Aug. 14, 1951 E. GREACEN, JR 2,564,159

ELECTRIC PLUG CONNECTOR

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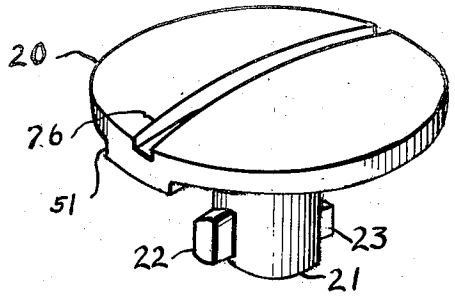


Fig. 2

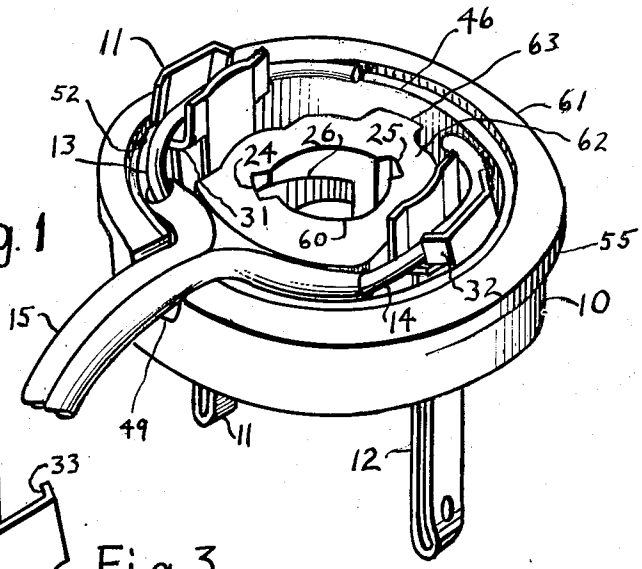


Fig. 1

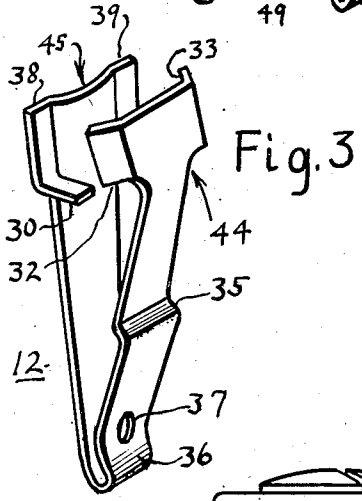


Fig. 3

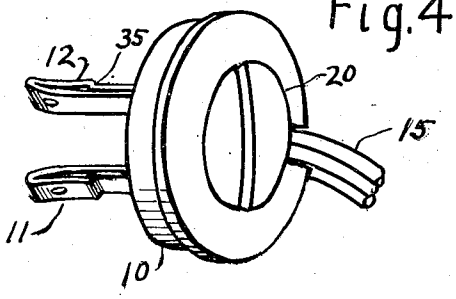


Fig. 4

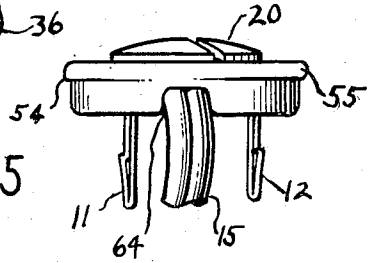


Fig. 5

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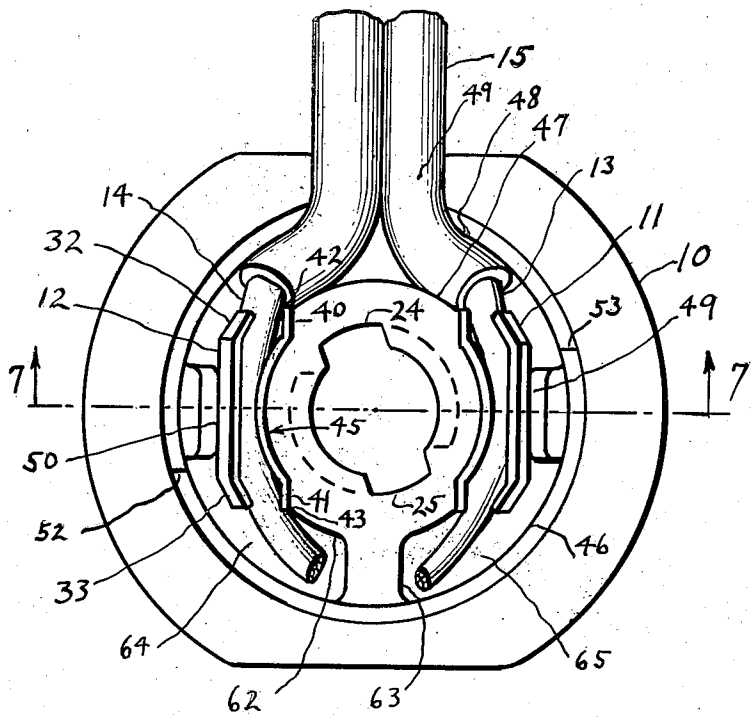


Fig. 6

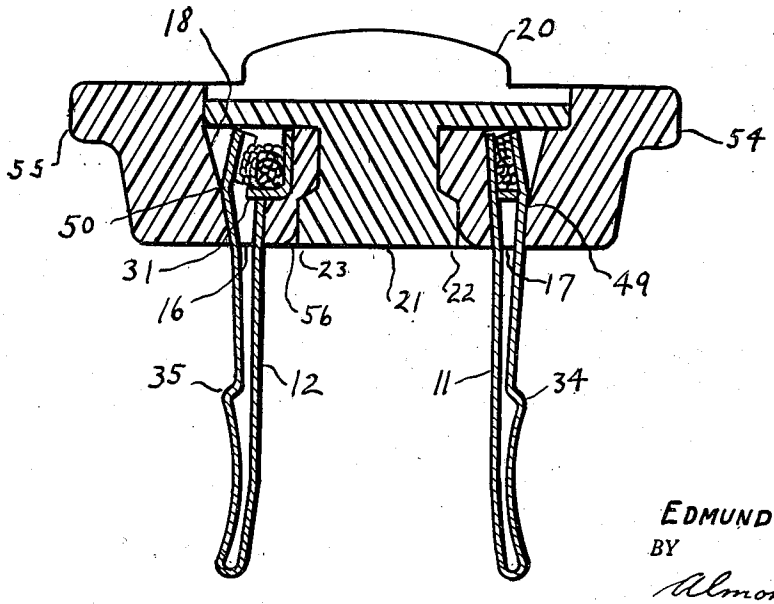


Fig. 7

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ELECTRIC PLUG CONNECTOR

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6 Claims. (Cl. 173—361)

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This invention relates to electrical connectors used for connecting appliances and the like to electric outlets. It relates particularly to an easily wired plug having no screw connections, in which the conductors are clasped between the tines of bifurcated prongs as the latter are pressed into the body of the plug.

It has been common in the prior art to construct plugs in which the wires are attached to the prongs by individual screws, but the use of individual screws is not as economical as the method of this invention and is comparatively slow.

It has also been common to embed the wires in a resilient body juxtaposed to the prongs, but in order to secure adequate strength for the assembly, a tight fit has been used which requires the use of elaborate machinery to assemble. This unfits it for home use.

Another method of connection to wires is to press sharp pins through the insulation. This requires the use of considerable force and precision tolerances in manufacture, otherwise the electrical contact will not be dependable. The present invention provides resilient members between the housing and the wires, and will therefore provide more dependable contact.

It is known in the prior art to retain wires in spring blades which are compressed onto the wires by the action of assembling a cap. This requires the use of a very strong cap and suitable locking provisions therefor. In this invention, the cap exerts no direct retaining force upon the wires.

Other methods of attaching wires to plugs are in use, but most of them lack fundamentally important features such as strain relief or the like.

It is the purpose of this invention to provide an electric plug in which contact with the wires is effected without the use of any screws, in which the establishment of good electrical contact is not critical to the dimensions of metal prongs, and which requires no machinery for assembly.

It is also the object of this invention to provide a plug to which the wires can be attached with especial ease.

Briefly, the invention utilizes an insulating body, bifurcated spring prongs and a cap. The wires are placed between the tines of the prongs while they are partially retracted from the body of the plug. When they are replaced, the tines are drawn together and thus clasp the wires. The cap is then applied to cover the live parts.

I am giving below, and illustrating in the accompanying drawings, a preferred example of the invention with a view to instructing others in the principles and operation thereof. It should

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be understood that this is not intended to be limiting of the invention. In the accompanying drawings:

Fig. 1 is a perspective view of a plug body and tines, constructed according to one embodiment of this invention, showing wires being loaded into bifurcated spring blades,

Fig. 2 is a perspective view of a cap, shown in position for assembly to the parts shown in Fig. 1,

Fig. 3 is a perspective view of a bifurcated prong,

Fig. 4 is a perspective view of an assembled plug,

Fig. 5 is an elevation of an assembled plug constructed according to a second embodiment of this invention,

Fig. 6 is a plan view of a plug body constructed according to the first embodiment, having both prongs in assembled position clasping wires, and

Fig. 7 is a cross-section along the line 7—7 of the plug parts shown in Fig. 6, with the addition of a cap similar to that shown in Fig. 2.

Referring to the drawings, the plug body 10 is made from insulating material, which may be ceramic or plastic. As indicated in Figs. 1, 6 and 7, it is a generally-flat cylindrical member having a round recess 46 in the middle surrounded by a rim 61. A channel 49 through the rim is used to admit the conductors or cord 15. In the middle of the recess is a boss 62, which is connected to the rim 61 by the rib 63. The boss and rib thus form a pair of arcuate channels 64 and 65 for retaining the two conductors 13 and 14 while keeping the live ends separated. In the bottom of each arcuate channel are the slots 16 and 17 for retaining the prongs 11 and 12. These may be formed with one or both inner wall portions tapered as indicated at 18 in Fig. 7.

A larger number of prongs may be used if desired, such as three for a three-phase line or a two-conductor line with separate ground. In that case the slots would be spaced around the recess as required and a channel provided for leading the third conductor to its respective prong.

Each prong is made for flexurable metal, bifurcated as shown in Fig. 3, and each tine 44, 45 terminates in jaws to firmly clasp conductors inserted therebetween. Laterally protruding members 32 and 33 may be used at the end of at least one tine, with their tips bent inwardly against the opposite tine, each tine thus having two pressure-applying jaws. These members are flexurable by reason of their shape and the springiness of the metal used. When a wire is inserted

between the jaws and the tines are pressed together, these jaw members 32 and 33 clasp the wire resiliently against the opposite jaw members 38 and 39 and effect a dependable electrical connection. This connection is not affected by minor variations in the dimensions of the plug parts and is effective for a wide range of wire diameters. One or two arms 30, 31 may be integrally formed on either tine of the prong for limiting the depth to which a wire falls when inserted between the tines. Another feature shown in Fig. 3 is the step 35 on one tine. This is made sufficiently high, approximately 0.020 inch, to stop the prong from being accidentally removed from the plug body during the operation of inserting conductors, but low enough to permit forcible assembly of the prong into the slot during the initial assembly. The tip of the prong may be curved and provided with a perforation 37 as well known in the art, for engaging with oppositely shaped spring members in an outlet receptacle. The shape indicated in Fig. 3 is preferred, the tip being curved outwardly at 36 as well as perforated with the hole 37. One tine 45 is shaped with flat shoulders 38, 39 which engage with corresponding flat portions of the plug body 40 and 41 respectively. These retain the tine 45 firmly in position so that the edges or jaws 42 and 43 press against the wire while the arms 30 and 31 retained the wire at the best point between the tines.

Referring to Fig. 7, the tapered entrance portion 18 enables the tines of the prong 12 to separate at the upper end when the prong is pushed upwards.

The wires are loaded into the prongs by pushing the prongs outwards until the stop 35 rests against the under side of the plug body. One wire is laid between the jaws of one prong, which separate by the flexure of the tines, as indicated on the left of Fig. 1, which is then pressed downwards into normal position in the plug body with the fingers, the upper side of the cap or a coin. On the right side of Fig. 1 is shown a prong part way down into normal position. Normal position is illustrated in Fig. 7. In this position, the bosses 49 and 50 on the outside, and bosses such as 40 and 41 on the inside, laterally constrain the jaws, and thus cause the jaws to clasp the wires.

The two prongs 11 and 12 are shown in Fig. 7 with their jaws closed different amounts to indicate how random variations in the array of wire strands may cause the jaws to assume various positions, any of which give satisfactory contact.

The tines of the prongs shown herein are designed to make contact with wire from which the insulation has been substantially removed. The jaws of the tines which grip the wire exert a scraping action on the wire which acts to clean the surface and effect a dependable contact. There are no restrictions on roughening the contacting edges or forming projections upon the jaws. The jaw edges may be roughened serrated for further penetrating insulation, as well known in the art.

An effective strain relief for the wires 13 and 14 is provided by the tortuous channel in which they are retained upon being pressed into normal position. Referring to Fig. 6, the inner promontory 47 presses the wire 13 against the inner surface 48 of the recess 46 in the plug. The wire 13 makes a bend to pass through the slot 49 in the edge of the plug body. The wire thus traverses an S-shaped path between the prong and the outside edge of the plug, which acts to keep the wire from being pulled out of the plug without dependence upon any retaining force which may be exerted by the action of the jaws of the prong.

In the embodiment shown in Figs. 1, 4 and 6, the cord 15 enters the plug through a slot 49 in the upper edge. In the embodiment of Fig. 5, a channel 64 for the cord is provided in the bottom edge. The former is easier to load and the latter provides a more substantial hold on the wire and the safety feature that the cord cannot be removed from the plug if the plug is in a receptacle.

The recess 46 in the plug body is normally closed by the cap 20 shown in Figs. 2 and 7. Integrally joined with the cap 20 is a central shaft 21, which normally engages in the socket hole 60 in the plug body. On the shaft 21 are short, radially-protruding teeth 22 and 23. These teeth are arranged to enter the socket hole 60 through the slots 24 and 25, and to engage on the under side of helically-disposed undercuts, one of which is shown at 26. These undercuts have a lead in the same manner as a screw to pull the cap down snugly into the recess in the plug in approximately one-quarter turn. The slots 24 and 25 may be angularly positioned as shown in Fig. 1, in which case the slot appears at an angle substantially perpendicular to the axis of the cord 15 when the cap is turned to the fully locked position.

The bottom edge of the central hole in the plug body is rounded as shown at 56 in Fig. 7 to enable a user to push the cap outwards from the bottom far enough to grasp it under the rim of the head portion on the top of the plug.

To safeguard the teeth 22 and 23, the corresponding abutting members within the body of the plug and the shaft 21 from being damaged by excessive forces accidentally incurred while twisting or turning the cap, a projection or stop 51 is provided on the cap head and a corresponding projection or stop 52 is provided in the recess of the plug body, as indicated in Figs. 1 and 6. Other projections may be used at diametrically opposite sides of the respective portions of the plug body and cap, as indicated on the body at 53 in Fig. 6. Since these stops are disposed at the periphery of the cap, they are capable of exerting much greater angular restraining force than the shaft teeth. They have no locking action. The cap is assembled after the prongs are pushed into position with a tool such as a coin, so that no force is exerted on the prong by any part of the cap. Similarly, the corresponding slot portions 24, 25 and 26 in the plug body are not highly stressed. A slot 76 is provided in the cap and proportioned to be operated by a coin. This slot 76 and the projection 51 are preferably oriented in the same plane as the teeth, thus making it possible to fabricate the piece in a mold which is split in a plane perpendicular to the slot. Accordingly, the cap may be economically molded.

Obviously, the conductors can not be removed without the use of a coin or other tool, thus making the plug safe on appliances for use by young children.

No parts of the plug body are highly stressed either in the wire-inserting operation or in normal operation, so that the plug body may also be economically molded.

The shaft 21 may alternatively be affixed to

the body 10 by a screw connection, as well known in the art.

The sides 54 and 55 of the plug body are shown extended laterally at the top in order to provide a convenient finger grip. Other shapes may be used for this purpose, as well known in the art.

What I claim is:

1. An insulating cap for enclosing and longitudinally restraining the prongs of an electrical connector comprising a shaft portion; spaced radial projections thereon for engaging with corresponding portions of the connector; a rigid head portion integrally joined with and having a cross-sectional area larger than the shaft portion, adapted to engage in a recessed portion of the connector and restrain the prongs longitudinally; a projection on the under side of the head portion for engaging with a corresponding projection on the connector, to stop excessive angular movement and thereby prevent damage to the cap from the application of excessive torque; and means for grasping the head portion with a convenient tool.

2. An electrical connector comprising an insulating body, a plurality of prongs and an insulating cap, said body having an outer supporting portion and an inner cavity portion, said cavity portion having a plurality of spaced slots extending through the bottom, each slot having walls adapted for constraining said prongs, at least one tortuous channel through said supporting portion for admitting conductors to said cavity portion and relieving strains thereon, and means for affixing the cap to the body, each prong being made from flexurable metal and bifurcated into two tines each having a free end, at least one tine having relatively short laterally-extended members at the side edges of the free end thereof inwardly directed toward the other tine for scraping and clasping conductors between said tines when laterally constrained in normal operating position by the walls of the slots, at least one tine having a transverse member integrally joined with a tine for determining the position at which a conductor may be placed between the tines, and the tines flexing to open the free ends thereof when the prongs are retracted for loading conductors.

3. A contact prong comprising a flexurable elongated metal strip folded substantially in the middle to form a bifurcated member having two tines each with a free end, each tine having relatively short members at the free ends thereof, said members extending laterally from the side edges of each tine and directed inwardly toward the corresponding members on the other tine, said lateral members being adapted to flex as the tines are approached one to the other and thereby clasp a conductor with a scraping and resilient gripping action conforming to a large range of conductor sizes.

4. An electrical connector comprising an insulating body, a plurality of prongs and an insulating cap, said body having an outer supporting portion and an inner cavity portion, said cavity portion having a plurality of spaced slots extending through the bottom, each slot having walls adapted for constraining said prongs, at least one tortuous channel through said supporting portion for admitting conductors to said cavity portion and relieving strains thereon, and means for affixing the cap to the body, each prong being made from flexurable metal, bifurcated into two tines terminating in conductor-clasping jaws, said jaws being laterally constrained closed by the walls of the slots in normal position and separated by flexure of the tines when the prongs are retracted for loading conductors into the jaws, said jaws comprising member means extending laterally from side edges of said tines and directed inwardly toward each other, and an outwardly-protruding step on at least one tine of each prong, whereby the prongs can be forcibly inserted into the slots upon initial assembly, and partially retracted for inserting conductors between the jaws of said prongs without danger of accidentally detaching said prongs from the slots.

5. An electrical connector comprising an insulating body, a plurality of prongs and an insulating cap, said body having an outer supporting portion and an inner cavity portion, said cavity portion having a plurality of spaced slots extending through the bottom, each slot tapering wider towards the inside, at least one tortuous channel through said supporting portion for admitting conductors to said cavity portion and relieving strains thereon, and means for affixing the cap to the body, each prong being made from flexural metal, bifurcated into two flexurable tines terminating in conductor-clasping jaws, said jaws comprising relatively short member means extending laterally from side edges of said tines, said member means of at least one tine being directed inwardly toward the member means on the other tine, whereby said member means may resiliently grip a conductor, a transverse member integrally joined with one of said tines for limiting the depth to which a conductor may be positioned between the tines, said jaws being separated by flexure of the tines when retracted from operating position for loading conductors and laterally constrained by the tapered walls of the slots when the prongs are pressed into normal operating position.

6. A contact prong comprising a flexurable elongated metal strip folded substantially in the middle to form a bifurcated member having two tines, each tine terminating in a conductor-clasping jaw, said jaws comprising relatively short member means extending laterally from side edges of said tines, said member means of at least one tine being directed inwardly toward the member means on the other tine, whereby said member means may resiliently grip a conductor, and at least one transverse member integrally joined with a tine for determining the position at which a conductor may be placed between the tines.

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