasably locking the closure member in its position closing the bore, and actuating means controlling the release of said locking means, said actuating means and said switching means being both controlled by the insertion and the withdrawal of the plug whereby the insertion of the plug automatically unlocks the closure member and closes the switching means and the withdrawal of the plug automatically relocks the closure member and opens the switching means.

17. A connector according to claim 10 wherein said switching means are disposed in a separate housing connected with the receptacle contact elements by the load current carrying wires leading to said contact elements.

18. An electrical connector including a receptacle comprising an insulating body provided with a bore having an entrance opening at the front side of the body, current carrying contact elements mounted within said bore, safety means associated with the receptacle for prevent-
ing access to the contact elements in the receptacle bore comprising a closure member for the entrance opening mounted to normally be in a position closing said opening and to slide inwardly to permit insertion of a plug carrying contacts for engagement with the receptacle contact elements, releasable locking means for the closure including a locking member mounted in the closure and movable to and from cooperating means in the body to lock the closure in the closed position and release it, means including a movable actuating member mounted to retain said locking member in the locking position and shiftable by insertion of a contact carrying plug into said entrance opening to release the locking member and permit the closure to slide inward for entrance of the plug into the receptacle, and means to return the closure to the locked entrance closing position on removal of the plug from the receptacle.

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