Nov. 7, 1967 E. D. JONES 3,351,887

INTERLOCKING ELECTRICAL CONNECTION

Filed June 28, 1965

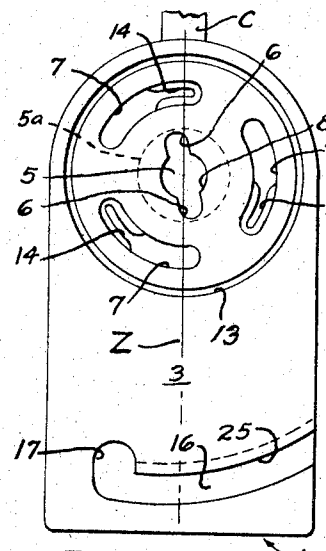


FIG. 1.

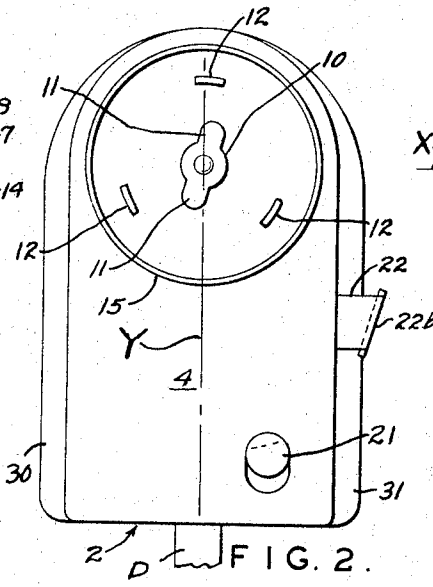


FIG. 2.

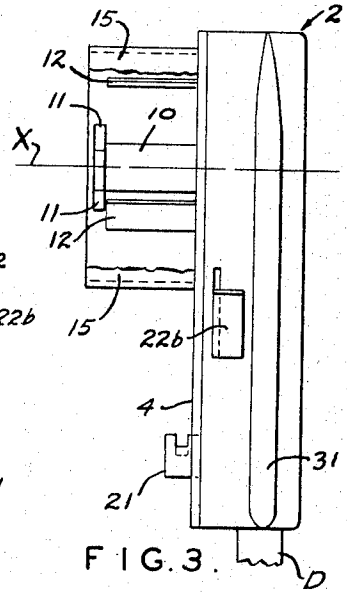


FIG. 3.

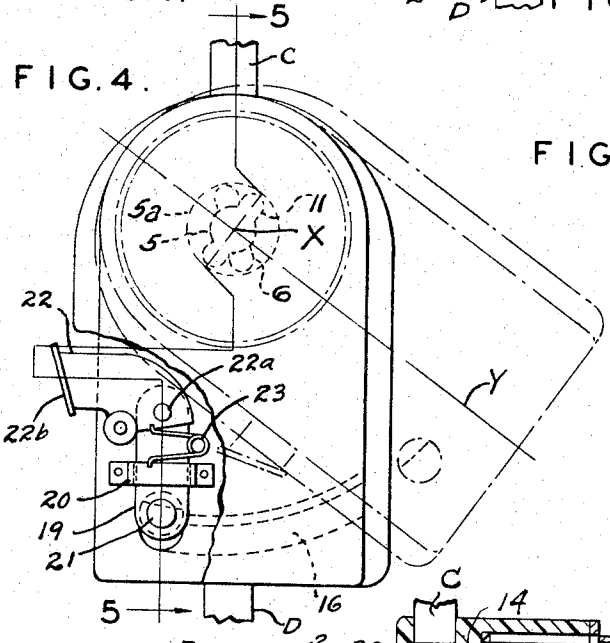


FIG. 4.

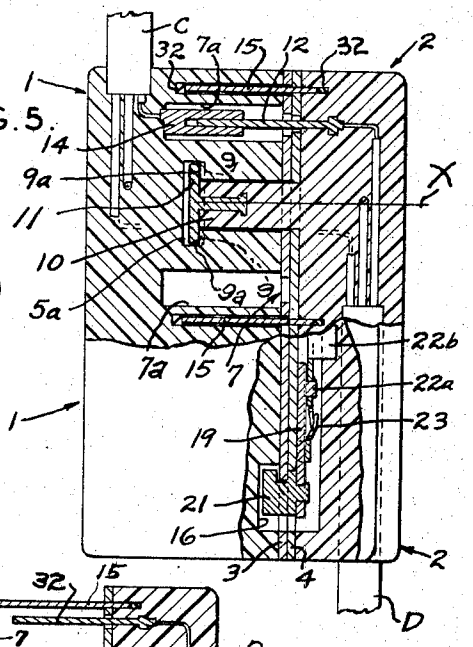


FIG. 5.

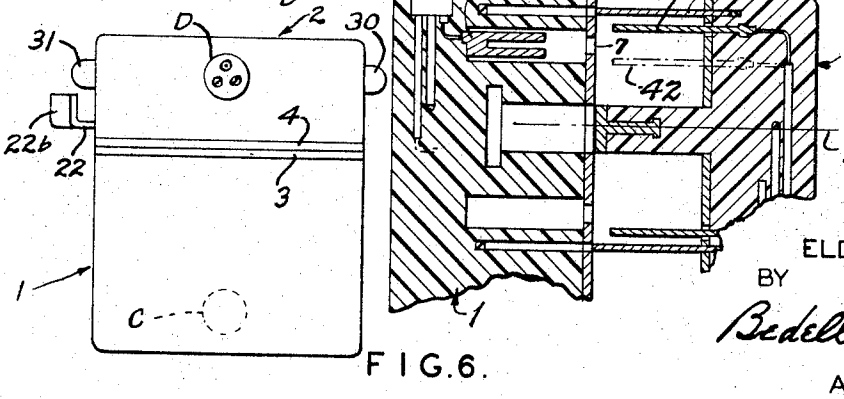


FIG. 7.

FIG. 6.

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3,351,887

Patented Nov. 7, 1967

3,351,887

INTERLOCKING ELECTRICAL CONNECTION

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Filed June 28, 1965, Ser. No. 467,467
6 Claims. (Cl. 339—91)

The invention relates to an electrical connector of the type embodying a receptacle with slots leading to conductor wire terminals and a plug with projecting prongs to which a take-off cord is attached, the plug and receptacle being assembled by insertion of the plug prongs into the receptacle slots and subsequent swinging of the plug relative to the receptacle to complete contacts between the plug prongs and the receptacle terminals.

The main objects of the invention are to avoid contact between the receptacle terminals and plug terminals except as a result of their swinging movement relative to each other after the prongs are inserted in the receptacle; to prevent separation of the receptacle and plug by "prying" the plug out of position, as distinguished from a preliminary reverse swinging movement before a movement of the receptacle and plug perpendicular to each other while their contacts are engaged, or by pulling on the plug cord; to safeguard the projecting terminal prongs of the plug against bending during assembly or disassembly of the plug and receptacle or when the plug is carelessly handled; to effect ready separation of the plug and receptacle, when swung to disassembly position, by facilitating the grasping of the plug at points spaced from the plug wire or cable, and to safeguard against the use of a plug and receptacle having critically different ampere and volt ratings.

These objects are attained by elongating the receptacle and plug, moving the receptacle and plug into a preliminary assembly, while their longitudinal axes are in substantially parallel planes, but are disposed in angular relation to each other about a common transversely pivotal axis, until opposing mating faces abut each other, then swinging them relative to each other about the pivotal axis until their longitudinal axes are parallel and, in so doing, bringing their respective terminals into contact with each other; utilizing an automatic latch to hold the receptacle and plug against reverse swinging about the pivotal axis until the latch is intentionally released manually; and further utilizing the natural apposition of the user's fingers and thumb in effecting release of the latch to position the fingers to grasp a gripping element on the plug for readily separating the plug from the receptacle by movement away from each other.

In the accompanying drawings illustrating a selected embodiment of the invention:

FIG. 1 is a front view of the receptacle or base, looking toward its mating face which is recessed to receive terminal prongs on the plug or cap.

FIG. 2 is a front view of the plug or cap, looking toward its mating face which is applied to the receptacle.

FIG. 3 is a side view of the plug.

FIG. 4 is a front view of the fully assembled receptacle and plug, showing them in alignment, the plug being reversed from the position shown in FIG. 2 and broken away in part to illustrate its structure. The dot-and-dash lines indicate a relatively inclined position of the plug relative to the receptacle at the beginning of an assembly swinging motion and at the end of a disassembly swinging motion.

FIG. 5 is a view and section on line 5—5 of FIG. 4.

FIG. 6 is an end view of the assembly.

FIG. 7 corresponds to the upper end of FIG. 5 but illustrates the receptacle rejection of a plug with an unmatched rating.

The connection assembly comprises an elongated block-like receptacle or body member **1**, with one end rounded, and a similarly shaped plug or cap member **2**. Members **1** and **2** are substantially of nonconducting material with mating faces formed by plates **3** and **4**, respectively, which are facing the viewer in FIGS. 1 and 2.

Receptacle **1** has a cylindrical recess **5** near its rounded end and leading inwardly from its mating plate with lateral enlargements **6** of restricted width forming a "keyhole" or "double keyhole" entry to a shallow circular undercut groove **5***a* (FIG. 5) at the inner end of the recess. Near the rounded end of plug **2** is a pivot lug **10** projecting from the plug mating plate **4** and having ears **11** of restricted width projecting radially of the outer end of the plug. Lug **10** and ears **11** are receivable in recess **5** and its enlargements **6** when the mating faces of the members are brought together with elements **10**, **11** opposite to elements **5**, **6**, respectively, as will be their relation when the members are inclined to each other about axis X as indicated by the dot-dash line position of the plug in FIG. 4. Then the plug may be swung clockwise parallel to the plane of the mating faces until longitudinal axes Y, Z are in alignment. Ears **11** then enter groove **5***a* under an overhanging shoulder **9** (FIG. 5) on member **1** formed by the undercut so that these plug and receptacle elements interlap and the plug and receptacle members cannot move away from each other until after the plug is rotated counterclockwise back to the dot-dash position.

Preferably the annular bearing formed by shoulder **9** is bulged downwardly of the recess at **9***a* so that as the plug is rotated, ears **11**, moving under bulges **9***a*, draw the mating faces more tightly together.

Disposed in angular sequence about axis X of recess **5** and spaced radially therefrom are a series of elongated curved slots **7** in plate **3** leading to corresponding recesses **7***a* (FIG. 5). Similarly disposed in angular sequence about lug **10** are terminal prongs **12** projecting from plate **4** (FIGS. 2, 3). The prongs are receivable through slots **7** into recesses **7***a* when the receptacle and plug are brought together if the receptacle and plug are coordinated. When the plug and receptacle are rotated subsequently to parallel their axes Y, Z, prongs **12** on the plug will move into contact with corresponding terminals **14** at the opposite ends of recesses **7***a*. Usual current supply wires in a conduit C are connected to terminals **14** and usual appliance wires in a cord D are connected to prongs **12**.

Prongs **12** on the plug illustrated are positioned at substantially the same distance radially of axis X as are slots **7** in the receptacle. Each terminal **14** at the bottom portion of a recess **7***a* comprises contact elements spaced transversely of the recess and yieldable to receive between them a plug prong as the plug is rotated clockwise about axis X even though the distance of the plug prongs from lug **10** may vary within the limits of the dimension between the flared ends of the elements of terminal **14**. However, if the plug prongs are spaced from axis X a greater or less distance than the outer and inner margins respectively of slots **7** in the receptacle, then the plug and receptacle could not be assembled. This feature makes it feasible to limit the use of an appliance to a selected range of amperage demands by the appliances plugged into the receptacle. For example, if the supply circuit has a rating of 40 amperes it would be dangerous to plug in an appliance drawing 80 amperes. The receptacle can be made so it will receive a plug on an appliance with an ampere or volt rating equal to or somewhat less than the rating of the receptacle circuit but will not receive a plug on an appliance with a higher rating than the receptacle circuit or unsafely less than the ampere or voltage rating of the receptacle circuit.

The prongs on the plug could be placed closer to the center of plug **10** for lower ratings and farther away from the center for higher ratings. The terminal elements in the receptacle would be limited in their flexing movement so the maximum movements from or toward plug **10** would correspond to that which will accept the prongs of the same rating, for example: by providing a 100 ampere appliance with plug prongs **32** ¾" from axis X while the receptacle slots **7** do not exceed ⅝" from axis X (as shown in full lines, FIG. 7), or providing the appliance plug with prongs **42** ½" from axis X (as shown in dot-dash lines, FIG. 7), there would be a safety differential which could not be ignored and only a satisfactory receptacle would receive the plug.

A cylindrical shield **15**, secured to plate **4**, projects from plug **2** and surrounds prongs **12** and is received in a circular recess **13** in the face of receptacle **1** when the members are assembled. Gaskets **32** form a seal between the edges of shield **15** and the bottoms of the recesses therefor in the plug and receptacle and render the connections explosion proof, i.e., dust or vapor in the ambient air will not be ignited by a spark between terminals **12, 14**.

Spaced longitudinally of receptacle **1** and from axis X is an arcuate undercut slot **16** which extends eccentrically relative to axis X. The outer end of slot **16** opens through one side of the receptacle. The inner end of slot **16** terminates in a notch **17**.

Slidable longitudinally of plate **4** is a link **19** retained by a bridge **20** secured to the plate. One end of the link carries a latch pin **21** and its other end is connected to a release lever **22** pivoted at **22*a*** on the plate and having a finger-engageable button **22*b***. A torsion spring **23** has one end seated in lever **22** and the other end seated in bridge **20** and thrusts the latch pin toward the swinging end of the plug. The latch pin projects outwardly from plate **4** and has a groove adapted to receive the projecting ledge **25** of plate **3** above slot **16** in receptacle **1**.

When the members are in the relative position indicated by broken lines of the plug in FIG. 4, pin **21** is aligned with the outer end of slot **16** and as the plug is swung in, clockwise from this position, pin **21** enters slot **16** and is cammed away from axis X until the pin reaches the inner end of the slot and at this point spring **23** urges pin **21** into notch **17** to positively hold the members against reverse swinging to the relatively inclined position indicated in FIG. 4 where they could be separated from each other.

Preferably ridges **30, 31** extend along the sides of plug **2** and these ridges may be grasped by the fingers of the user to swing the plug on the receptacle about axis X and to separate them. Ridge **30** is directly above and in proximity to button **22*b*** and the user's thumb or finger may readily grasp the ridge and simultaneously depress the button to align pin **21** with the slot and, after the swing-out movement, to pull the plug away from the receptacle.

This structure reduces or eliminates the likelihood of unplugging the connection by a pull on the lead-out cord, whether intentional or accidental; or the tilting of the plug relative to the receptacle while terminals are in contact; or injury to the plug prongs when separated from the receptacle, thus contributing to safety and extended life of the connection.

The accompanying drawings show a receptacle and plug adapted for a common polarity and voltage arrangement but the structure may be modified readily to accommodate other arrangements without departing from the invention and exclusive use of this and other variations of structure coming within the scope of the claims is contemplated.

What is claimed is:

1. In an electrical connection, a plug member with a mating face and terminal prongs projecting from said face, a receptacle member with a mating face having recesses adapted to receive said prongs as said member faces are moved toward each other into contiguous relation if said members are disposed angularly to each other with said faces parallel, said receptacle having terminals in said recesses normally spaced from said prongs during such movement and positioned to be contacted by said prongs as said members are swung about an axis normal to said faces after the latter are in said relation, said members being elongated transversely of said axis, securing means comprising a latch pin in one member slidable lengthwise thereof, and a recess in the other member receiving said pin and having an offset positively engaging said pin as said members are swung relative to each other in one direction to terminal-contacting position, and a release element on the exterior of one member for manually disengaging said latch pin from said recess offset to permit reverse relative swinging of said members.

2. An electric outlet structure according to claim **1** in which at least one of the members includes a finger-engageable part for ready engagement manually for moving the members away from each other, said part being adjacent to the release element to permit simultaneous engagement of said part and the element by the fingers of one hand of the user.

3. An electric connection according to claim **1** in which the securing means recess in one member is accentric to the axis of swinging movement of the two members whereby the latch pin is moved lengthwise of the members as the latter are swung to terminal contacting position, and a spring acting to thrust said pin into the recess offset, the release element being disposed to manually move the pin against the spring thrust.

4. In an electrical connection, a plug member with a mating face and terminal prongs projecting from said face, a receptacle member with a mating face having recesses adapted to receive said prongs as said member faces are moved toward each other into contiguous relation if said members are disposed angularly to each other with said faces parallel, said receptacle having terminals in said recesses normally spaced from said prongs during such movement and positioned to be contacted by said prongs as said members are swung about an axis normal to said faces after the latter are in said relation, the plug member prongs being disposed in arcuate sequence about the axis of swinging movement, said plug member including a shield projecting from its mating face adjacent to and beyond the outer ends of said projecting prongs and protecting the latter and extending into a corresponding groove in the mating face of the receptacle member as the members are moved toward each other, said shield and groove being cyclindrical, there being gasket-like means between the shield and the bottom of the groove sealing the space within the shield from the exterior of the connection as the plug and receptacle are rotated about the axis of swinging movement and before the plug prongs and receptacle member terminals contact each other.

5. An electrical connection according to claim **4** in which the plug member shield is substantially cylindrical and the plug member includes a lug projecting from the plug member axially of the shield and having a lateral ear at its outer end, the receptacle member having a recess for said lug with a lateral enlargement at its inner end to receive said ear as the plug member is rotated about the axis of swinging movement, said enlargement having a restricted portion offset lengthwise of the recess to draw the plug and receptacle members tightly together as the members are rotated about said axis.

6. In an electrical connection, a plug member with a mating face and terminal prongs projecting from said face, a receptacle member with a mating face having recesses adapted to receive said prongs as said member faces are moved toward each other into contiguous relation if said members are disposed angularly to each other with said faces parallel, said receptacle having terminals

in said recesses normally spaced from said prongs during such movement and positioned to be contacted by said prongs as said members are swung about an axis normal to said faces after the latter are in said relation, said members being elongated transversely of said axis, securing means including a plate slidable lengthwise of the mating face of one member, a spring normally thrusting said plate away from the outer end of the member, a pin projecting from said plate, the other member having an arcuate slot in its mating face and opening through one edge of the member and aligned with said pin in the spring-thrust position of the latter, said slot being eccentric to the swing axis of said faces and terminating at its inner end in a lateral notch offset away from the adjacent end of the structure and receiving said spring-thrust pin when the two members are aligned, and a plunger on the plug member for dislodging said pin from said notch

to permit reverse rotation of said members and the exi of said pin from said slot.

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