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D. C. GILLESPIE
ELECTRICAL CONNECTOR
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2,706,647

Fig. 1

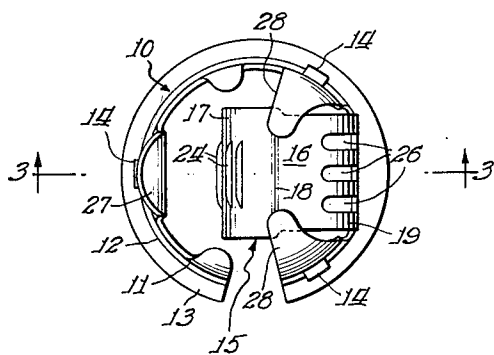


Fig. 2

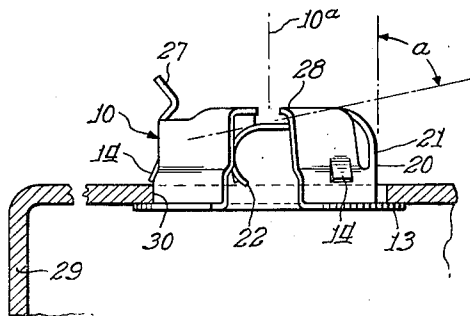
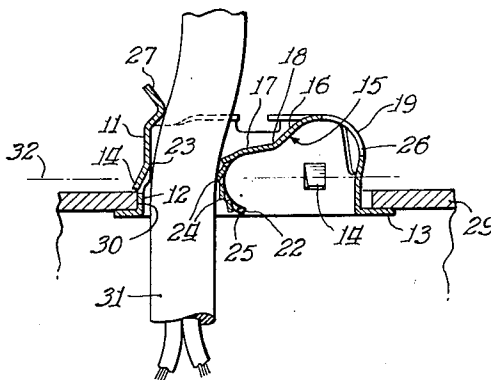


Fig. 3



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2,706,647

ELECTRICAL CONNECTOR

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Application December 22, 1948, Serial No. 66,737

16 Claims. (Cl. 285—6.5)

My invention relates to improvements in electrical appliances and more particularly to an improved connector for holding electrical cables in the walls of outlet boxes.

A connector of this type is shown in my prior application, Serial No. 778,873, filed October 9, 1947, which has since matured into U. S. Patent No. 2,577,748, granted December 11, 1951, and the present invention constitutes an improvement on the connector shown in the prior patent.

My prior patent illustrates an electrical connector which has a resilient arm or finger extending from one side of the tubular body of the connector toward an opposite inner surface of the tubular body with which the finger is adapted to engage an electrical cable passing through the tubular body. It is an object of the present invention to provide lugs on the tubular body of a connector of this type which limit movement of the finger and prevent an overcenter unlocking movement of the finger which might happen if too small a cable were used in the connector. It is contemplated that these lugs shall also have an additional function of preventing too large a cable from being inserted into the connector.

It is another object of the invention to provide an improved connector of this type which has a tubular body formed of portions having two diameters, so that the connector may be inserted in an outlet box opening with its smaller diameter first and then have its portion of larger diameter brought into the opening in which position the connector may fit snugly in its applied position.

It is another of the invention to provide a cable guide on the end of the connector which functions to guide the cable between the inner surface of the tubular body and the end of the resilient finger.

It is another object of the invention to provide a finger of improved form in such a connector and more particularly to provide a finger having a concave bend in its central portion so as to present a greater gripping surface for larger cables and to cooperate with the lugs just mentioned so that a smaller cable may be gripped in the connectors than if no such bend were provided. It is another object to connect the finger with the body of the connector at a point remote from the end of the connector from which a cable is inserted in the connector, so that the finger may have a compound lever action to provide a great cable gripping force.

My invention consists of the novel constructions, arrangements and devices to be hereinafter described and claimed for carrying out the above-stated objects and such other objects as will appear from the following description of a preferred embodiment of the invention illustrated with reference to the accompanying drawing, in which:

Fig. 1 is a top view of an electric connector embodying the principles of the invention;

Fig. 2 is a side elevational view of the connector; and

Fig. 3 is a sectional view taken on line 3—3 of Fig. 1 in the direction indicated, with a cable being shown extending through the connector.

Like characters of reference designate like parts in the several views.

Referring now to the drawing, the electric connector illustrated may be seen to comprise a tubular body 10. The body is formed of a single piece of metal bent into tubular form and comprises a portion 11 of smaller diameter and a portion 12 of larger diameter. The portion 11 is on one end of the body and the portion 12 is on the opposite end. The larger body portion 12 is

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provided with a flange 13, and lugs 14 are struck from the metal adjacent the flange 13 for retaining the connector in an outlet box.

The body 10 is provided with an inwardly extending finger 15. The finger comprises a portion 16 and a portion 17 which extend at an angle with respect to each other, the finger being bent along the line 18 to provide a concavity in this region of the finger and to provide the two angularly extending portions 16 and 17. The finger also comprises a rounded portion 19 which is joined to the body 10 at a point 20 adjacent the enlarged body portion 12 by means of a portion 21 extending substantially parallel with the axis 10a of the tubular body 10.

The finger 15 at its inner end is provided with a curved terminal portion 22, curving away from the opposite inner surface 23 of the body 10 and downwardly as seen in Figs. 2 and 3 which is the direction in which a cable is inserted into the connector to present a convex surface to the inner body surface 23. The finger is provided with a plurality of prongs 24 on this convex surface which provide gripping tooth-like edges, and as will be noted from Fig. 3 in particular, these edges extend substantially the thickness of the metal above the lowest points 25 of the prong surfaces. In order to give increased flexibility to the finger 15 the finger is perforated at three places indicated at 26 in its curved portion 19.

An outwardly flared cable guide portion 27 is provided on the end of the connector remote from the flange 13, the guide portion 27 being located substantially opposite the finger 15. A pair of spaced lugs 28 are formed on this end of the connector, the lugs being located on opposite sides of the finger and having their outer ends disposed so as to overhang the finger 15. The lugs are made relatively rigid as compared to the flexible finger 15 to serve as stop members, and the lugs extend substantially perpendicular to the longitudinal axis 10a of the connector body 10, as shown. As is apparent from Fig. 2, the finger 15 extends at an acute angle a with the axis of the body 10 when the finger 15 is free, the angle a indicating generally the direction the finger 15 extends. The finger 15 is movable in a substantial arc against the resilient action of the finger, flexing and pivoting particularly in its curved portion 19, and the curved terminal portion 22 moves in a substantial arc and has its point of closest approach to the inner body surface 23, but is still spaced from the surface 23, when the angle a is approximately 90°. The lugs 28 being behind the finger 15 will prevent rearward movement of the finger past center position, that is, the position at which the angle a would be 90 degrees. This is important in preventing release of the connection in the event the cable were pulled rearwardly with sufficient force to pivot the finger over center. The lugs are in the path of movement of the concave portion of the finger 15 in the vicinity of the line 18, for purposes to be described.

In order to put the connector into use with a junction or an outlet box 29, the connector is inserted through an opening 30 in the box from the inside of the box until the flange 13 abuts against the edges of the opening, and when the connector is in this position, the lugs 14, which were cammed inwardly as the connector was inserted through the opening, will snap out and function to hold the connector in place. The portion 11 of the connector body which is the portion of smaller diameter is inserted through the opening 30 first and provides a loose fit between the connector and opening so that such insertion is easy. Further movement of the connector into the opening brings its portion 12 of larger diameter into the opening, and this portion of the connector fits snugly in the opening. The body 10 is a split tube, as will be noted, which may be contracted to bring the lugs 14 over the edges of the opening 30, and the portion 12 of larger diameter may be made to fit as snugly as desired in the opening 30 by having the portion 12 of slightly larger diameter than the diameter of the opening 30 when the connector is in its free condition.

When the connector is in place as is shown in Figs. 2 and 3, an electric cable 31 may be inserted into the connector, as from the top in Fig. 3. The guide portion 27 on one end of the connector functions to guide the

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cable 31 between the surface 23 and the finger 15, and when the cable 31 is pushed through the connector, the finger 15 bends at its point of connection with the connector body 10 in the vicinity of the perforations 26 so that the angle a decreases, and the finger 15, being resilient, while pressing against the cable 31, permits the cable to be readily slipped through the connector from the upper end, as viewed in Fig. 3.

When a load is put on the cable 31 tending to pull the cable out of the junction or outlet box, that is, toward the top in Fig. 3, then the finger 15 pivots in the vicinity of the perforations 26, and the angle a is increased. The cable 31 is gripped between the curved end 22 of the finger 15 and the surface 23 with the teeth 24 functioning to grip and frictionally hold the cable. The finger 15 clamps and squeezes the cable rather than digging into it, due to the fact that the gripping tooth-like edges of the prongs 24 extend substantially only the thickness of the metal above the lowest points 25 of the prong surfaces. As will be noted from Fig. 3, the point of attachment 20 of the finger 15 with respect to the body 10 is approximately opposite the point where the curved surface 22 bears against the cable 31, that is, both points are approximately on the line 32 which is parallel with the side of the junction box 29 through which the connector extends and is at right angles to the axis of the connector, and the finger 15 between these two points is return bent particularly in its portion 19, as is apparent, so as to be resilient in a direction at right angles to the axis 10a of the connector body 10 and the surface 23. Thus, when a force is put on the cable tending to pull it outwardly of the junction box (upwardly in Fig. 3) the finger bends first in the vicinity of the perforations 26 in the curved portion 19 and moves upwardly as seen in Fig. 3 like a simple lever. As the cable tightens severely, the finger then begins to bend at point 20 outwardly with respect to the tubular body. This bending at point 20 produces a clamping effect which is at right angles to the cable, and the holding effect thus is the sum of the effect of the finger pivoting in its curved portion 19 and the clamping effect from the outward bending at right angles to the cable in the vicinity of the point 20. In order to facilitate bending at the point 20 and to localize the bending in this area, the finger may be narrowed in this area to reduce its cross-section and thereby weaken the finger in this area.

In case a cable 31 of too small a size is inserted into the connector so that a force in the direction to move the cable back out of the connector (upwardly in Fig. 3) tends to pull the finger 15 over center so that the angle a approaches 90 degrees, the lugs 28 will cooperate with the finger 15 to prevent such an overcenter movement of the finger. It will be apparent that if the finger did move overcenter in this manner, it would completely disengage with the cable and free it. The lugs 28 also have another purpose; they extend into the tubular connector body 10 and function to limit the size of cable that can be inserted into the connector body.

The bend in the finger 15 along line 18 has two principal purposes. When the connector is assembled with relatively large cable, the end portion 22 of the finger 15 has a greater curved surface bearing on the cable than would be the case without the bend in the finger. In the latter case only the inner end adjacent portion 17 of the curved terminal portion 22 would bear on the cable. In other words, the finger, being concave adjacent the line 18, tends to continue to present the major pronged portion of terminal portion 22 to the side of the cable despite bending of the finger in the perforated area 19 and the area of point 20. The bend 18 thus eliminates the loss in holding power that would occur if a large flat smooth surface, such as the inner end only of the curved terminal portion 22 adjacent the portion 17, bore on the cable. The second purpose of the bend along line 18 is to permit the finger area comprising primarily portions 17 and 16 to assume a position more nearly parallel to the line 32 (with a resultant smaller gap between the finger and the surface 22) before the lugs 28 begin to restrict further movement of the finger. Smaller cables can thus be used with the connector in this form.

My improved connector advantageously functions to hold a cable without injuring it due to the fact that the connector functions to hold primarily due to the clamping and squeezing effect rather than to any digging in of prongs into the cable. The cable guide 27 on

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one end of the connector advantageously functions to guide a cable being inserted into the connector between the finger 15 and the opposite inner surface 23. The lugs 28 prevent an excess overcenter pivotal movement of the finger 15 when a cable 31 of too small a diameter for the connector is used so that the finger 15 will completely release the cable, and the lugs 28 have still another advantageous function of limiting the size of the cable that may be inserted into the tubular body 10. The finger 15 is bent into its two portions 16 and 17 along the line 18 in order to provide a greater holding effect on large cables and to permit the use of smaller cables. The finger 15 is joined to the body 10 at the point 20 which is relatively adjacent the end of the connector carrying the flange 13 and is relatively remote from the opposite end of the connector in order to provide an augmented clamping effect by the finger 15.

I wish it to be understood that my invention is not to be limited to the specific constructions and arrangements shown and described except only insofar as the claims may be so limited, as it will be apparent to those skilled in the art that changes may be made without departing from the principles of the invention.

I claim:

1. A cable connector comprising in combination, a hollow body adapted to receive a cable therethrough, a finger extending from said body at one side thereof and toward the opposite inner surface of the body, said finger being pivotally movable and being constructed and arranged to grip a cable between it and said inner body surface for holding the cable in the connector, and an outwardly flared portion on said body at one end of said surface for facilitating the entrance of a cable in said body between said surface and said finger.
2. A cable connector comprising in combination, a tubular body adapted to receive a cable therethrough, a pivotally movable finger extending from said tubular body at one side thereof and toward the opposite inner surface of the tubular body at an acute angle with respect to the axis of the tubular body, said finger being constructed and arranged to grip a cable between it and said inner body surface, and an outwardly flared portion formed on said tubular body on one end of said surface from which end a cable may be inserted through the tubular body in a direction decreasing said angle with said flared portion guiding the cable in entering the tubular body.
3. A cable connector comprising in combination, a tubular body adapted to receive a cable therethrough, and a resilient pivotally movable finger integral with and extending from said tubular body at one side thereof and toward the opposite inner surface of the tubular body, means defining an end portion on said finger constructed and arranged to grip a cable between it and said surface for holding the cable in the connector, and a lug extending perpendicularly to the axis of said body from an edge of said body toward its center and overlying said resilient finger for limiting the size of cable that can be inserted through said tubular body to a smaller diameter than the inner diameter of the tubular body.
4. A cable connector comprising in combination, a hollow body adapted to receive a cable therethrough, a finger extending from said body at one side thereof and toward the opposite inner surface of said body, said finger being pivotally movable and having a curved end portion presenting a convex surface to said inner surface and being constructed and arranged to grip a cable between its curved end portion and said surface for holding the cable in the connector, said finger being further constructed and arranged to provide a bend between its said curved end portion and its point of connection with said body concave from the direction in which a cable is moved into the connector for presenting a greater surface of said curved end portion to a cable in the connector.
5. A cable connector comprising in combination, a tubular body adapted to receive a cable therethrough, and a resilient finger extending from said tubular body at one side thereof at an acute angle with respect to the axis of the tubular body and toward the opposite inner surface of the tubular body so that a cable may be inserted into the connector from one end of said body whereby to decrease said angle, said finger having its end curved to extend in the direction in which a cable is inserted into the connector and to present a convex surface to said inner surface and being adapted to grip a cable between its curved end and said inner surface for holding the cable in the

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connector, said finger being bent between its curved end and its point of connection with said tubular body to be concave from the direction in which a cable is moved into the connector for presenting a greater surface of said curved end to a cable in the connector.

6. A cable connector comprising in combination, a hollow body adapted to receive a cable therethrough, said body comprising a pair of parts facing each other and adapted to grip between them a cable passing through said body, one of said parts constituting a finger extending from said body at one side thereof and pivotally movable in a substantial arc toward said other part toward a position on said arc closest to said other part, and relatively rigid stop means on said body intersecting the arc in which said finger is movable for preventing a cable unloosening pivotal movement of said finger substantially beyond its said position of closest approach to said other part.

7. A cable connector comprising in combination, a tubular body adapted to receive a cable therethrough, a finger extending from said tubular body at one side thereof and toward the opposite inner surface of the tubular body for gripping a cable between it and said surface, said finger being pivotally movable in a substantial arc toward said surface toward a position on said arc closest to said surface, and relatively rigid stop means on said body intersecting the arc in which said finger is movable for preventing a cable unloosening pivotal movement of said finger substantially beyond its said position of closest approach to said surface.

8. A cable connector comprising in combination, a tubular body adapted to receive a cable therethrough, a finger extending from said tubular body at one side thereof and toward the opposite inner surface of the tubular body for gripping a cable between it and said surface, said finger being pivotally movable in a substantial arc toward said inner surface toward a position on said arc closest to said surface, and a relatively rigid lug formed on said tubular body intersecting the arc in which said finger is movable forming stop means cooperating with said finger for preventing a cable unloosening pivotal movement of said finger substantially beyond its said position of closest approach to said inner surface.

9. A cable connector comprising in combination, a hollow body adapted to receive a cable therethrough, said body comprising a pair of parts facing each other and adapted to grip between them a cable passing through said body, one of said parts constituting a resilient finger extending from said body at one side thereof and pivotally movable in a substantial arc toward said other part toward a position on said arc closest to said other part, and a relatively rigid lug extending from an edge of said body toward its center intersecting the arc of movement of said finger and overlying said resilient finger functioning as stop means for preventing a cable unloosening pivotal movement of said finger substantially beyond its said position of closest approach to said other part and the lug limiting the size of cable that may be passed through said body.

10. A cable connector comprising in combination a tubular body adapted to receive a cable therethrough, a finger extending from said tubular body at one side thereof and toward the opposite inner surface of the tubular body and adapted to grip between it and said surface a cable passing through said body, said finger being pivotally movable in a substantial arc toward said inner surface toward a position on said arc closest to said surface, and a pair of lugs extending perpendicularly to the axis of said body from an edge of said body toward the center and overlying said resilient finger for acting as stop means for preventing a cable unloosening pivotal movement of said finger beyond its said position of closest approach to said surface and for limiting the size of cable that may be passed through said tubular body to less than the inside diameter of said tubular body.

11. A cable connector comprising in combination a tubular body adapted to receive a cable therethrough, a finger extending from said tubular body at one side thereof and pivotally movable in a substantial arc toward an opposite inner surface of said connector toward a position on said arc closest to said inner surface and adapted to grip a cable between it and said surface for holding the cable in the connector, and a lug on said tubular body adapted to contact with and stop movement of said finger for preventing a cable unloosening pivotal

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movement of the finger beyond its said position of closest approach to said inner surface, said finger being formed concave in its region adapted to contact said lug for allowing said finger to be moved substantially to its said position of closest approach to said inner surface.

12. A cable connector comprising in combination a hollow body adapted to receive a cable therethrough, said body comprising a pair of parts facing each other and adapted to grip between them a cable passing through said body, one of said parts constituting a resilient finger extending from said body at one side thereof and toward said other part, said finger on its free end having a cable engaging surface and on its other end being attached to said hollow body, said finger being constructed and arranged so that said cable engaging surface thereon and said other end thereof both are approximately in a plane lying substantially at right angles to the axis of said body whereby the finger is adapted to exert a substantial force at right angles to a cable passing through the body.

13. A cable connector comprising in combination a tubular body adapted to receive a cable therethrough, a spring finger extending from said body at one side thereof and toward an opposite inner surface of said body for gripping a cable between a cable engaging portion of the finger and said inner surface, said finger being attached at one end to said body, said finger being constructed and arranged so that the point of attachment thereof to said body and the cable engaging portion thereof lie in a common plane extending substantially at right angles to the axis of said body, said finger adjacent its end fastened to said body having a return bent portion whereby the spring finger may exert a substantial force normal to said inner surface and to a cable passing through the body.

14. A cable connector comprising in combination a tubular body adapted to receive a cable therethrough, a spring finger attached to and extending from said body at one side thereof and toward the opposite inner surface of said body for gripping a cable between the free end of the spring finger and said inner surface, said spring finger having a curved end portion presenting a convex surface to said inner body surface and functioning as a cable gripping surface, said spring finger being constructed and arranged to have its curved cable engaging surface and its point of attachment to said body located substantially in a common plane lying at right angles to the axis of said body.

15. A cable connector comprising in combination a tubular body adapted to receive a cable therethrough, a spring finger attached to and extending from said body at one side thereof and toward the opposite inner surface of said body for gripping a cable between the free end of the finger and said inner surface, said finger on its said free end having a curved cable engaging portion presenting a convex surface to said inner body surface, said finger being constructed and arranged to have said curved cable engaging portion on the free end of said spring finger and the point of attachment of said spring finger to said body both substantially lying in a common plane which extends at right angles to the axis of said body, said spring finger being provided with a curved return bent portion adjacent its end at which it is attached to said body whereby the spring finger is adapted to provide a force substantially perpendicular to said inner body surface for squeezing a cable between the cable engaging surface of the spring finger and said inner body surface.

16. A connector for securing an electrical outlet conduit in a hole in an outlet box, comprising a one-piece hollow tube-like section of thin resilient sheet metal, said section being provided with a slot extending longitudinally throughout the length of the section, the edges of the section which define the slot being substantially spaced apart to render the section resiliently contractible to reduce the circumference thereof for insertion and expansion in the hole, said section having formed integrally with one end thereof a reversely bent tongue of substantial width which extends radially inwardly and axially forwardly within the body of said section, said tongue having a curved inner end provided with corrugations on the outer surface thereof for resiliently clamping a conduit within the section and permitting ready insertion of the conduit from one end of the section into clamped engagement with said tongue, said section having integrally formed stop members which project ra-

dially inwardly of the same end thereof into the path of rearward movement of said tongue and said section also having formed integral therewith longitudinally spaced outwardly directed abutments adjacent the other end thereof for engagement with the opposite sides of the hole of the outlet box to prevent endwise movement of the section subsequent to its insertion and expansion in the hole.

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