Aug. 2, 1960 W. R. FRANCIS ET AL 2,947,966

RECEPTACLE FOR ELECTRICAL CONNECTOR

Filed Sept. 3, 1957

FIG. 1.

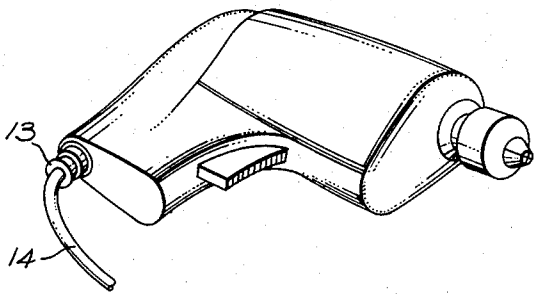


FIG. 2.

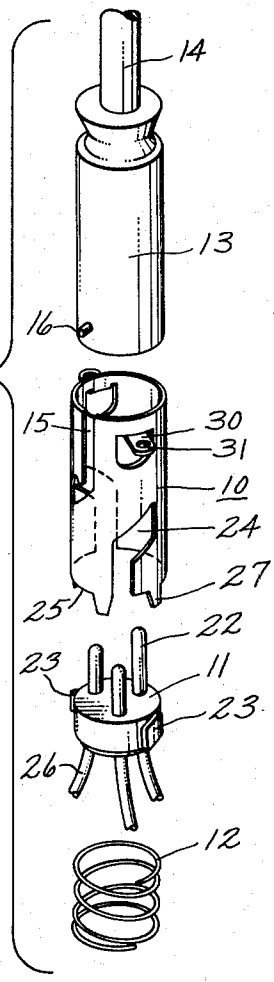


FIG. 3.

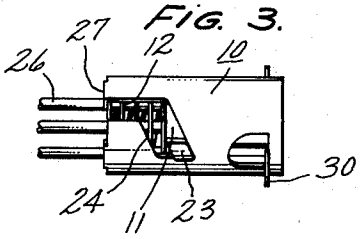


FIG. 4.

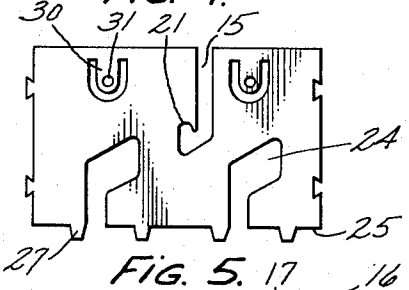


FIG. 5.

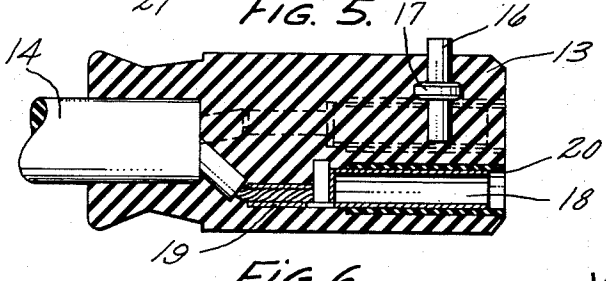
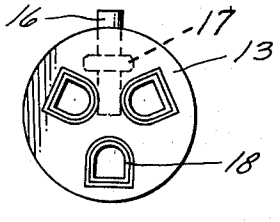


FIG. 6.



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RECEPTACLE FOR ELECTRICAL CONNECTOR

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6 Claims. (Cl. 339—188)

The present invention relates to a receptacle that is to be joined with an electrical connector fastened on an end of an electric cord. Such a receptacle is particularly useful when mounted in a portable electric tool such as a drill, saw, sander, or lawn trimmer.

Up until this time almost all portable electric tools have been provided with a power cord as a permanent part of the tool. Many such power cords, especially those for the larger tools, are of heavy cross-section and are difficult to fold into a tool box with the tool. Also, as the average home owner accumulates more electric tools, he has a sizeable investment in electric cords. Now the portable tool industry is interested in removable cordsets of standard design which may be interchanged with the different tools. A removable cordset must be capable of making a good electrical connection and also be easily removable, but not liable to be removed accidentally.

The principal object of this invention is to provide a receptacle adapted for mating engagement with an electrical connector with a positive locking arrangement between the parts.

A further object of this invention is to provide a receptacle of the class described wherein a twisting action is necessary to effect the locking of the parts, there being special provision made to insure that the receptacle will be in a position to receive the connector after the connector is removed.

A further object of this invention is to provide a receptacle of the class described with a novel cylindrical shell that will permit the parts of the receptacle to be assembled through the base of the shell.

A still further object of this invention is to provide a receptacle of the class described with automatic means for turning the connector into a locking position as the connector is forced into the receptacle.

The present invention relates to a receptacle that is particularly adapted to be mounted within the handle or housing of a portable electric tool so that a connector of a power cord may be fitted in the receptacle. The mechanical connection between the connector and the receptacle of the tool must be both substantial and reliable because it should withstand a 35 pound pull test exerted on the cord. Accordingly, a positive locking arrangement is preferable to a straight spring lock. A common type of mechanical lock is a bayonet pin and slot connection which has been adopted for this invention. The receptacle is provided with a cylindrical metal shell having a spring base at one end while the opposite end is left open to receive a cord connector. A bayonet slot is formed in the wall of the shell and it extends to the edge of the open end of the shell. A connector that is adapted to fit within the shell of the receptacle has a transverse bayonet pin mounted in its side to cooperate with the bayonet slot of the receptacle.

The connector includes two or more female contacts molded therein. The mating pin contacts of the receptacle are mounted on a plunger of insulating material that is confined within the shell of the receptacle. Since

the connector must be twisted in the receptacle to lock the bayonet pin in the slot, the plunger must also be capable of turning. Thus, a pair of ears extend from the opposite sides of the plunger and are confined in inclined slots formed in the walls of the shell. A coiled spring is seated in the base of the shell to bear against the plunger and normally hold the plunger with its ears positioned in the far ends of the slots. In this position, the pin contacts of the plunger will be properly oriented with relation to the female contacts of the connector as the bayonet pin is being inserted into the bayonet slot of the receptacle. Also, when the connector is being shoved into the receptacle, the plunger will be slightly depressed against the spring until its ears engage the lower edges of the inclined slots. Then the plunger will begin to turn in the shell. Finally, when the pushing force is removed from the connector, the spring in the receptacle will expand in an attempt to return the plunger to its original position. However, instead the bayonet pin of the connector will become entrapped in the bayonet slot, which is the final locking position between the connector and receptacle.

Another important feature of this invention is in the method of assembling the several parts of the receptacle. The base end of the shell is first left open with a series of bendable tabs extending downwardly from the bottom edge of the shell. The inclined slots for guiding the movement of the plunger have lower extensions that open in the edge of the base of the shell to enable the plunger to be brought in through the base until the ears are confined within the inclined slots. Then, the coiled spring is inserted into the shell and against the plunger, and lastly the tabs are bent inwardly to form a seat for the spring.

Our invention will be better understood from the following description taken in connection with the accompanying drawing and its scope will be pointed out in the appended claims.

Figure 1 is an isometric view of a small portable electric drill with a receptacle according to this invention mounted in the handle and in mating engagement with the connector of a power cord.

Figure 2 is an exploded view of the receptacle of this invention and a typical grounding connector that is adapted to be inserted in the receptacle.

Figure 3 is a side view of a completely assembled receptacle embodying this invention.

Figure 4 is a showing of the blank of sheet steel from which the cylindrical shell of the receptacle is formed.

Figure 5 is a cross-sectional view taken through the center of the grounding connector of Figure 2 showing the manner of anchoring a bayonet pin in the side of the connector.

Figure 6 is a right end view of the grounding connector of Figure 5.

Referring in detail to the drawing, and in particular to Figure 2, there is shown a cylindrical metal shell **10**, a disc-shaped plunger **11** of insulating material and a coiled spring **12**. These three elements **10**, **11** and **12**, comprise the principal elements of the receptacle of the present invention which is shown fully assembled in Figure 3. The function of the receptacle is to make both a mechanical and an electrical connection with a connector **13** that is formed on one end of a power cord or cordset **14**. The mechanical coupling or locking arrangement is performed by the cooperation of a bayonet slot **15** in the wall of the shell **10** and a bayonet pin **16** that extends from one side of the connector **13** near the free end thereof.

As seen in Figures 5 and 6, the connector **13** is a grounding connector having three conductors, one of which is a ground wire. The connector includes three D-shaped female contacts or sleeves **18** which are

crimped at their terminal ends **19** to the conductors of the cord **14**. A fiber insulating sleeve **20** is slipped over each contact **18** to reinforce the contacts because they are rolled into shape from flat stock and might otherwise become enlarged by the pin contacts of the receptacle. The bayonet pin **16** has an inner end that extends between two of the adjacent contacts **18** as best seen in Figure 6. The fiber sleeves **20**, however, will insulate the pin **16** from the contacts so as not to short-circuit the cord. The center portion of the pin **16** has a shoulder **17** which anchors the pin in the connector body.

The receptacle has three pin contacts **22** mounted on the plunger **11** for mating engagement with the female contacts **18** of the connector. It should be remembered that in order to lock the bayonet pin **16** of the connector in the bayonet slot **15** of the receptacle it is necessary to twist the connector until the bayonet pin **16** is lodged in the concave seat identified as **21**. Accordingly, it is not feasible to fix the plunger **11** in the shell **10** because the plunger must be capable of turning with the connector. A pair of ears **23** extend from opposite sides of the plunger **11** and are confined within inclined slots **24** in the walls of the metal shell **10**. The inclined edges of each slot **24** are parallel to each other and arranged at an angle of approximately 60° to the longitudinal axis of the shell **10** as seen in Figure 4. The ears **23** of the plunger also have inclined top and bottom sides which correspond with the inclined edges of the slots **24**. The lower ends of the inclined slots **24** extend downwardly toward the base end **25** of the shell. The plunger **11** is assembled in the shell **10** by inserting the ears **23** of the plunger through the base of the shell and into the slots **24**. As seen in Figure 2, lead wires **26** are attached in the plunger **11** to the pin contacts **22** and extend downwardly therefrom. The plunger **11** is held in position by means of the coiled spring **12** that is likewise inserted through the base **25** of the shell. The lower edge of the shell **10** at the base end **25** is provided with a series of bendable tabs **27** which are turned inwardly after the spring **12** is assembled to serve as a seat for the spring. The lead wires **26** are brought out through the center of the spring and between the tabs **27**.

Turning now to a consideration of Figures 2 and 3 for an understanding of the movement of the plunger **11**, the several motions of the parts during the insertion of the connector **13** into the shell of the receptacle will be discussed.

First, the bayonet pin **16** of the connector is aligned with the open end of the bayonet slot **15** of the shell **10**. The connector is then pushed into the shell and the female contacts **18** will drop over the pin contacts **22** and the plunger **11** will be forced inwardly of the shell against the action of the coiled spring **12**. As seen in Figure 3 the parallel inclined edges of the slots **24** are further apart than the depth of the ears **23**. Hence, as the plunger **11** moves back into the shell **10**, the ears **23** will strike against the lower inclined edges and tend to slide on that lower surface. In so doing, the plunger **11** will turn in the shell until the bayonet pin **16** strikes the side of the bayonet slot. At this point the connector should be released so the spring **12** will force the plunger **11** upward and the bayonet pin **16** will become latched in the seat **21**. To uncouple the connector **13**, it is again forced inwardly of the shell **10** until the bayonet pin is driven out of the seat **21** and a reverse twist is given to the connector so that the bayonet pin **16** will slide out through the slot **15**. As the connector **13** is being disengaged from the shell **10**, the ears **23** of the plunger **11** are in the position shown in Figure 3. The upward force of the spring **12** on the plunger **11** and the upward inclination of the upper edges of the slots **24** cooperate to turn the plunger until the ears **23** are in the far ends of the slots **24**.

The shell of the receptacle of this invention has a pair of lanced tabs **30** struck from opposite sides of the shell near the open end thereof. Each tab has a small opening **31** for receiving a fastening screw (not shown) that will attach the receptacle in place. The tabs are formed outwardly to lie within a common horizontal plane but it should be understood that this mounting means forms no part of the present invention.

Having described above our invention of a novel receptacle for an electric cord connector, it should be realized by those skilled in this art that this design is both simple and easy to manufacture as well as being reliable in operation. While the lower edges of the inclined slots **24** have been described as the elements which force the connector to turn in the shell, another modification would be to have the bayonet pin **16** strike the inclined bottom edge of the bayonet slot **15**. In this case the opposite ears **23** of the plunger would not engage the lower edges of the slots **24** at all. Also, if a person were careful it would be possible to insert the connector into the shell and lock the connector in place without this automatic turning feature.

The upper edges of the inclined slots **24** are of primary importance because they serve to position the ears **23** of the plunger at the far end of the slots due to the action of the spring **12**. This spring is relatively stiff so that it is practically impossible to insert a finger or a tool into the shell and rotate the plunger where it might be caught in an intermediate position which would not accept the bayonet pin and female contacts of the connector **13**.

Modifications of this invention will occur to those skilled in this art and it is to be understood, therefore, that this invention is not limited to the particular embondiments disclosed and that it is intended by the appended claims to cover all modifications which are within the true spirit and scope of this invention.

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

1. An electrical receptacle comprising a cylindrical shell having at least one bayonet slot that is open at one end of the shell, a plunger of insulating material positioned in the shell, a pair of ears extending from the sides of the plunger, and a pair of inclined slots formed on diametrically opposite sides of the shell for receiving the said ears of the plunger, spring means seated in the other end of the shell and bearing against the plunger to urge the ears to the far ends of the slots due to the inclination of the slots, and electrical contacts mounted in the plunger and arranged for mating engagement with contacts of an electrical connector to physically couple said plunger to said connector for simultaneous rotation, said bayonet slot serving as means for cooperation of said connector with said receptacle, at least one of said bayonet and inclined slots being arranged to turn said plunger and said connector toward a locked position upon movement of said connector and plunger after the initial engagement thereof.

2. An electrical receptacle as recited in claim 1 in combination with an electrical connector that has a bayonet pin for locking engagement in the said bayonet slot, a downwardly sloping surface at the bottom of the bayonet slot so that when the connector is thrust into the receptacle, the pin will engage the said sloping surface and be forced to slide down such surface thereby automatically turning the connector toward a locking position.

3. An electrical receptacle for a portable tool comprising a cylindrical shell having at least one bayonet slot that is open at one end of the shell for cooperation with a bayonet pin of a connector so that they may be locked together, a plunger of insulating material positioned in the shell beyond the bayonet slot, at least two pin contacts mounted on said plunger and arranged for mating engagement with said connector, a pair of ears formed on the sides of the plunger, and a pair of oppositely inclined slots formed on diametrically opposite

sides of the shell, the ears of the plunger being confined within the said inclined slots and guided thereby, and spring means seated in the opposite end of the shell to bear against the plunger and urge it to turn until the ears are situated in the far ends of the slots, at least one of said bayonet and inclined slots being arranged to turn said plunger and said connector toward a locked position upon movement of said connector and plunger after the initial engagement thereof.

4. An electrical receptacle as recited in claim 3 with the addition of a male connector for insertion within the shell, the connector including at least two female contacts for engagement with the pin contacts of the receptacle, a bayonet pin extending from one side of the connector for cooperation with the bayonet slot of the receptacle, the said spring serving to turn the plunger so that the pin contacts of the receptacle will be in the proper position to receive the female contacts of the connector when the bayonet pin is being inserted in the bayonet slot.

5. An electrical receptacle and connector for a portable tool comprising in combination a cylindrical metal shell for a receptacle, the shell having a base at one end and being open at the other end, a bayonet slot in the shell adjacent the open end, a plunger of insulating material positioned in the shell intermediate the base and open end, a pair of oppositely directed ears on the sides of the plunger, and a pair of inclined slots formed on diametrically opposite sides of the shell for receiving the said ears of the plunger, each ear having inclined surfaces that are parallel to the inclined edges of the mating slot, and spring means seated in the base of the shell and bearing at its opposite end against the plunger to bias the plunger to turn in the shell until the ears are

situated in the far ends of the inclined slots, at least two pin contacts mounted on the plunger on the side adjacent the open end of the shell, and lead wires extending through the base of the shell and through the said spring for termination with the said pin contacts on the plunger, the connector comprising a cylindrical plug of insulating material having at least two female contacts provided therein, and a bayonet pin adjacent the end of the connector containing the contacts, so that when the bayonet pin is aligned in the bayonet slot of the receptacle the connector may be forced into the receptacle thereby bringing the several contacts into engagement and depressing the plunger against the spring so that the ears of the plunger will turn as they slide down the edges of the inclined slots, whereby a locking engagement is effected by the bayonet slot when the connector is released as the spring forces the plunger toward the open end of the shell in an attempt to return the plunger to its original position.

6. An electrical receptacle and connector for a portable tool as recited in claim 5 wherein the said pair of inclined slots each have a slotted portion that extends to the base end of the shell, and a plurality of tabs formed on the base end of the shell so that the ears of the plunger may be inserted into the inclined slots from the base end of the shell, and the spring pressing against the plunger and held in place by the tabs being bent inwardly toward each other.

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