

Aug. 18, 1936.

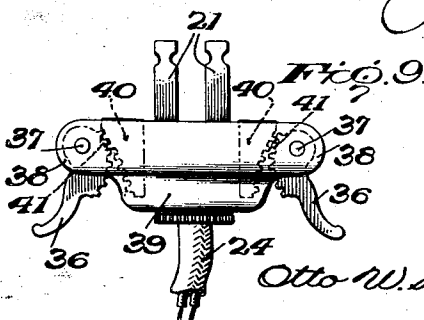
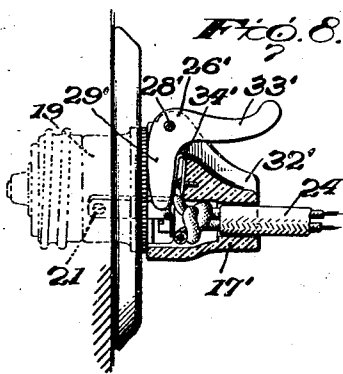
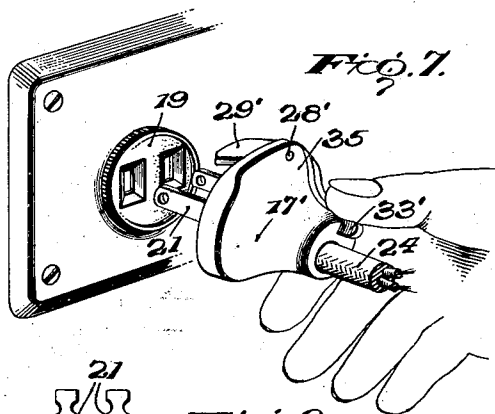
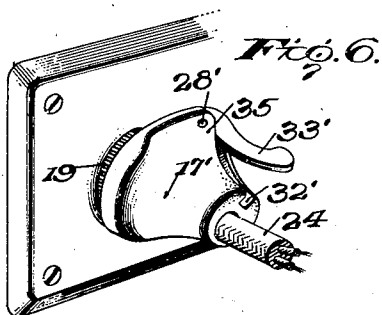
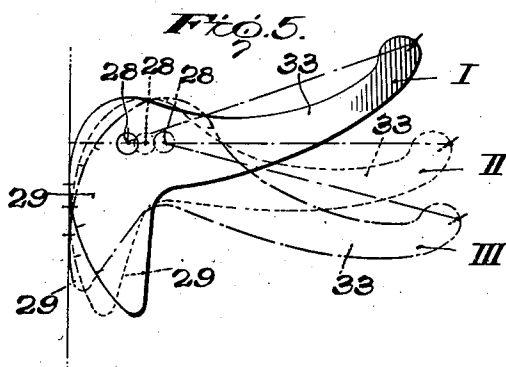
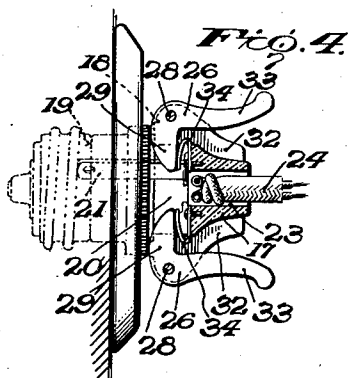
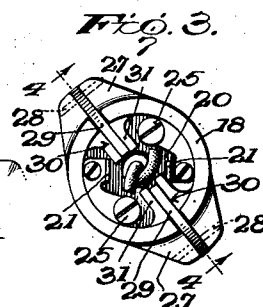
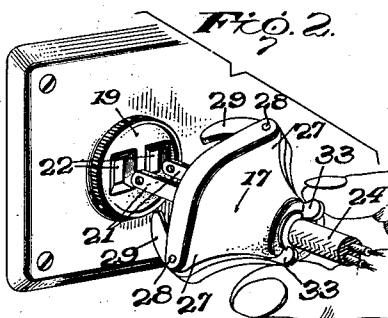
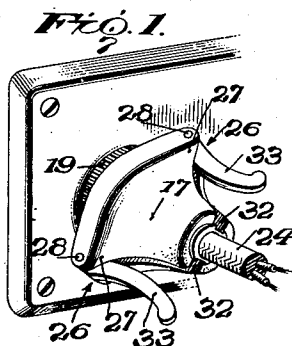
O. W. SCHLUMS

2,051,425

ELECTRIC PLUG

Filed June 25, 1934

2 Sheets-Sheet 1



Inventor

Otto W. Schlums

By Cameron, Kerkam & Lutton
Attorneys

Aug. 18, 1936.

O. W. SCHLUMS

2,051,425

ELECTRIC PLUG

Filed June 25, 1934

2 Sheets-Sheet 2

Fig. 10.

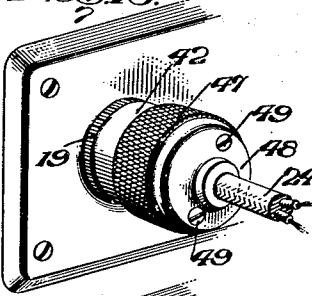


Fig. 11.

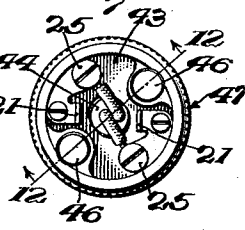


Fig. 12.

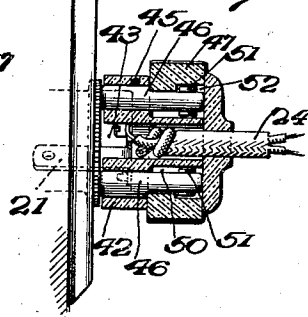


Fig. 13.

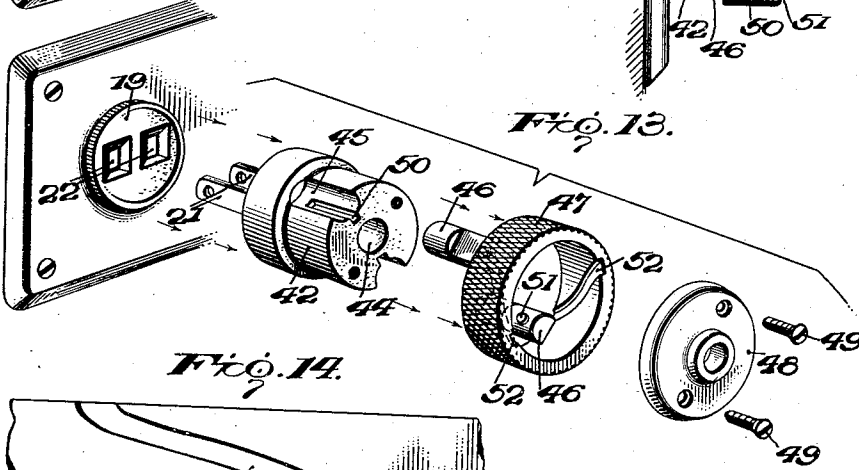


Fig. 14.

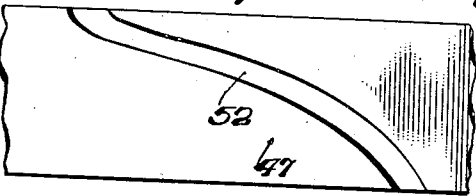


Fig. 15.

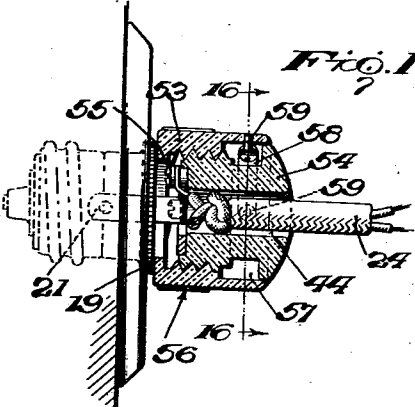
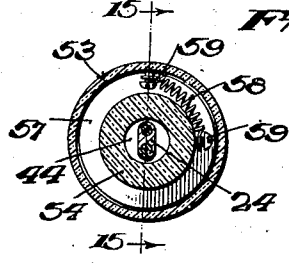


Fig. 16.



Inventor

Otto W. Schlums

By Cameron, Kerkam & Sutton
Attorneys

UNITED STATES PATENT OFFICE

2,051,425

ELECTRIC PLUG

Otto W. Schlums, Winthrop, Mass.

Application June 25, 1934, Serial No. 732,311

13 Claims. (Cl. 173—361)

This invention relates to electric plug devices, and more particularly to plugs of this type which are adapted for removable connection to an electric socket.

Electric plugs of the usual type are notoriously difficult to separate from their sockets because of the frictional grip which is necessarily maintained on the terminal prongs of the plug by the resilient clip terminals of the socket in order to make a good electrical contact. The ordinary plug is usually provided with a knurled portion to be grasped in the hand when separating the plug from the socket, but due to the unsatisfactory grip which this affords, it is a common procedure for the person wishing to disconnect the plug to grasp the electric cord or cable leading thereto and to abruptly pull the plug from the socket by this means. This practice is obviously objectionable since it often tears the electrical conductors loose from their terminals, and causes short circuits and blown fuses.

It is therefore one of the objects of the present invention to provide a novel electric plug which may be quickly and easily detached from an electric socket without injury to the plug or its electrical connections.

Another object is to provide an electric plug embodying novel means for disconnecting the plug from its socket which means affords a mechanical advantage so as to render the disconnection of plug and socket easy of accomplishment and rapid in action.

Still another object is to provide a novel electric plug embodying mechanical means for disconnecting the plug from its socket which means possess a mechanical advantage greater than unity and are capable of actuation by the application of a very small force, the separation of plug and socket occurring so rapidly as to prevent the possibility of arcs and short circuits.

Another object is to provide an electric plug with novel disconnecting means embodying an inherent mechanical advantage that is variable during the disconnecting operation, preferably being greatest at the time of initial disconnecting movement when the resistance to disconnection is likewise at a maximum.

A further object is to provide an electric plug embodying novel means for mechanically disconnecting the plug from its socket wherein the disconnecting force is applied symmetrically with respect to the plug thereby insuring a quick disconnection without the possibility of jamming.

A still further object is to provide a novel electric plug which may be readily and positively disconnected from its socket by mechanical means which plug is simple and rugged in structure, efficient in operation and economical of manufacture.

These and other objects will appear more fully from a consideration of the detailed description of the invention which follows. Although several embodiments of the invention are described and illustrated in the accompanying drawings, it is to be expressly understood that these drawings are for the purpose of illustration only and are not to be construed as a limitation of the scope of the invention. Reference should be had for this latter purpose to the appended claims.

In the drawings, wherein like reference characters indicate like parts throughout the several views;

Fig. 1 is a perspective view of one embodiment of the present invention showing the plug in its connected position;

Fig. 2 is a perspective view of the plug shown in Fig. 1 in its disconnected position;

Fig. 3 is an end view of the plug shown in Figs. 1 and 2;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is a diagram illustrating the variation in mechanical advantage obtainable during disconnection by the use of disconnecting levers constructed in accordance with the present invention;

Fig. 6 is a perspective view similar to Fig. 1 of a second embodiment of the invention;

Fig. 7 is a perspective view similar to Fig. 2 of the embodiment shown in Fig. 6;

Fig. 8 is a sectional view similar to Fig. 4 of the embodiment shown in Figs. 6 and 7;

Fig. 9 is a side view of a third embodiment of the invention;

Fig. 10 is a perspective view similar to Figs. 1 and 6 of a fourth embodiment of the invention;

Fig. 11 is an end view of the embodiment shown in Fig. 10;

Fig. 12 is a sectional view taken on line 12—12 of Fig. 11;

Fig. 13 is a drawn-out perspective view of the embodiment shown in Figs. 10—12 indicating the manner in which the component parts of the plug are assembled and cooperate;

Fig. 14 is a development of a portion of the inner surface of the rotatable collar of the embodiment shown in Figs. 10—13 indicating the

varying pitch of the plunger ejecting grooves thereof;

Fig. 15 is a longitudinal sectional view of a fifth embodiment of the invention taken on line 15—15 of Fig. 16; and

Fig. 16 is a transverse section taken on line 16—16 of Fig. 15.

Referring now to Figs. 1-4, there is shown therein a novel electric plug adapted for removable connection to an electric socket which plug embodies manually operable disconnecting means having an inherent mechanical advantage greater than unity and variable during the disconnecting operation. As shown, the plug comprises a body 17 molded from any suitable insulating material and substantially elliptical in cross section, the sides of the body tapering away from the socket-engaging face of said plug so as to progressively decrease the area of the cross section and thus provide a surface readily adapted to be grasped in the hand. The socket-engaging face of body 17 is provided with a circular flange 18 which is adapted to abut the outer face of socket 19 which may be a wall outlet or any other suitable type of electric socket. The portion of body 17 within flange 18 is hollowed out to provide a recess 20 in which are mounted the usual terminal prongs 21 which are adapted to engage corresponding frictionally gripping terminals 22 provided in socket 19. Plug body 17 is also provided with a longitudinal central bore 23 through which passes an electric cord or cable 24 the conductors of which are electrically connected to terminal prongs 21 in the usual manner as by screws 25. The plug as thus far described comprises all the elements of the usual type of electric plug and may be connected to its socket by simply grasping plug body 17 in the hand and inserting terminal prongs 21 into corresponding terminals 22 of socket 19.

Novel means, however, have been provided for mechanically disconnecting the plug from its socket easily and quickly, and for avoiding the common objectionable practice of performing the disconnecting operation by pulling on cable 24. In the form disclosed, a pair of substantially L-shaped levers 26 are fulcrumed in the diametrically opposite ears 27 of plug body 17 on suitable pins 28 with their inner arms 29 adapted to be housed in grooves 30 formed in the socket-engaging face of plug body 17 between walls 31 made integral with and projecting radially inwardly from flange 18. Suitable grooves 32 are also provided in the outer portion of plug body 17 for receiving outer arms 33 of levers 26. When the plug is in connected position, as shown in Figs. 1 and 4, inner arms 29 are fully housed within grooves 30 and abut the outer face of socket 19, while outer arms 33 extend outwardly from body 17.

Outer arms 33 of levers 26 are suitably shaped so as to provide a good finger grip. When it is desired to disconnect the plug from its socket, outer arms 33 are forced radially inwardly by a slight pressure of the fingers, thereby rocking levers 26 about fulcrum pins 28 and quickly ejecting the plug from its socket due to the abutting engagement of inner arms 29 with the face of socket 19. In the fully disconnected position, shown in Fig. 2, outer arms 33 of levers 26 are fully withdrawn into grooves 32 and inner arms 29 extend outwardly from the socket-engaging face of body 17.

As is shown best in Fig. 5, each of levers 26

is so constructed that the mechanical advantage obtained by the use thereof is always greater than unity, and preferably is variable during the disconnecting operation, being greatest at the time when the resistance to disconnection is also at a maximum—namely, when the plug first commences to move outwardly from its socket. To this end, the outer surface of each of inner arms 29 is curved in such a manner with respect to its fulcrum pin 28 that the effective point of contact between said surface and the face of socket 19 varies as lever 26 moves about its fulcrum in response to the pressure applied to the outer arm 33, moving further away from said fulcrum (and thereby decreasing the mechanical advantage obtained) as the disconnecting operation proceeds.

For example, in the full line position I shown in Fig. 5, corresponding to the fully connected position of plug and socket of Figs. 1 and 4, the distance from fulcrum pin 28 to the end of outer arm 33 is more than four times the distance from said fulcrum to the point of contact between inner arm 29 and the face of socket 19 thereby providing a mechanical advantage greater than 4 at the moment of initiation of the disconnecting operation. In the intermediate position II, wherein the plug has been started away from the socket and is partially disconnected therefrom, the mechanical advantage has decreased to approximately 3, while in position III, corresponding to a practically completed disconnection, the mechanical advantage is but slightly more than 2. Obviously, these values for the mechanical advantage are for purposes of illustration only, and may be increased or decreased as desired.

If desired, suitable resilient means such as V-shaped springs 34 may be secured to plug body 17 in any suitable manner so as to exert a yielding thrust against inner arms 29 tending to always force said arms outwardly beyond the socket-engaging face of the plug. The use of such resilient means maintains outer arms 33 of levers 26 in their housed positions within grooves 32 at all times except when the plug is connected to its socket, and thereby avoids any possibility of breakage of said outer arms during handling.

The second embodiment of the invention, shown in Figs. 6-8, is generally similar to the form disclosed in Figs. 1-4, with the exception that only one ejecting lever 26' is provided, fulcrumed on a suitable pin 28' in a projecting ear 35 of plug body 17', the inner arm 29' of lever 26' extending between terminal prongs 21 and being so shaped as to contact socket 19 at a point halfway between said prongs. By thus making the point of contact between inner arm 29' of lever 26' and the outer face of socket 19 central with respect to terminal prongs 21, the disconnecting force which is exerted when outer arm 33' is manually actuated is equally effective on each terminal 21, and thereby insures a quick, positive disconnection without the possibility of jamming due to a tilting of the plug, which might occur if the disconnecting force were not thus symmetrically applied with respect thereto. With this construction, however, the mechanical advantage obtained, while greater than unity, is not variable during the disconnecting operation.

In Fig. 9 there is disclosed still another form of the invention wherein the disconnecting means are both symmetrically disposed with re-

spect to the terminal prongs and so constructed that the mechanical advantage obtained is variable during the disconnecting operation. As shown, manually actuatable ejecting levers 36 are fulcrumed on suitable pins 37 carried by projecting ears 38 of plug body 39. Housed within plug body 39 in any suitable manner so as to be longitudinally movable relative thereto are a pair of ejecting plungers 40, the inner ends of which are adapted to abut and thrust against the face of socket 19. Plungers 40 are operatively connected to levers 36 by a rack and pinion arrangement, indicated generally at 41, consisting of interengaging teeth formed on levers 36 and plungers 40, respectively. In the preferred form, the rack and pinion connection is elliptic in character, the gear teeth being so designed that the mechanical advantage obtained is a maximum at the beginning of the disconnecting operation and decreases as the plug is moved away from its socket.

In the embodiment shown in Figs. 10-14, the mechanical disconnecting means comprises a novel cam-and-follower construction embodied in a plug having a substantially cylindrical body 42 in the socket-engaging face of which there is provided a recess 43 in which are mounted terminal prongs 21 in the usual manner. Body 42 is provided with the usual central bore 44 through which passes cord or cable 24. Body 42 is also provided with a plurality of longitudinal bores 45 parallel to and symmetrically disposed with respect to central bore 44 and adapted to house ejecting plungers 46 the inner ends of which abut the outer face of socket 19. The outer portion of plug body 42 is of slightly smaller diameter than the inner portion and is adapted to receive a rotatable knurled collar 47 which is maintained on body 42 and prevented from having longitudinal movement relative thereto by means of a cap 48 secured to body 42 as by screws 49. The portion of body 42 on which collar 47 is mounted is provided with longitudinal keyways or grooves 50 extending radially inwardly from bores 45 and each adapted to receive one of a pair of diametrically opposite pins or other suitable projections 51 extending transversely to the outer end of plunger 46, the diametrically opposite projection of each plunger 46 being adapted to engage a suitable spiral or oblique groove 52 formed in the inner surface of collar 47.

As is shown best in Fig. 14, grooves 52 are of such a pitch that the disconnecting force exerted by plungers 46 is greater than that applied to collar 47. The mechanical advantage thus obtained is also preferably made variable during the disconnecting operation, as in the previously described embodiments of Figs. 1-5 and 9, by simply varying the pitch of grooves 52 at points intermediate their ends, the pitch being so selected that the mechanical advantage is greatest upon initiation of the ejecting movement of plungers 46.

With this cam-and-follower construction, plungers 46 are normally maintained fully withdrawn into bores 45 with projections 51 engaging the outer ends of grooves 50 and 52. The plug may then be connected to its socket in the usual manner, the parts occupying the positions indicated in Fig. 12. In order to disconnect the plug from the socket, it is only necessary to grasp knurled collar 47 in the hand and rotate it relative to plug body 42, the slope of grooves 52 forcing ejecting plungers 46 quickly outward rela-

tive to said plug and thereby separating plug body 42 from socket 19 and breaking the electrical connection between terminal prongs 21 and terminals 22.

Still another embodiment of the invention is disclosed in Figs. 15 and 16, wherein the mechanical disconnecting means comprises an annular collar 53 surrounding and internally threaded to engage the threaded outer surface of a substantially cylindrical plug body 54, and having a flange 55 adapted to bear against the face of socket 19. Body 54 is provided with the usual terminal prongs 21 and central bore 44 to receive cable 24. Collar 53 surrounds body 54 throughout its length and is provided with a knurled portion 56 to be grasped in the hand. The pitch of the threads connecting collar 53 and body 54 is such that a relatively small rotation of the collar will move body 54 outwardly to the right, as viewed in Fig. 15, so as to rapidly and efficiently disconnect terminal prongs 21 from corresponding terminals 22 in the socket.

If desired, a suitable annular recess 57 may be provided between the outer ends of collar 53 and body 54 in order to house a resilient member such as a coil spring 58 the ends of which are suitably secured as by screws 59 to collar 53 and body 54, respectively. Spring 58 is so placed as to oppose relative rotation of collar 53 with respect to body 54, and therefore tends to maintain these parts in their fully inter-threaded position illustrated in Fig. 15. It will thus be seen that after rotating collar 53 to disconnect the plug from its socket, said collar will be returned to its original position by spring 58.

There is thus provided by the present invention a novel electric plug which is adapted to be connected to an electric socket in the usual manner but to be easily and efficiently disconnected therefrom by mechanical means. Each of the various forms of disconnecting means illustrated is of a force multiplying type embodying an inherent mechanical advantage greater than unity so that a child can readily perform the disconnecting operation, while in three of the embodiments the disconnecting means are further distinguished by possession of a mechanical advantage which varies during disconnection. The disconnecting force which is applied to eject the plug from its socket is in each case symmetrically applied with respect to the plug and thereby insures a rapid and clean break in the electrical circuit, similar to the operation of a switch. The plug bodies and disconnecting means are so formed as to provide suitable gripping means whereby a grasp may be easily retained on the plug after it has been removed from the socket. In the forms shown in Figs. 1-8, provision has been made for retaining the outer arms of the ejecting levers housed within suitable recesses formed in the plug body at all times except when the plug is connected to the socket, thereby preventing possible damage to these levers during handling. The novel plugs thus provided are simple and rugged in structure, inexpensive of manufacture, and highly efficient for the purpose intended.

It will be obvious that the invention is not limited to the forms shown in the drawings, but is capable of a variety of mechanical embodiments. For example, any suitable shape of plug body may be substituted for those shown and described, and it will be obvious that any suitable number of levers or plungers may be used in place of the specific number shown. Also, any

other suitable cam-and-follower construction may be used in place of that disclosed in Figs. 12 and 13. Various other changes which will now occur to those skilled in the art may be made in the forms, details of construction and arrangement of the parts without departing from the spirit of the invention. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

10 This application is a continuation in part of my prior application, Serial No. 526,496, filed March 30, 1931.

What is claimed is:

1. An electric plug of the type adapted for removable connection to an electric socket of the ordinary house wiring system including a body of such mass as to be readily handled by the human hand, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means carried by said plug body for exerting a positive disconnecting force against said socket to separate the plug therefrom, said means having an inherent mechanical advantage greater than unity and being so constructed and arranged that said mechanical advantage varies during the disconnecting operation, being at a maximum at the time when said disconnecting movement is initiated.

2. An electric plug for removable connection to an electric socket of the ordinary house wiring system including a body of such mass as to be readily handled by the human hand, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising a lever fulcrumed in said plug body, one arm of said lever being adapted to abut the surface of the socket at a point which varies in its distance from the fulcrum during the disconnecting operation, said distance being a minimum at the time when said disconnecting movement is initiated, the other arm extending outwardly of said plug body and adapted to be manually actuated for performing the disconnecting operation.

3. An electric plug for removable connection to an electric socket of the ordinary house wiring system including a body of such mass as to be readily handled by the human hand, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising a plurality of levers fulcrumed in and symmetrically disposed with respect to the terminal prongs of said plug body, one arm of each of said levers being adapted to engage and exert a disconnecting force against the face of the socket, said arms being so constructed that the effective points of engagement with said socket vary in their distance from the lever fulcrums during the disconnecting operation, said distance being a minimum at the time when said disconnecting movement is initiated, whereby a variable mechanical advantage is obtained.

4. An electric plug for removable connection to an electric socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising manually actuatable means for initiating the disconnecting force, a plurality of plungers housed within and symmetrically arranged with respect to said plug body and adapted to exert the disconnecting force against said socket, and means operatively connecting said manually actuatable means and said plung-

ers for converting movement of the former into movement of the latter, said connecting means being so constructed and arranged that a mechanical advantage greater than unity is obtained.

5. An electric plug for removable connection to an electric socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising a plurality of socket-engaging plungers carried by and symmetrically arranged with respect to said plug body, and manually actuatable means possessing an inherent mechanical advantage for moving said plungers relatively to said plug body and thereby exerting a disconnecting force against said socket, said means being so constructed and arranged that said mechanical advantage varies during the disconnecting operation.

6. An electric plug for removable connection to an electric socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means carried by said plug body for disconnecting the plug from the socket comprising manually movable means for initiating the disconnecting force, and motion reducing means associated with said manually movable means for multiplying the manually applied disconnecting force and exerting it against said socket, both of said means being symmetrically arranged with respect to said plug body and exerting a disconnecting force which is balanced with respect to said terminal prongs.

7. An electric plug for removable connection to an electric socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising a plurality of levers fulcrumed in and symmetrically disposed with respect to said plug body, the inner arms of said levers being in position to contact the face of the socket and exert thereagainst a disconnecting force which is balanced with respect to said terminal prongs, and their outer arms extending outwardly of said plug body.

8. An electric plug for removable connection to an electric socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising a plurality of levers fulcrumed in and symmetrically disposed with respect to said plug body, each lever being housed within a radial groove formed in said body with its inner arm adjacent the socket-engaging face of said plug and its outer arm extending outwardly of said plug body, the inner arms of said levers being so constructed and arranged as to exert a disconnecting force which is balanced with respect to said terminal prongs.

9. An electric plug for removable connection to an electric socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising a plurality of levers fulcrumed in and symmetrically disposed with respect to said plug body, each lever being housed within a radial groove formed in said body with its inner arm adjacent the socket-engaging face of said plug and its outer arm extending outwardly of said plug body, the inner arms of said

levers being so constructed and arranged as to exert a disconnecting force which is balanced with respect to said terminal prongs, and resilient means tending to force said inner arms of the levers to extend beyond the socket-engaging face of said plug and thereby withdraw the outer arms into said radial grooves.

10. An electric plug for removable connection to an electric socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising a rotatable collar having a surface adapted to abut the socket, and a screw-threaded connection between said collar and plug body.

11. An electric plug for removable connection to an electric socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising a sleeve having a surface adapted to abut the socket, said sleeve surrounding and having a threaded engagement with said plug body.

12. An electric plug for removable connection to an electric socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising a sleeve having a surface adapted to abut the socket, said sleeve surrounding and having a threaded engagement with said plug body, and resilient means connecting said sleeve and body and opposing relative rotation therebetween.

13. An electric plug for removable connection to an electric socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising a plunger housed within said plug body and adapted to thrust against the socket, a rotatable collar carried by said body, and means operatively connecting said plunger and collar whereby rotation of the latter causes longitudinal movement of the former relative to the plug body.

14. An electric plug for removable connection to an electrical socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising a plunger housed within said plug body and adapted to thrust against the socket, a rotatable collar carried by said plug body, a longitudinal groove formed in said body, a groove formed in said collar oblique with respect to said longitudinal groove, and projec-

tions formed on said plunger and engaging said longitudinal and oblique grooves, respectively.

15. An electric plug for removable connection to an electric socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising a plurality of plungers housed within and symmetrically disposed with respect to said plug body, a collar carried by said body and rotatable relative thereto, and cam-and-follower means operatively connecting said plungers and collar whereby rotation of the latter causes longitudinal movement of the former relative to the plug body.

16. An electric plug for removable connection to an electric socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising a plurality of plungers housed within and symmetrically disposed with respect to said plug body, a collar carried by said body and rotatable relative thereto, a groove formed in said collar, and projections formed on said plungers and engaging said groove whereby rotation of said collar causes longitudinal movement of said plungers relative to the plug body.

17. An electric plug for removable connection to an electric socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising manually actuatable means for initiating the disconnecting force, a plurality of plungers housed within said plug body and adapted to exert the disconnecting force against said socket, and means operatively connecting said manually actuatable means and said plungers for converting movement of the former into movement of the latter, all of said means including said plungers being symmetrically arranged with respect to said plug body whereby the disconnecting force is balanced with respect to said terminal prongs.

18. An electric plug for removable connection to an electric socket including a body, terminal prongs mounted on said body and adapted to engage corresponding terminals in the socket, and means for disconnecting the plug from the socket comprising a collar carried by said body and rotatable relative thereto, and means operatively associated with said collar and said plug body and so constructed and arranged as to convert rotation of said collar relative to said body into rectilinear disconnecting movement of the latter with respect to said socket.

OTTO W. SCHLUMS.