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PLUG-AND-SOCKET CONNECTOR

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Fig. 1

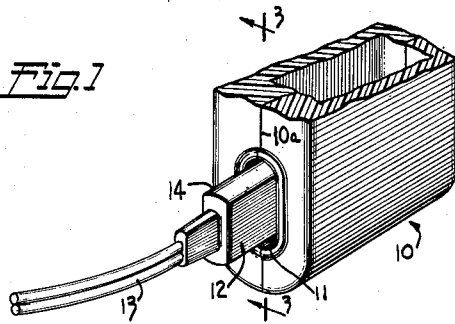


Fig. 2

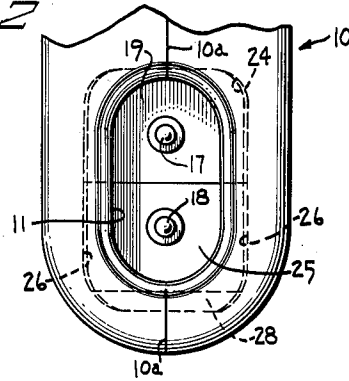


Fig. 3

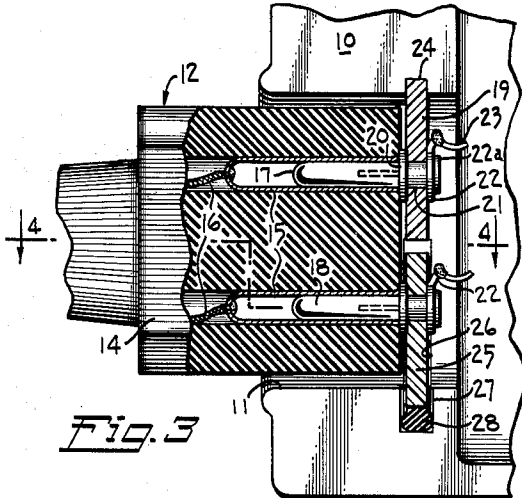


Fig. 4

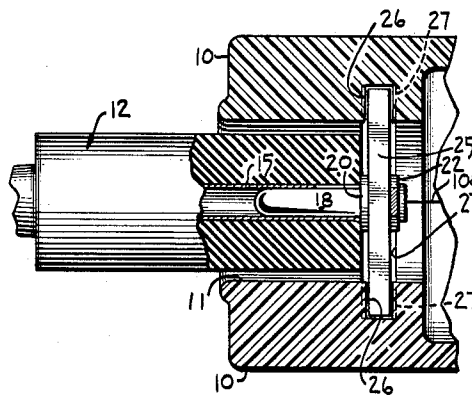
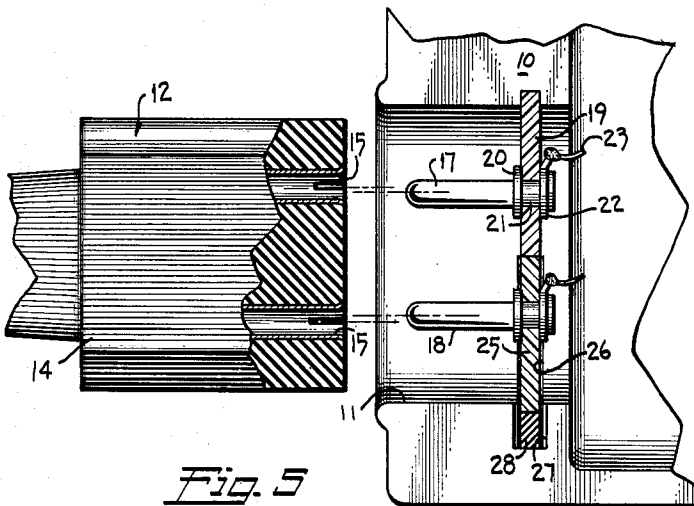


Fig. 5



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PLUG-AND-SOCKET CONNECTOR

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This invention pertains to a novel electric plug-and-socket connector. More especially it pertains to connectors of the foregoing type characterized by an improved gripping engagement between cooperating members of the connector whereby inadvertent separation of such members is greatly reduced. A specific example of where the invention finds particular use is in the provision of a plug-and-socket arrangement for an electric shaver. In order that a more compact packing arrangement of the shaver can be effected, it is desirable that the power supply cord for the shaver be separable therefrom when desired. At the same time, inadvertent separation of the cord from the shaver while in use is highly annoying and to be prevented if at all possible. The problem of preventing such separation is particularly aggravated in the case of electric shavers where the constant shifting motion imparted by the user during the operation of shaving is prone to cause the cord connector member to work loose from the cooperating connector member of the shaver, especially when the connector members become old and somewhat worn.

The invention disclosed here is designed to help overcome this difficulty. Briefly the means by which this is accomplished includes the provision of a plug-and-socket connector member having a contact element therein movable with respect to its adjacent element. In the uncoupled condition of the plug-and-socket members, such movable contact element is normally urged to a position in which it is slightly misaligned with respect to the contact element it is adapted to engage in the opposed member, being shiftable into proper alignment therewith by the action of coupling together the connector members. It is moreover an important feature of the arrangement here disclosed that the aforesaid movement of the movable contact element be so effected as to maintain its axis parallel with that of the adjacent contact element as well as the one it engages when the connector members are coupled together.

It has of course long been common practice to provide plug-and-socket connector members in which one of the contact elements is shiftable by the action of coupling or uncoupling the connector members, both for the purpose of increasing frictional contact to prevent inadvertent uncoupling, as well as to improve the electrical contact afforded by such connector members. Such attempts have hitherto almost invariably resorted to a pivotal movement of a contact element so that parallelism in but one plane at most can be maintained between the elements of the connector member and consequently between respectively engaging elements of the separable plug-and-socket members. In fact in such prior arrangements it is a temporary displacement from parallelism which is generally relied on to obtain the desired resistance to inadvertent uncoupling of the connector members.

It can be seen that maintenance of parallelism between the two contact elements of the connector member is highly desirable, as such an arrangement provides for a surface contact rather than a mere point or line

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contact between the mating elements of the respective connector members. This not only reduces electrical resistance and hence increases current carrying capacity, but it also of course increases the frictional contact between the engaged elements which is desired in order to reduce the susceptibility of the connector members to inadvertent uncoupling.

As mentioned above, the invention is particularly useful in the construction of plug-and-socket connector members for an electric shaver and such an arrangement is illustrated in the accompanying drawings and described in detail hereinafter. In the drawings:

Fig. 1 is a perspective view of a plug-and-socket connector arrangement in an electric shaver, only so much of the latter being here shown as is necessary to illustrate the aforesaid connector;

Fig. 2 is an elevational view of the plug receptacle of the connector arrangement of the shaver shown in Fig. 1;

Fig. 3 is a sectional view taken on line 3-3 of Fig. 1 of the cord plug engaged in the receptacle of the shaver;

Fig. 4 is a sectional view on line 4-4 of Fig. 3; and

Fig. 5 is a cross-sectional view in side elevation, similar to that in Fig. 3 but showing the plug about to be inserted into the shaver receptacle.

In the drawings, an electric shaver 10 whose case or housing is composed of complementary half-shells parting along line 10a is provided with a receptacle or socket 11 which is adapted to receive a plug 12 constituting a terminal end of a conventional parallel conductor electric cord 13 for supplying power to the shaver. Plug 12 is composed of a conventional molded plastic rubber or other insulating material body 14 within which are embedded a pair of female contact elements or sleeves 15 to which the conductors 16 of the cord are soldered, as shown in Fig. 3. The receptacle or socket 11 of the shaver comprises a cavity or recess within a portion of the shaver body into which the plug 12 is adapted to be inserted. A cooperating pair of male contact elements or pins 17, 18, as here shown are positioned within the socket to cooperate with the sleeves 15 of the plug when inserted to complete the electrical connection to the shaver 10. Pin 17 is mounted on an insulating support member or panel 19, the pin being provided with a shoulder 20 which rests upon the outer surface of panel 19 while a pin stud 21 passes through a hole in the panel and a soldering lug 22 and is then peened over at the back side of the panel to provide a retaining shoulder 22a. A conductor 23 is soldered to lug 22 and leads to the motor of the shaver. Panel 19 is permanently secured in a groove 24 formed in the upper half of the periphery of the socket 11, being engaged on its upper and opposite side edges in said groove to position the panel parallel to the face of the socket opening. Panel 19 fits snugly within the groove and may, if desired, be glued therein to further secure it.

The complementary contact pin 18 is also mounted upon an insulating panel 25 which is generally similar to panel 19. Pin 18 is also provided with a shoulder 20 and a stud 21 which passes through the panel 25 and a solder lug 22 and is riveted over at the back side thereof to fasten the pin firmly to panel 25. Panel 25 is marginally supported in aperture 11 in a groove 26 which is coextensive with groove 24 and is formed in the lower half of the periphery of the socket 11. In this instance, groove 26 is slightly wider than the thickness of panel 25 so that the panel is free to slide up and down slightly in the socket without binding in the groove. A well 27 is provided at the bottommost portion of the groove, this being slightly wider still than the groove 26. A strip of resilient rubber 28 is disposed in this well, being confined between the lower edge of panel 25 and the bottom of well 27, thus biasing panel 25 upwardly into abut-

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ment with the upper panel 19, as shown more especially in Fig. 5. As there shown, the axes or center lines of pins 17 and 18 in this condition are slightly closer together than the center lines of sleeves 15 of the plug 12. Thus, when the plug 12 is inserted into the socket, the lower pin 18 and its panel 25 are forced downwardly, compressing the rubber strip 28 as shown in Fig. 3. In order to facilitate engagement of the plug in the socket, the tips of pins 17 and 18 are rounded and the mouths of the sleeves 15 are slightly flared so that notwithstanding the initial slight misalignment of the pins with their respectively cooperating sleeve members, displacement of the movable pin assembly will be effected easily. Well 27 permits the expansion of the rubber strip 28 to occur freely, as shown best in Fig. 3, when the movable pin assembly is depressed by the insertion of plug 12. Thus panel 25 and its associated contact pin 18 are capable of rectilinear movement between limiting positions which span that assumed by them in the fully coupled condition of the plug-and-socket connector.

As can be seen from the foregoing, pin 18 is maintained parallel at all times to pin 17 since panel 25 is confined for rectilinear movement by the grooves 26 in opposite side walls of the socket 11. Thus in the fully coupled condition of the plug 12 and socket 11, pin 18 is coaxially aligned with its cooperating sleeve 15 of the plug member and the contact surface between the two is accordingly a maximum. Not only does this afford good electrical connection for the plug-and-socket arrangement but it also provides increased frictional resistance to withdrawal of the plug. That is, since the movable pin assembly is urged under the influence of the compressed rubber strip 28 into its upper position as viewed in Figs. 3 and 5, i. e. closer to its companion pin 17, the "squeezing" action thus obtained when the plug 12 is inserted in the socket prevents the plug from working out of the socket inadvertently.

The particular construction just described can of course be modified in many respects to accomplish the same end result in a somewhat different manner without departing from the spirit of the invention. For example, instead of placing the resilient member such as the rubber strip 28 in a well 27 at the outer end of panel 25, it may obviously be positioned between the stationary panel 19 and the movable panel 25. In such case, the pin 18 is urged into slightly wider than normal spacing and must accordingly be forced back toward pin 17 when engagement is made with the complementary connector member. The gripping engagement between the connector members is thus effected by reason of the tendency of pin 18 to move outwardly against the sleeve 15 in this arrangement, which is just opposite that of the example previously described. The construction may also be such that both panels 19 and 25 can slide in

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grooves or ways in the receptacle so that both pins are capable of translational movement to provide the differential spacing. In passing it may also be mentioned that while the resilient means specifically described hereinabove is a rubber strip, it is obvious of course that other types of resilient means such as flat or coil metal springs can be employed equally well. Likewise it is clear that while the foregoing description has dealt with mounting the male pins so as to be movable, these can be fixed and the cooperating female sleeve or sleeves can, alternatively, be mounted so as to be capable of the aforesaid translational movement.

In all of these modifications the same basic concept is present, namely that at least one of the contact elements is movable with respect to its cooperating contact elements and is biased to a position normally which affords a differential spacing between the respectively cooperating contact elements in their coupled and uncoupled conditions. The movement permitted the movable contact member or members, however, is in all cases confined to straight translational movement so that the axes of all of the contact elements remain parallel at all times.

What is claimed is:

1. In an electrical plug-and-socket connector, a hollow body member having a socket therein, a groove extending about the inner periphery of the socket, a first panel held rigidly within the said groove, a second panel slidably movable in said groove, means for biasing said second panel towards said first panel, and an electrical contact element carried by each panel, said contact elements extending axially of the socket, and being parallel to each other.

2. In an electrical plug-and-socket connector, a hollow body member having a socket therein, a continuous groove extending about the inner periphery of the socket in a plane parallel to the face of said socket, a first panel held rigidly within the said groove, a second panel slidably movable in said groove, resilient means interposed between the groove base and the second panel adapted to bias the second panel towards the first panel, and an electrical contact element carried by each panel, said contact elements extending axially of the socket, and being parallel to each other.

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