Aug. 29, 1967 R. L. MARTIN 3,339,170

PRESSURE LOCK GROUNDING OUTLET

Filed Dec. 11, 1964 2 Sheets-Sheet 1

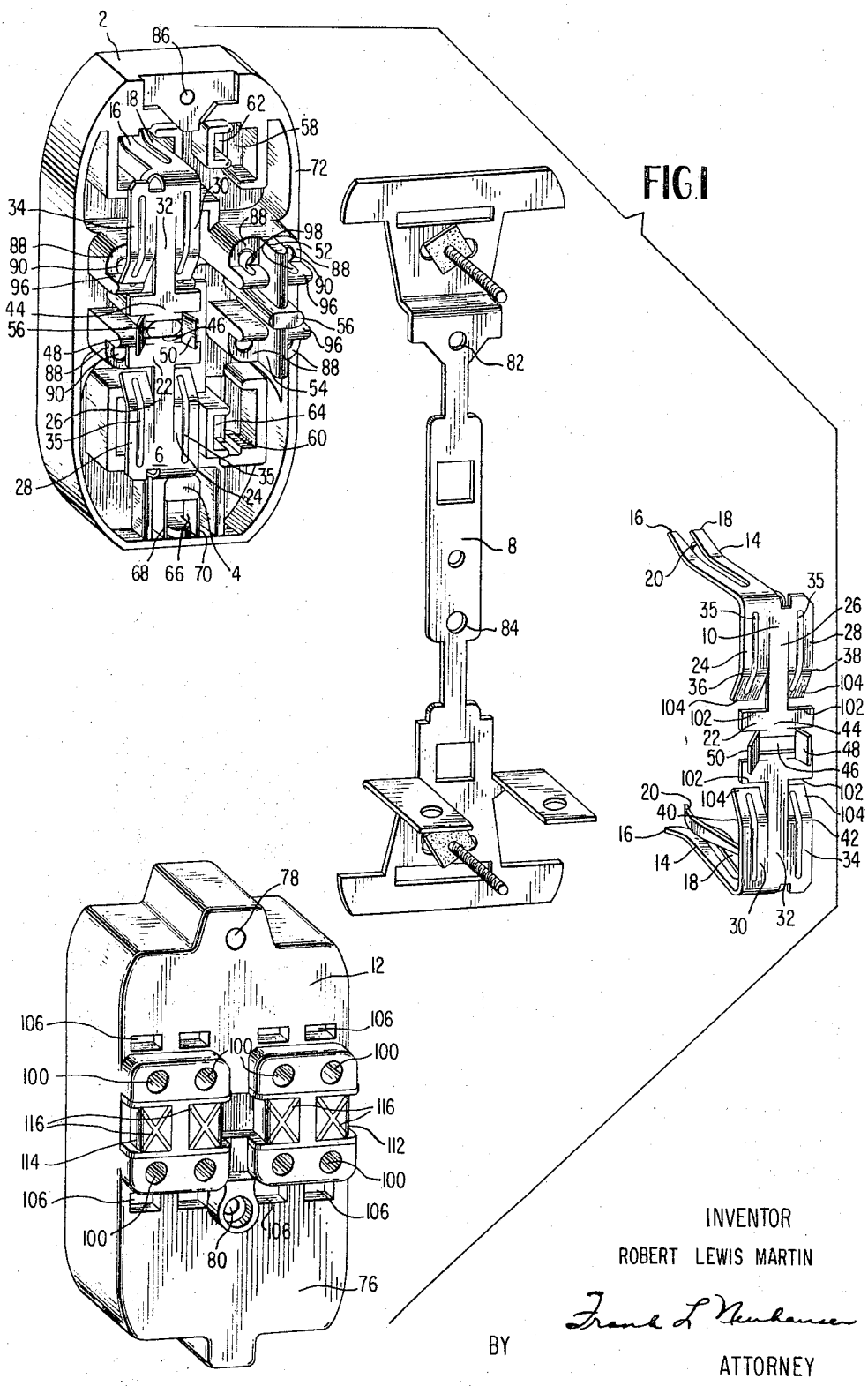


FIG. 1

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FIG. 2

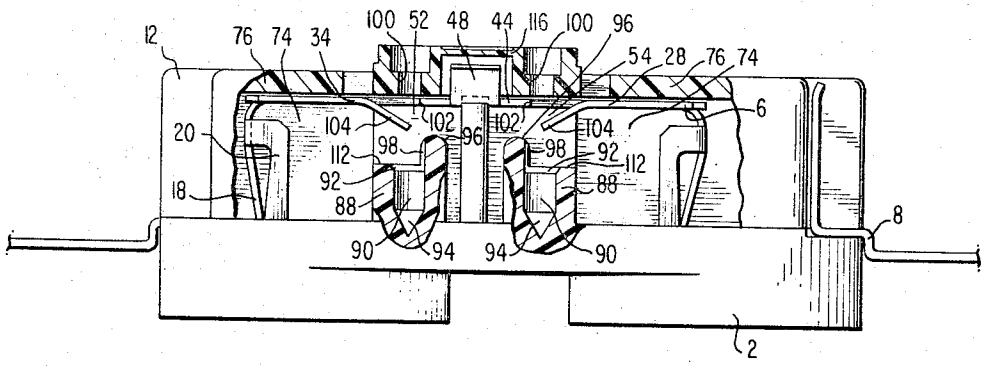


FIG. 3

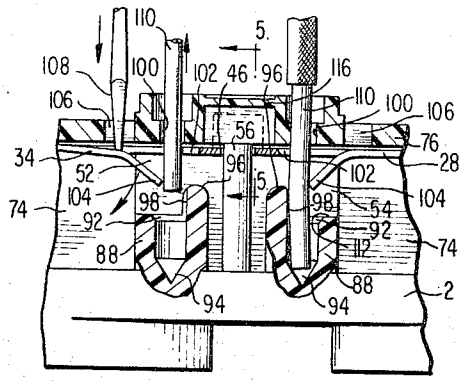
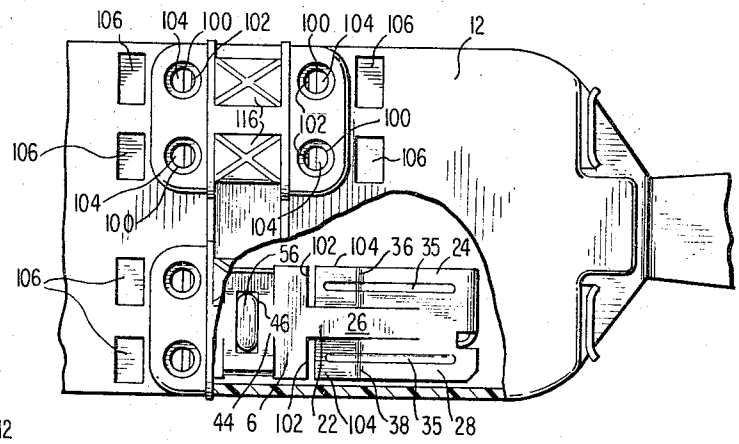


FIG. 4



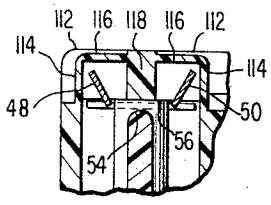


FIG. 5

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PRESSURE LOCK GROUNDING OUTLET

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ABSTRACT OF THE DISCLOSURE

A screwless electrical connector is provided for attachment of a plurality of wires. The electrical connector has an E form the end members of which comprise cams for holding wires pushed into contact therewith.

This invention relates to a grounding outlet having multiple spring-operated wire fastening means for providing electrical engagement with inserted line wires of different sizes. More specifically, it relates to a duplex plug receptacle having a pair of electrical line contacts each having spring operated wire gripping means adapted for gripping several line wires of different sizes.

The performance of prior art duplex plug receptacles which have been provided with spring type wire fastening means has been less than satisfactory where two or more wires of different sizes are fastened and it is desired to release only the larger of the wires while the smaller wire is under tension. The gripping elements of these spring type fastening devices have been designed in various ways, but these prior designs have been deficient in a number of respects. One principal defect is observed when line wires of different sizes are employed and this has also been found to be the case where wires of the same size are inserted.

Where an attempt is made to remedy this deficiency by utilizing a bifurcated spring to provide two spring locking elements for a fastening arrangement, this arrangement has also proven less than satisfactory in actual use in holding two wires of the same or different sizes. This arrangement is especially deficient during the releasing of the wires in that it is not possible to release only one of the wires without simultaneously releasing the other where both are held by the same spring element even though it is bifurcated where deflection of one prong of the spring serves to impart a similar deflection to the other prong.

Surprisingly it has been found, however, that it is possible to provide highly effective spring action where two wires are held by two portions or two locking tongues of a single spring element. In fact, it has been found that in accordance with the present invention, the pressure on a first wire which is held by a first locking tongue of a single spring element is increased rather than decreased when the pressure on a second wire, held by a second locking tongue of the same spring element is decreased.

It is an object of this invention to provide a convenience electrical outlet in which a plurality of electrical supply wires of different sizes will be firmly grasped simply on insertion of the wires.

It is another object of this invention to provide a device in which the simple pushing in of a plurality of supply wires establishes sound electrical contact with the contact elements for supply of heavy electrical loads from one of said wires to another.

It is another object of this invention to provide such a device in which a single electrical contact member is readily connectable with two or more electrical supply wires of different sizes.

It is a further object of this invention to provide an insulating housing for such a device so that the spring elements which engage a supply wire are enclosed in separate insulated pockets formed as an integral part of the insulating housing.

Still another object is to provide a device in which wires can be connected by push in techniques to carry relatively heavy electrical loads.

In one of its broader aspects, the article of the present invention comprises a push-in type of electrical connector having a pair of leaf spring locking tongues disposed as the outer prongs of an E form,

holding means for limiting the flexural movement of the central prong when an outer prong is flexed,

holding means for limiting rotational or linear motion of said E form in the plane of said form,

the connecting arm of said E form being free to serve as a force transmitting lever operating about the center prong as a fulcrum to impart counterflexing force to one outer prong when flexing force is applied to the other outer prong.

In another of its aspects a number of the objects are accomplished in accordance with this invention by providing a convenience electrical outlet for use with a grounding attachment plug to have a grounding contact and two shallow U-shaped line contacts, each U-shaped line contact of which is provided with arms terminating in prong receiving means and each U-shaped line contact of which is also provided in the base thereof with four separate cam arrangements for engaging four separate wires in a spring-lock arrangement in the base of each contact.

To provide the four separate cam arrangements, the line contacts are formed from metal strip having good leaf spring property and the strip is trifurcated at two longitudinal portions of the base of the line contact so as to form three parallel prongs or legs extending lengthwise of the contact. One end of each of the outer legs is made free of the base so as to form a cantilevered cam leg. The two outer cam legs in combination with the central leg and the portion of the strip which joins the three legs at their held end comprises an E form which is integrated into the contact as one component element thereof.

Each of the cam legs may be bent up from the base of the U-shaped contact so that a wire may be pushed through the opening in the base formed by the bending up of the end of the cam leg. A wire may thus be engaged in the base of the contact between the free, movable end of the cam leg and the remaining edge or shelf of the contact base from which the free end was displaced. An inserted wire is electrically contacted on one side by the shelf and on the other side by the free end of the leg. Four wires can therefore be individually held in firm engagement with such a U-shaped line contact.

The line contacts are enclosed within an insulating housing which is formed by two molded insulating members. One of these members, a base, is provided with a pair of pockets, each of which snugly receives one of the U-shaped line contact strips. Elongated ribs are provided on the second housing member, a cover, to hold the line contacts firmly against the base when the base and cover are in the assembled position.

Each line contact is also provided with a pair of break-off tabs whereby each contact can be made into two separate pieces, each of which can be connected to two wires of different sizes for split-circuit wiring. The elongated ribs also partially divide the pair of pockets so as to be interposed between the cam legs of each of the separate pieces.

Other objects and further details of that which is believed to be novel in the articles of the present invention will be clear from the following description and claims taken with the accompanying drawings wherein:

FIG. 1 is an exploded view of a grounding outlet constructed in accordance with this invention and incorporating the E form spring locking element.

FIG. 2 is a side view of the grounding outlet with portions broken away and others shown in sections.

FIG. 3 is a portion of a side view of the grounding outlet with portions shown in section.

FIG. 4 is a portion of a rear view of a grounding outlet with a portion of the base broken away.

FIG. 5 is a portion of a side view of a grounding outlet with a portion shown in section taken along the line **1—1** in FIG. 3, to reveal a pair of break-off tabs.

By reference to FIG. 1, it will be seen that a grounding outlet constructed in accordance with this invention comprises six principal components. A molded cover **2** is shown with a grounding contact **4** and a line contact **6** assembled thereon. Shown in spaced relationship with respect to cover **2** is a mounting bracket **8**, a second line contact **10**, and a molded base **12**.

Referring now to line contact **10**, which is identical to line contact **6**, it will be seen that the line contacts are each formed from a single piece of metal, preferably a spring tempered brass, and are generally of a shallow U-shape. Each arm of the U-shape contact is formed to provide prong receiving means **14**. The prong receiving means **14** are trifurcated portions of the contact, and comprise three legs **16**, **18**, and **20**. Legs **16** and **18** are parallel, and the third leg **20** is perpendicular to them. The three leg arrangement provides a double-wipe arrangement for engaging the prong of a connector. This double-wipe is provided with either the parallel prongs of a 125 volt plug, or with the in line arrangement of the prongs of a 220 volt plug. It is necessary to use a different cover when changing voltages, for the aperture for the prong must be formed differently. However, the single device is adapted for use at a plurality of voltages by appropriate change of the cover element.

The base **22** of the U-shaped line contact is generally rectangular in shape. Two spaced portions of the base are trifurcated so as to form legs **24**, **26**, **28**, **30**, **32**, and **34**. The outer legs **24**, **28**, **30**, and **34** are each cut free of the base at one end and partially bent so as to form cantilever cam legs. A channel **35** is shown to be coined in the center of each of the legs **24**, **28**, **30** and **34** extending the length of the leg to add strength to the cantilever cam legs. The legs **24**, **28**, **30**, and **34** are also bent at points **36**, **38**, **40**, and **42**, respectively, so that the free ends of the cam legs extend out of a plane of the base **22** in the direction of the prong receiving means **14**. Central leg **26** separates the cam legs **24** and **28** from each other and mechanically joins their held ends to a central portion **44** of the base **22**. Similarly, cam legs **30** and **34** are separated from each other and mechanically joined to the central portion **44** of the base by center leg **32**. The central portion **44** is formed with a rectangular aperture **46** therein, and with a pair of break-off tabs **48** and **50** on either side of the aperture. These break-off tabs **48** and **50** are bent out of the plane of the base to make them more accessible when it is desired to break them off, as will be later described.

Referring to molded cover **2**, and line contact **6** in FIG. 1, the positioning of the line contacts **6** and **10** with respect to the cover will be understood. The features provided on the cover **2** for the mounting of line contact **10** are the mirror image of those for the line contact **6** which is shown in its operative position. Furthermore, in the duplex type plug receptacle or outlet which is shown, the line contacts are positioned symmetrically with respect to perpendicular axes drawn through the center of the outlet and extending in directions parallel to the length and width of the outlet respectively. The cover **2** is provided with elongated ribs **52** and **54** extending in the direction of the center legs and upon which rest the center legs **26** and **32** of the line contact. These elongated ribs **52** and **54** also serve as insulating barriers between the cam legs. A locating projection **56** extends through the rectangular aperture **46** formed in the line contact.

Before discussing the wire fastening arrangement of the duplex plug receptacle illustrated in FIGS. 1 through 5, the remainder of the receptacle assembly shown in FIG. 1 will be discussed.

Wells **58** and **60** are provided in the cover **2** for accepting the prong receiving means **14** of the line contacts. Apertures **62** and **64** are provided in the cover in alignment with the wells **58** and **60**, respectively, for the insertion of plug prongs which engage the prong receiving means **14**.

The grounding contact **4** shown positioned on the cover **2** is provided with two double-wipe prong engaging portions, one of which is shown at **66**. The double-wipe prong engaging portion which is shown includes the contact members **68** and **70**. The mounting bracket **8** which is provided with the usual mounting means at either end is positioned on the molded cover in abutting relationship with the grounding contact **4**, and in insulated relation between the line contacts **6** and **10**. The molded base **12** is placed over the line contacts **6** and **10** and the mounting bracket **8**. The edge **72** of the cover **2** engages an edge of the base. This edge is on the hidden side of the base in FIG. 1.

Referring to FIG. 2, it will be seen that the base **12** is provided with an insulating wall or barrier **74** which extends lengthwise of the base and divides the base into two pockets, each of which has a rectangular shape conforming to that of the base **22** of the U-shaped line contacts **6** and **10**. The back wall **76** of the base **12** engages the base **22** of the line contacts, holding the center legs of the contacts **6** and **10** in engagement with the elongated ribs **52** and **54**. The end of the wall **74** which projects away from the back wall **76** engages the mounting bracket **8** securing it and the grounding contact **4** between the base **12** and the cover **2**. After the six major components shown in FIG. 1 are assembled, they are held together by a pair of screws. These screws pass through the holes **78** and **80** in the molded base, and holes **82** and **84** in the mounting bracket and engage threaded holes in the cover **2**, one of which (**86**) is shown.

Refering now to the detail sectional views in FIGS. 2, 3 and 4 along with the exploded view in FIG. 1, the wire fastening means of the duplex outlet shown will be understood. On both sides of the elongated ribs **52** and **54** are formed identical shelf portions **88**. Each of these shelf portions is provided with a wire receiving bore **90**. As is best seen in FIGS. 2 and 3, this bore **90** is provided with a chamfered lead **92**, and a conical end **94**. The chamfered lead **92** aids in guiding a wire into the bore, and the conical end **94** serves as an inclined surface or ramp for developing a wedging action as explained below, and the conical end also aids in centering the wire which is gripped by the fastening means. Extending from each shelf **88** is a rib **96** which has a groove **98** formed therein. This groove can be tangent with a portion of the perimeter of the bore **90** to aid in directing a wire into the bore.

Base **12** is provided with eight identical holes **100** through which wires are inserted to be engaged by the spring lock fastening means. Two of these holes **100** are shown in cross-section in FIGS. 2 and 3. As can be seen by making reference to FIGS. 2 through 4, the edges or shelves **102**, from which the free ends of the cam legs are severed, extend into the projection of the holes **100**. Also, the free ends **104** of the cam legs extend within the projection of the holes **100**. A wire upon being inserted in a hole **100** may first engage shelf **102**, and may be deflected by it to engage the inclined surface of free end **104** of a cam leg as it is further inserted.

Although the shelf **102** extends into the projection of hole **100**, it does not extend so far as to prevent free insertion of the wire past the extending portion of shelf edge **102** and directly into contact with the deflectable cam leg end **104**.

The end of an inserted wire can ride down the inclined surface of the end of cam leg **104** until it reaches its furthest extent of entry before the cam leg end **104** is de-

flected. At this point the wire will contact the inclined surface leg end **104**, shelf edge **102** and the upper edge of the side of hole **100** diametrically opposite shelf edge **102**.

Pushing the wire causes the leg end **104** to deflect and allows the wire to contact the surface of rib **96**. Surface **96** then becomes a third contact point on the wire in place of the edge of hole **100**. Further insertion of the wire in the hole causes it to engage the groove **98** in the rib **96**. It may then ride up and over an inclined surface such as a continuation of chamfered lead **92** through groove **98** before being guided into the bore **90**. The wire is centered in the bore **90** by the conical end **94**.

Another important aspect of the novel gripping means of this invention is described with reference to FIGURE 3. On the right side of FIG. 3, a wire is shown engaged by the spring-lock fastening means. As the wire is inserted in the hole **100** and presses against the free end **104** of the cam leg, the cam leg is deflected in cantilever fashion throughout its length, thereby providing spring bias force on the side of the wire. Aiding in providing a resilient bias on the free end of the cam leg and giving more yieldability to the cam leg is a torsional spring force provided by the center leg **26** or **32**. As is shown in FIG. 2, a portion of the center legs **26** and **32** of the base **22** of the U-shaped contact is held in firm engagement with the back wall **76** of the molded base **12** by the elongated ribs **52** and **54**. The elongated ribs can be made to engage the center legs **26** and **32** only along a relatively short length and along a narrow area. Engagement along a narrow central area is accomplished by making the elongated ribs **52** and **54** half-rounded, as best seen in FIG. 1. With this construction the insertion of a wire in the spring-lock fastening means not only causes deflection of the yieldable cam legs, but also causes a torsional deflection or yielding of the center legs **26** and **32** which aids in providing a spring bias force upon the wire. The line like contact between the half-rounded edges of the elongated ribs **52** and **54** and the center legs **26** and **32** provides a pivot line or fulcrum for torsional deflection of the center legs. Use of this fulcrum can also confine the deflection largely to the cam legs and the associated center leg, where it is desired to immobilize or otherwise prevent movement of other parts of the line contact. Such immobilization can be accomplished whether one or both of the cam legs adjacent a center leg are utilized in gripping a wire. The cam legs are also confined between the elongated ribs **52** or **54** and either the outer walls or dividing wall **74** of the base **12** which prevent deflection of the cam legs other than that which is desired.

Rectangular apertures or access holes **106** are provided for the insertion of a tool to release the pressure-lock wire fastening means. A tool such as a screwdriver **108** as shown in FIG. 3 is inserted through a rectangular aperture **106** and is brought to bear on the cam leg **34**, thereby deflecting the cam leg away from the wire **110** and releasing the wire. Surface **112** of shelf **88** is engaged by the free end **104** of the cam leg before the leg is deflected beyond its elastic limit, thereby preventing permanent damage of the contact when a wire is released. Where the advantage of increased contact pressure is sought on the cam leg opposite that deflected for release of a wire, the rib support can preferably extend to the region of the contact strip at which the release pressure is to be exerted.

As previously mentioned, the line contacts are provided with break-off tabs **48** and **50** in case it is desired to form two separate contact pieces from each line contact for split-phase wiring. The molded base **12** is provided with fracturable wall portions **112** which cover the break-off tabs. These wall portions prevent shorting of the break-off tabs before they are removed. The vertical walls **114** and the horizontal walls **116** which enclose the break-off tabs **48** and **50** are best seen in FIG. 5. In order to provide split-phase wiring, the wall portions **114** and **116** are broken away to expose the break-off tabs **48** and **50**. After breaking away these wall portions the tabs **48** and **50** are each grasped by a tool such as pliers and broken away from the central portion **44** of the line contact. The separate pieces are firmly held within the housing comprising the molded cover **2** and the molded base **12** during and after removal of the break-off portions by the portion **118** of the base which holds the central portion **44** of the contact in firm engagement with the elongated rib **54** of the cover. Each piece is held within a well formed by the side walls of the base **12** and the central wall **74** which divides the base into two pockets. Also, the center leg **26** or **32** of each separate piece is held against the molded base **12** by the elongated ribs **52** and **54** respectively.

It has thus been seen that in one of its narrower aspects this invention discloses a double grounding outlet in which each of the line contacts is formed from a single sheet of spring tempered brass. Four separate spring-lock wire fastening means are provided on each line contact. Whereas the four spring-lock wire fastening means are separate, it is possible to connect four wires of different sizes to each line contact. Furthermore, by providing the line contacts with a pair of break-off tabs it is possible to separate the line contacts into two separate pieces, each of which can be connected to two wires of different sizes.

While a particular embodiment of the invention has been shown, other embodiments of the invention will be apparent to those skilled in the art, and it is intended to cover by the appendant claims all the embodiments falling within the scope thereof.

One of the more important features of the device of the present invention relates to the facility with which the device may be used in the field as a versatile tool for the rapid wiring of a variety of circuits. In part, this is due to the inclusion of four separately operable cam legs, all of which are electrically joined for each contact strip used in the device. Where the device is not used for the wiring of separate circuits to the two electrically separable outlets, it is evident that the four wire gripping cam legs can accommodate and provide junction connection among four wires of different dimensions in any combination. For example, where the electrical supply from a first supply line to the outlet is made with a number 10 gauge wire, the device may be wired by the insertion of the stripped wire ends directly into holes **100** in the rear of the device so that one supply wire of the line is gripped by each of the contact strips. If the electrical supply for a ceiling fixture is to be obtained from the circuit already connected to the outlet, this may be accomplished by simply inserting the stripped ends of the wire which might be of a number 12 gauge into the appropriate pair of holes **100** in the reverse of the outlet.

Similarly, if a clock outlet is to be wired from the same outlet device, a number 14 wire may be connected in the outlet by the insertion of its wire ends into appropriate holes in the reverse side of the device.

While each of these wires is held firmly in place, if some change in the wiring should be found necessary, this may be accomplished simply by use of the release mechanism by inserting an instrument into the appropriate hole **106** adjacent the wire to be released and only that wire will be released which is held by the specific cam leg acted on by the instrument inserted through the hole.

One highly useful modification of the device of the present invention which illustrates its capabilities as a wiring device for the quick easy wiring of a variety of electrical circuits is that which employs only the wire gripping portions of the contact strips such as **6** and **10** of FIGURE 1. These portions comprise two E-forms face to face and joined by their central legs to a shelf strip.

In this modification the prong receiving ends may be omitted and the spacing between the parallel strips may be reduced to provide a very compact unit having an insulating barrier between the contact strips. The unit produced by this modification is very compact and is use-

fully mounted on the inside of the cover of a junction box to provide means for rapid connection of four wires to each of two contact strips. An operating device of this construction had a housing for containing the contact strip which housing was two inches long, one inch wide and slightly over one half inch deep.

Alternatively a junction box push in type connector can be provided with three parallel contact strips, each being adapted for push-in connection of four wires. Such a connector can be supplied with 220 volt power by connecting two wires supplying the 220 volt power to two of the three contact strips, and connecting a third wire at an intermediate supply voltage to the third contact strip. For example, the two wires having the 220 voltage level between them can be connected to the two outer contact strips, and the third wire at the intermediate voltage can be connected to the center of the three parallel contact strips.

By then making push-in connections of one set of two wires to one outer and the center strip respectively and by making separate push-in connections of a second set of two wires to the center and the other outer strip respectively, two separate 110 volt circuits can be rapidly and securely connected in the junction box through the three strip junction unit.

Also longer strips having more than two pairs of cam legs or having cam legs with different orientation are contemplated within the scope of this invention.

As a separate unit incorporated into the junction box, an insulated grounding strip equipped to be connected by screw terminals can be mounted in insulated relation with the cover of the box on which the junction box itself is mounted or it can be mounted in integral fashion with the insulated housing of the junction box itself.

One of the advantages of the present invention derives from the better electrical contact which is established between the stripped copper conductor and the electrically contacted edges of the contact strip. This better contact is the result of the development of a contact pressure which is quite high for the effort needed to establish the pressure. This pressure is developed through a novel combined pinching and wedging action as the conductor passes over a guiding surface such as the surface of rib **96**. This surface receives the wire, and at the same time the wire is pinched between the two edges **102** and **104**.

Referring particularly to FIGURE 3, it will be seen that the free end **104** on one side of the wire acts to pinch the wire between the surface **98** and the contact edge **102** of the shelf on the other side of the wire. The relation of these three surfaces is shown more clearly in FIGURE 2 which illustrates the position of the three surfaces before the wire end is pushed into place for establishing electrical contact. As is evident, the shelf edge **102** protrudes out slightly beyond the closest portion of the hole **100**, i.e. the edge **102** is positioned closer to the axis of the hole **100** than the portion of the vertical surface above the edge **102**.

Surface **98** serves to provide a wedging action in guiding the wire end as it rides over this surface during the pushing in of the stripped wire. This is particularly evident as the wire end rides up the inclined surface of the conical end **94**.

The contact strip is not held in a completely immovable fashion so that as the bared wire is pushed into place there is a slight movement of the contact strip back and forth as the need arises. However, the latitude of movement of edge **102** does not permit it to move to a position where the shelf will not intersect a straight line between the portions of the surfaces **100** and **98** closest to the center of the outlet. Also, as may be seen from FIG. 4, the distance from one of the two exposed shelf edges **102** of the contact strip to the other edge **102** is longer than the distance between the most closely spaced sides of holes **100**. The result of the exposure of the edge **102** in each hole **100** coupled with the guiding action of the surface of fin **96** is a wedging action of the entering wire against the edge of free end **104** after the wire is brought into contact with the edge of end **104** by deflection of the end.

The improved electrical contact results in part because the two edges **102** and the edge of end **104** are both urged into contact with the stripped copper conductor but at higher pressures than those achieved by other devices which permit such easy entry of the conductor.

A unique wire locking mechanism is accordingly provided pursuant to this invention from a single strip of material forming the contact because of this combination of ease of the push-in entry of the wire and firmness of gripping the wire at higher contact pressure.

What is claimed is as follows:

1. A push-in type electrical connector disposed in a housing, said connector comprising a pair of conductive leaf spring locking tongues disposed as the outer prongs of an E-form, holding means on said housing for limiting the flexural movement of the central prong when an outer prong is flexed, further holding means on said housing for limiting rotational or linear motion of said E-form in the plane of said form, the connecting arm of said E-form being free to serve as a force transmitting lever operating about the center prong as a fulcrum to impart counter flexing force to an outer prong when flexing force is applied to the other outer prong.

2. The connector of claim **1** in which the center prong of the E form is joined to a cross member portions of which are disposed proximate the free ends of the outer prongs so that a tensile force is developed in said center prong when a separative force is applied between one of the free ends and a portion of said cross member.

3. The connector of claim **2** in which said E form and joined cross member are formed from a single piece of conductive metal.

4. The connector of claim **1** in which a plurality of E-forms are electrically joined by their central prongs.

5. The connector of claim **4** in which the joined E-forms are fashioned of a single piece of metal.

6. The connector of claim **5** in which the free ends of the E-form outer prongs are confronted with a cross piece attached at the central prong.

7. The connector of claim **6** in which the strip has weakened portions in the cross pieces adapted to be broken to separate said strip into a plurality of portions each having at least one E-form.

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