April 14, 1964 F. J. BROCH 3,129,048

ELECTRICAL CONNECTOR

Filed June 15, 1961

2 Sheets-Sheet 1

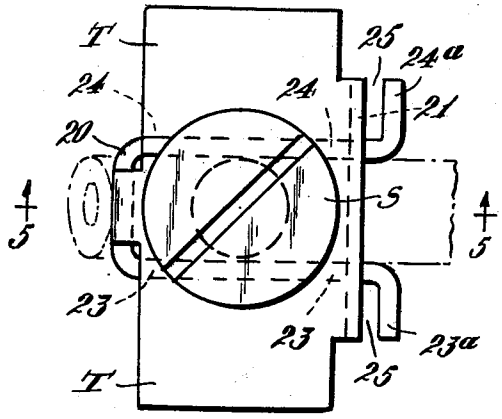


Fig. 1

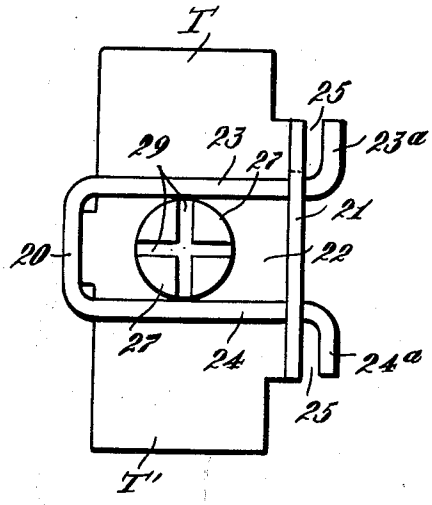


Fig. 3

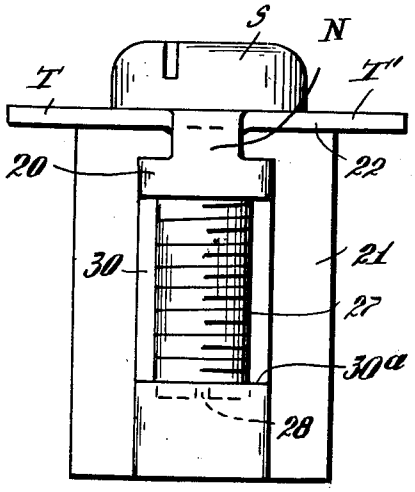


Fig. 2

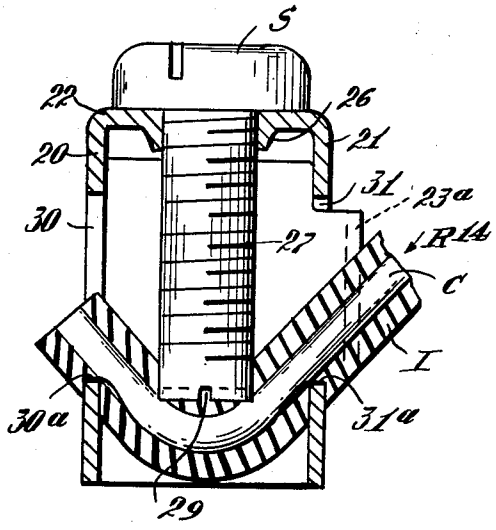


Fig. 5

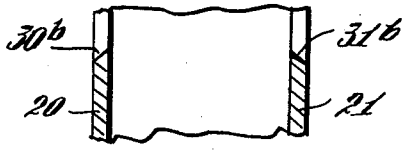


Fig. 12

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April 14, 1964 F. J. BROCH 3,129,048

ELECTRICAL CONNECTOR

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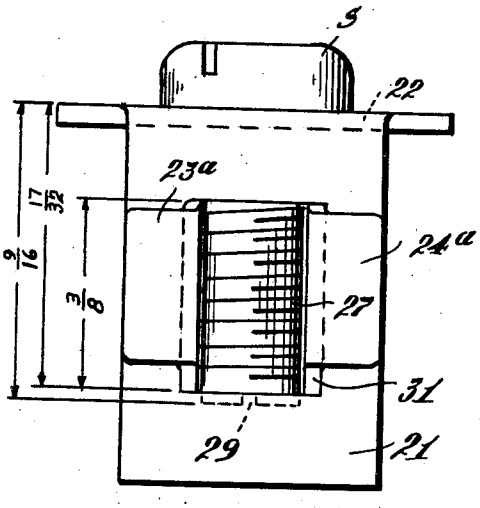


Fig. 4

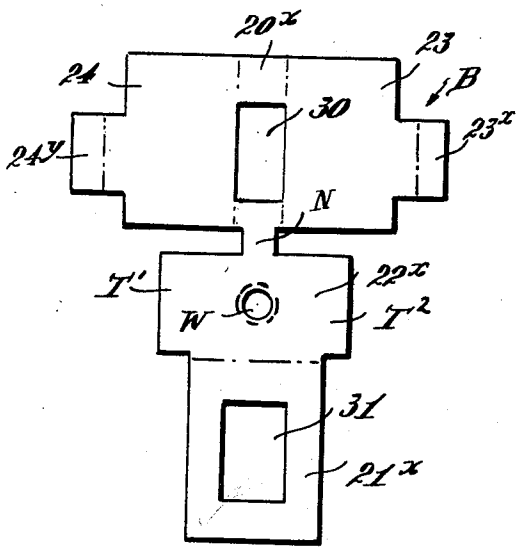


Fig. 6

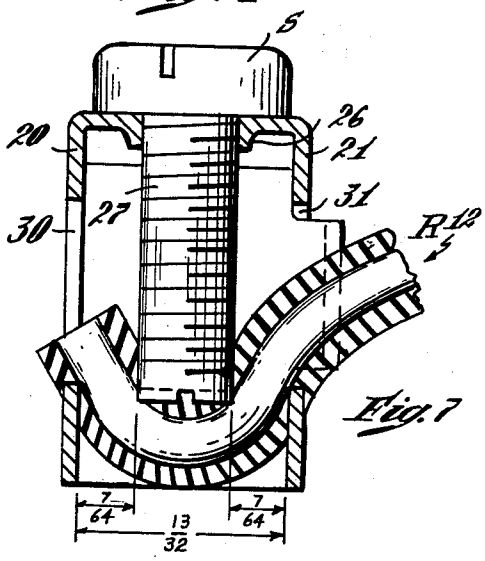


Fig. 7

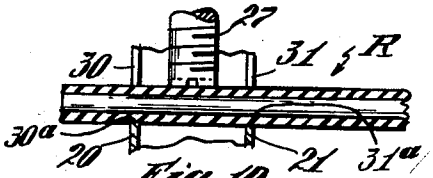


Fig. 10

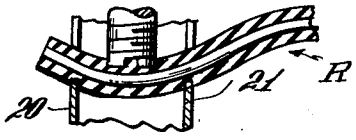


Fig. 11

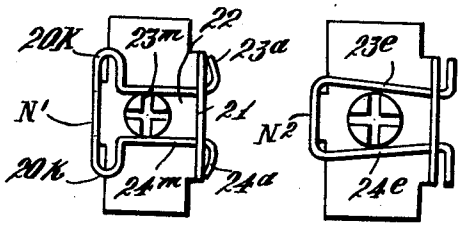


Fig. 8

Fig. 9

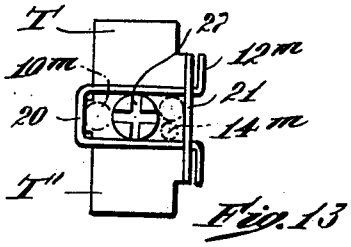


Fig. 13

United States Patent Office 3,129,048 Patented Apr. 14, 1964

3,129,048

ELECTRICAL CONNECTOR

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Filed June 15, 1961, Ser. No. 117,215
13 Claims. (Cl. 339—97)

This invention pertains to electrical connectors of the solderless type, and more especially to a connector or terminal primarily intended for use with insulated solid-core conductors, and particularly conductors having Nos. 14 or 12 copper core wires—these being the sizes generally used in wiring 20 ampere standard toggle switches, receptacles and so forth, for lighting circuits. However, the connector, as herein described and illustrated, is also useful with No. 10 plastic insulated conductors employed in 30 ampere circuits. The connector of the present invention depends for its intended functioning upon the inherent stiffness of standard copper conductive wire of the above sizes, although in a preferred embodiment it is also capable of receiving and holding, by an eye bend a stripped, stranded-core conductor of standard type, in sizes from No. 18 up, while concomitantly holding a solid-core conductor such as above referred to.

The insulation used upon solid-core conductors, within the above size range, is usually hard and difficult to remove and after it has been stripped off, the core wire is so stiff that it is not easy to curl or "eye bend" the bared portion of the wire about the shank of the customary terminal screw, such as is commonly employed in anchoring the end of a conductor to a switch base or the like. I am aware that connector devices (for example plugs for use with No. 18 stranded core conductors) have been proposed for temporary use wherein the conductor is clamped in place by a sharp pointed screw which penetrates the insulation and indents the stranded core, thus avoiding the necessity for stripping, but providing only a single point, inadequate contact. I am also informed of another kind of connector for use with a stranded core conductor which provides a blunt-ended clamping screw designed to force the insulated conductor down into spaced V-shaped notches, very close to the periphery of the screw, whose edges constitute cutters which penetrate the insulation to form spaced points of contact. However, connectors of the latter type would not be acceptable for holding solid core conductors (at least within the above range of size) since, in such connectors the screw does not deflect the conductor, and the mere pressure of the screw against an undeflected conductor would not provide sufficient anchorage to satisfy the requirements of the Underwriters Code and, furthermore, as designed, such prior connectors would be dangerous from the standpoint that in the hands of unskilled or careless users, the core wire might easily be so deeply indented as to result in breakage if not actually sheared off.

The present application is a continuation-in-part of my co-pending application for United States Letters Patent, Ser. No. 619,766, filed November 1, 1956, and now abandoned for Dual-Purpose Electrical Connector.

An object of the invention is to provide a connector to which such a solid-core conductor may be firmly and adequately secured in good conducting relation thereto without the usual preliminary step of stripping the insulation from the terminal portion of the wire or forming an eye-bend in the core wire.

A further object of the invention is to provide a connector by means of which an insulated conductor, of the above type and within the size range referred to, may be so attached that no degree of longitudinal stress imposed upon the conductor, short of that which would destroy the connector, will pull the conductor from out of the connector, and wherein such capability to resist withdrawal

of the conductor is a function of the stiffness of the wire core and the consequent difficulty of straightening a short bend in the conductor solely by applied longitudinal stress. In making use of the reluctance of a bend of short radius, made of stiff wire, to straighten in response to longitudinal stress, the present invention provides a connector so designed that a straight length of the insulated conductor may be introduced into the connector without difficulty, and then, by applying force by means of a screw, to the midportion of a length of the insulated conductor resting upon supports (spaced apart a distance which exceeds the screw diameter by, at least, a multiple of the diameter of the core wire) and with no intermediate support, bowing the unsupported part of the conductor downwardly to form a deep U-bend and so confining the bend, thus formed, as positively to prevent withdrawal of the bent portion of the conductor from the connector except the screw by purposely retracted, and concomitantly providing four areas of metal-to-metal contact between the connector and conductor core wire.

Other objects are to provide a simple, inexpensive and reliable connector for use with solid core insulated conductors within the range of from No. 10 to No. 14 wire; to provide a connector of such design and proportions as to provide at least four areas of contact between the core wire and the connector; and wherein the areas of contact are the result of a scraping action rather than mere indentations; to provide a connector so designed that simply by threading the insulated conductor through openings in the frame provided therefore and manipulating a single element, the conductor is so permanently defromed that it cannot be withdrawn accidentally from said openings by longitudinal pull except in response to stress sufficient to destroy the connector, while at the same time, to provide a connector such that in establishing contact between the core wire and the connector, the connector is so resiliently stresed as to insure maintenance of the contact regardless of slight change in the shape of the core wire; to provide a connector comprising a unitary frame of sheet metal and a single, movable, force-applying elements carried by the frame by means of which force may so be applied to the conductor as to form therein a permanent bend which cannot be displaced except after the purposeful retraction of the force-applying element; and wherein the frame is so proportioned and the force-applying screw is of such diameter that the conductor cannot slip laterally from beneath the tip of the force-applying screw either during the application of bending force or after the bend has been formed. A further object is to provide a simple connector by means of which a solid core conductor, within the size range 14–10, may be electrically connected (without previous stripping of the solid-core conductor) to a stranded core conductor of No. 18 or smaller, after the latter has been stripped.

Other and further objects and advantages of the invention will be pointed out in the following more detailed description and by reference to the accompanying drawings wherein:

FIG. 1 is a plan view to a scale of 4:1 of a connector embodying the present invention—a No. 14 solid-core rubber-insulated copper conductor being shown to scale in broken lines as secured to the connector;

FIG. 2 is a front elevation of the connector, omitting the conductor, to the same scale as FIG. 1;

FIG. 3 is a bottom view of the conductor of FIG. 1, to the same scale, omitting the conductor;

FIG. 4 is a rear view of the connector of FIG. 1, omitting the conductor;

FIG. 5 is a vertical section, substantially on the line 5—5 of FIG. 1, the conductor being in vertical axial section and showing how, by the action of the force-applying

screw, a permanent downward bight or bend has been formed in the conductor and, at the same time, the insulation has been penetrated to provide metal-to-metal contacts at four separate points;

FIG. 6 is a plan view, to smaller scale, of a metal blank from which such a connector as that of the previous views may be made;

FIG. 7 is a view similar to FIG. 5, but showing the connector having a No. 12 rubber-insulated conductor secured thereto and illustrating the type of bight produced in a conductor of that size by the action of the deflecting screw;

FIG. 8 is a diagrammatic bottom view, to double actual size, of a preferred embodiment of the present invention, omitting the conductor;

FIG. 9 is a view similar to FIG. 8, illustrating another modification;

FIGS. 10 and 11 are diagrammatic fragmentary vertical sections illustrating successive steps in the formation of the permanent bend in the conductor in securing it to the connector of the present invention;

FIG. 12 is a fragmentary vertical section, in the same plane as FIG. 5, showing conductor-supporting edges of a different transverse shape; and

FIG. 13 is a diagrammatic horizontal section illustrative of the clearance between the deflecting screw and the cutting edges as compared with the diameters of the metal core wires of conductors of sizes 10, 12 and 14, respectively.

The following is a table from the National Electrical Code, 1959, showing the standard sizes of solid-core insulated copper conductors of American wire gauge sizes 14, 12 and 10:

Size AWG	Allowable Current-Carrying Capacity in Amp. for Rubber and Thermoplastic Insulation	Dia. in Inches of the Bare Solid Copper Conductor	Approx. Dia. in Inches of the Insulated (Covered) Conductor	
			Rubber Type Letter: R, RH, RHH, RHW, RHRW, RW	Thermoplastic Type Letter: T, TW, RU, RUH, RUW
14	15	.0641 (≐ 1/16)	.171 (≐ 11/64)	.131 (≐ 9/64)
12	20	.808 (≐ 3/32)	.188 (≐ 3/16)	.148 (≐ 5/32)
10	30	.102 (≐ 7/64)	.242 (≐ 1/4)	.168 (≐ 11/64)

The connector, of the present invention, is based upon the discovery that the inherent stiffness of a No. 14 solid core insulated, conductor is sufficient (when deflected to form a bight or bend, as hereinafter described, and by means equivalent to that disclosed) to insure four metal-to-metal contact points and to prevent it from being withdrawn from the connector regardless of the longitudinal stress which may be applied to the conductor. It will be obvious, from the further description, that the same insulation-penetrating and retention characteristics will be inherent in conductors heavier than No. 14 and that the sharpness of deflection of such heavier wires will be greater than that of No. 14 wire, thus providing even more powerful opposition to withdrawal of the conductor from the connector.

As above noted, solid-core insulated conductors in Nos. 14 and 12 sizes are those which are most generally used for the wiring of 20 ampere standard toggle switches, receptacles, and so forth.

Referring to the drawings and, in particular, to FIGS. 1 to 5 inclusive, which illustrate one desirable embodiment of the invention, the frame of the connector, which is desirably of sheet metal, is shown as comprising the substantially parallel, apertured front and rear walls **20** and **21** which are integrally joined to a substantially flat, horizontal top wall **22**. The terms "front" and "rear" are here used for convenience in description and have no functional significance. Side walls **23** and **24** are also integrally joined to the front wall and, as shown in FIGS. 1 and 3, extend in substantially parallel relation from their junctions with the front wall **20** to the rear wall and then outwardly through the aperture **31** in the rear wall and have their extremities bent in opposite directions, as shown at **23***a* and **24***a* (FIG. 3), respectively, so that these extremities are substantially parallel to the outer surface of the rear wall **21** and normally spaced from said outer surface, as shown at **25** to provide clearance of the order, for example, of 1/32 of an inch. The front wall **20** is provided with the aperture **30** (FIGS. 2 and 5) aligned with the aperture **31**. Edges **30***a* and **31***a* constitute the lower boundaries of apertures **30** and **31** respectively. As illustrated, these conductor-supporting and insulation-cutting edges are of the thickness of the sheet metal; flat, horizontal, substantially rectilinear and parallel to each other; and are equally spaced from the lower edges of the walls **20** and **21**. The frame thus defines a chamber having front, rear, side and top walls, but bottomless.

The top wall **22** is provided with a central opening W (FIGS. 6 and 8). Desirably, the metal is downwardly struck to form a thick marginal portion **26** (FIG. 5) surrounding the opening—the wall of the opening being screw-threaded for the reception of the screw-threaded shank **27** of a conductor-deforming screw S having a head provided with a flat undersurface for engagement with the upper surface of the top member **22**. The shank of this screw **27** is of a length, between the undersurface of its head **28** and its lower extremity such that, when the head contacts the surface of the top member **22**, the lower end of the screw is below the horizontal plane of the edges **31***a* and **32***a* of the apertures in the front and rear walls. As here illustrated, this distance is 1/16", and the length of the screw shank is 9/16". Desirably, although not necessarily, the tip of the screw is provided with one or more grooves **29**, here shown as extending diametrically, and whose edges constitute abrading elements to facilitate the penetration of the conductor insulation as the screw is manipulated for deforming the conductor, as hereinafter more fully described. While the edges **31***a* and **32***a*, as shown in FIG. 5, preferably are at right-angles to the vertical surface of the apertured walls, it is contemplated that these edges may be beveled as shown at **31***b* and **30***b* (FIG. 12), in order to provide for more readily incising the conductor insulation.

Desirably, the frame of the connector, just above described, may be made from a single blank B (FIG. 6), for example of hard sheet brass of approximately 1/32 of an inch in thickness. Other metals, having the desired mechanical and electrical characteristics, may be substituted if desired. This blank, as illustrated, comprises the part **22***x* which forms the top member **22** of the frame, the part **21***x* which forms the rear wall **21** of the frame, and the part **20***x* which forms the front wall of the frame, and which is connected to the part **22***x* by the neck N—the part **20***x* having the aperture **30**, while the part **21***x* has the aperture **31**. The top member **22***x* of the blank has the centrally located aperture W. The parts **23***x* and **24***y* of the blank form the terminal portions **24***a* and **23***a* of the side walls of the frame, while the parts T^1 and T^2 of the blank form ears T, T^1 (FIG. 2) extending outwardly from the top wall and exemplifying means whereby the frame may be secured to any structure in which the connector is to be embodied, for example a switch base, and/or to metallic conducting elements.

In FIG. 5 the connector is shown as having a conductor R^{14} secured to it, this conductor comprising the solid No. 14, metal core C and the installation I. It will be noted that the edges **30***a* and **31***a* of the frame have penetrated the insulation of the conductor so as to contact the metallic core, while the tip of the screw shank has likewise penetrated the insulation so as to make contact with the metal core of the conductor at diametrically opposite points of the tip of the screw. Thus, the connector contacts the metal core at four separate points. When the frame is of

metal of the above order of thickness, the edges 30*a* and 31*a*, even though square, readily penetrate the insulation.

It is preferable that the conductor, when secured to the connector, should not project downwardly below the plane of the lower edge of the frame. Thus, for example, to accommodate conductors of the range above referred to, the frame may be so dimensioned that the lower end of the conductor-deflecting screw, when in operative position, where it has penetrated the insulation and contacts the metal core, is spaced approximately 5/32" above the plane of the lower edge of the frame. It may further be noted (FIG. 5) that the slope of each leg of the U-shaped bight of core wire, in a No. 14 conductor, extends upwardly from the lowest point of the bend at an angle of the order of 45°, and that the full diameter of the core wire, at the lowest point of the bight, is below the plane of the edges 30*a* and 31*a*.

As shown in FIG. 3, the shank 27 of the conductor-deforming screw is of a diameter approximately equalling the distance between the inner surfaces of the side walls 23 and 24 of the frame as here illustrated, a diameter of 3/16". While a screw of somewhat smaller diameter may be employed, it should not be so small as to permit a No. 14 conductor to slip laterally from beneath the screw tip as pressure is being applied, or during use.

The distance between the periphery of the screw shank and the inner surfaces of the front and rear walls 20 and 21 is at least as great as the diameter of the core of the largest conductor (that is to say, a No. 10, plastic insulated conductor), with which the connector may be used. This is diagrammatically illustrated in FIG. 14, where the core 10*m* of a No. 10 conductor is shown in dotted lines as interposed between the screw shank and the wall 20 of the frame, while at 12*m* and 14*m* the cores of a No. 12 wire and No. 14 wire, respectively, are shown in dotted lines as interposed, with much clearance, between the screw and the wall 21.

Referring to FIGS. 10 and 11, which illustrate the manner of connecting a conductor to the connector—FIG. 10 shows the conductor R as having been passed through the apertures in the walls 20 and 21 of the frame, so as to provide a horizontal portion resting upon the insulation-incising edges 30*a* and 31*a*. The frame is completely open at its bottom and there is nothing to support the conductor which bridges between the edges 31*a* and 32*a* and nothing which the bridging portion of the conductor may contact as the screw 27 is turned, so as to force the bridging portion of the conductor downwardly between the edges 30*a* and 31*a*. An early stage in the bending of the conductor is shown in FIG. 11, where the tip of the screw is shown as beginning to enter the insulation and the edges 30*a* and 31*a* are also beginning to penetrate the insulation. It will be appreciated that as the unsupported portion of the conductor begins to bend, the direction of pressure at the edge 31*a* is no longer at right-angles to the axis of the core wire, but becomes more-and-more inclined to said axis. The result of this action is that the core wire moves axially, relatively to the edges 30*a* and 31*a* and the tip of the screw, thus resulting in a scraping action which produces clean longitudinally extending contact areas, rather than mere notches. This not only insures good contact but eliminates all danger of shearing the wire. The final result of the downward advance of the screw is that shown in FIG. 5 as above described.

Because of the stiffness of the core of conductors of the size range for which the connector is designed, it requires a load of at least 50 pounds to deflect a No. 14 wire, as shown in FIG. 5, and a load of at least 80 pounds to deflect No. 12 wire as shown in FIG. 7. The deflection to the extent shown in FIG. 5 is such that the core wire takes a permanent set and has no appreciable tendency to straighten out if the screw be retracted. Because of the stiffness of the wire, when it has once been bent downwardly, as shown in FIG. 5, it is impossible to withdraw it from the connector except after the screw has been retracted, since no longitudinal tensile strain applied to that part of the conductor, located outside of the connector, is sufficient to straighten the core wire to permit it to be withdrawn from beneath the screw. Since the clearance space between the periphery of the screw and each cutting edge is sufficient to receive a No. 10 core wire, it follows that for wires of sizes 10 and 12, the contact pressure between the core wire and the edges 30*a* and 31*a* will be greater than for No. 14 wire and the legs of the bight will slope more steeply than when the conductor is of No. 14 wire and thus, for all three sizes of wire for which the connector is designed, the downward deflection of the conductor by the deforming screw is such as to prevent accidental withdrawal of the wire from the connector. In fact, the deflection of even the No. 14 wire is greater than actually necessary to accomplish the desired result, so that it is possible to clamp an eye-bend of stripped, stranded-core conductor of No. 18 size or smaller, between the head of screw S and the top surface of the connector frame without interfering with the attachment of the No. 14 conductor as above described.

Since the downwardly directed bight once formed is permanent and cannot be straightened except by the use of suitable tools, it is necessary that the opening above the cutting edge be of a height such as to permit the unstraightened bend of the wire to be withdrawn (after having retracted the screw), in order that, when desired, the conductor may be disconnected from the connector. Experiments show that to permit such withdrawal of the bent portion of the wire, the height of the opening above the cutting edge should be at least twice the outside diameter of the insulated conductor. Since this connector is designed to be used with insulated conductors of sizes 12 and 14, and also No. 10, plastic-insulated conductors, it follows that the height of the opening, above the cutting edge, should be approximately 3/8 of an inch which is approximately twice the outside diameter of a rubber-insulated No. 12 conductor, although a greater height is permissible.

In FIG. 7 of the drawings, a conductor R^{12} (of No. 12 size) is shown as secured to the connector of the present invention, and it will be noted that because of the larger diameter of this conductor, as compared with that shown in FIG. 5, the slope of the downwardly directed bight is steeper than that of the No. 14 wire.

In certain of the views desirable dimensions are indicated as a specific example of a connector having the desired capabilities and which is useful with rubber-insulated conductors of sizes No. 12 and No. 14, and plastic-insulated conductors Nos. 10, 12 and 14.

In FIG. 8 a preferred modification of the frame is illustrated wherein the neck N^1 of the frame (which may be larger than the neck N shown in FIG. 6) is shown as integrally united by U-shaped bends 20*k*, directed oppositely, with the side walls 23*m* and 24*m*. In this instance, the extremities 23*a* and 24*a* of the side walls are so bent that their tips contact the outer surface of the rear wall 21.

In the arrangement of FIG. 3, wherein there is a clearance space 25 between the parts 23*a* and 24*a* and the rear wall 21, it is possible for the lower portion of the rear wall to spring, relatively to the front wall, slightly in response to the downward advance of the screw in securing the conductor to the connector, so that the stiffly resilient metal of the frame, by reason of its tendency to resume its original or normal shape, insures a continued contact of the tip of the screw with the core of the conductor throughout the use of the device, even though the shape of the bight in the core wire should gradually change by fatigue. The same effect is produced with the arrangement of FIG. 8, wherein, because of the U-shaped bends 20*k* between the front wall and the side walls, the lower portion of the front wall may spring, slightly, in response to the downward advance of the screw in connecting the conductor to the frame.

In FIG. 9 a further slight modification is illustrated wherein the neck N^2 (wider than the neck N of FIG. 6) is integrally joined to the side walls 23*e* and 24*e* which in this device converge toward each other from their junction with the apertured front wall toward the rear wall 21*e*, but substantially midway between the front and rear walls are spaced apart a distance approximately equal to the outside diameter of the screw. This arrangement facilitates the entry of the end of a conductor by first inserting it into the aperture in the front wall and then advancing it between the side walls until its end emerges from the open end of the rear wall.

As above noted, as the conductor-deflecting screw is advanced, the bridging portion of the conductor resting upon the insulation-incising edges will be forced downwardly, gradually, thus increasing the length of the bridging portion of the conductor. This means that the legs of the bight are inclined more-and-more relatively to the planes of the front and rear walls, so that the insulation-incising edges form incisions in the insulation which make acute angles with the axis of the metal core, thus facilitating the insulation-incising operation and, at the same time, form longitudinally extending scraped areas on the core wire, thus completely eliminating the danger of injuriously nicking the core or severing the core. Thus, even though a screw of abnormal length were to be substituted by a user for that which forms a part of the connector as manufactured, a careless or thoughtless user could not possibly sever the conductor by advancing such an abnormally long screw to its full extent.

Hard sheet brass of the order of 1/32 inch in thickness, such as is here recommended for use in making the connector, is so stiff that the frame made therefrom normally retains the shape imparted to it during its manufacture but, nevertheless, such material is inherently resilient so that, when stressed in the operation of deflecting the conductor, the front and rear walls of the frame may spring out of exact parallelism but, nevertheless, will return to their original positions when the strain is released and meanwhile maintain the pressure of the conductor against the screw tip.

The dimensions of insulated conductors are standardized and when herein reference is made to a conductor of a certain number, it is to be understood that the dimensions of such conductor are those given in the National Electrical Code, published by the National Fire Protection Association of 60 Batterymarch Street, Boston 10, Massachusetts.

It is obvious that if the insulation-incising edges were spaced very widely apart, without change in the other dimensions of the connector, the downward bight produced by the advance of the screw would be relatively shallow as compared with its length, that is to say, the slope of its legs would be relatively slight and thus the difficulty of straightening of the conductor by longitudinal pull might be decreased to a point such that the connector would not function as intended. When the distance between the insulation-incising edge and the periphery of the screw approximately equals the diameter of the core wire of a No. 10 conductor, the slope of the legs of the downwardly directed bight is approximately 45° for the smaller conductor (No. 14). It has been determined that this is sufficient to insure the proper functioning of the connector, and it is recommended that this spacing of the incising edge from the periphery of the screw should not be substantially exceeded.

Obviously, the connector here disclosed may be used, if desired, in conventional manner for holding an eye-bend in a pre-stripped conductor by clamping the eye-bend beneath the head of the screw. Since the connector of the present invention is designed to be useful with rubber-insulated conductors of sizes 12 and 14, and also with a plastic-insulated conductor of size No. 10, the specific dimensions suggested, as desirable, are such as to accommodate conductors of all three sizes. However, it is manifest that the dimensions might be proportionately reduced if the connector were designed for use with a No. 14 conductor only, and for this reason certain of the claims define the dimensions of the connector, not in inches but by reference to the outside diameter of the insulation of the core of the conductor with which it is to be used, or to the relative dimensions of the parts of the connector such as are requisite to provide a downwardly directed bight of the conductor of the depth required to insure the proper retention of the conductor when secured to the connector.

While certain desirable embodiments of the invention have herein been illustrated and described by way of example, it is to be understood that the invention is broadly inclusive of any and all modifications falling within the scope of the appended claims.

I claim:

1. An electrical connector for use with a solid-core conductor of a stiffness at least as great as that of a conventional No. 14 copper-core conductor, said connector comprising a metal frame including spaced front and rear members and an upper part having therein a screw-threaded hole, a screw, whose axis is vertical, having threaded engagement with the hole in the upper part, each of said front and rear members, respectively, having an insulation-cutting edge, said edges collectively constituting a support for a length of conductor arranged to bridge the space between said edges, the axis of the screw being midway between said edges and the latter being so spaced from the periphery of the screw that, as the screw is advanced downwardly so as to apply pressure to the middle of the bridging portion of the conductor, the said bridging portion will be gradually bowed downwardly between said edges thus increasing the length of the bridging portion of the conductor and causing the insulation-cutting edges to form incisions in the insulation which make acute angles with the axis of the metal core, and means operative to prevent horizontal deflection of the conductor in response to the downward pressure exerted by the screw.

2. A connector for use with insulated electrical conductors whose core wires are of a stiffness approximating that of standard copper conductor wire within the range of from No. 14 to No. 10, said connector consisting of a unitary frame of hard sheet brass of the order of 1/32 inch in thickness, said frame having spaced front and rear walls, side walls, and a top wall collectively defining an interior chamber open at its bottom, each of the front and rear walls having an aperture of a size to permit free passage therethrough of a rubber-insulated conductor of size No. 12, the lower edge of each aperture constituting an insulation-incising element, the top wall of the frame having a screw-threaded aperture, a conductor-deflecting screw having threaded engagement with said aperture, the axis of the screw being midway between said insulation-incising edges, each edge respectively, being spaced from the periphery of the screw a distance at least as great as, but not substantially greater than, the diameter of the solid copper core wire of a No. 10 plastic-insulated conductor, the screw shank being of a length such that, when an insulated conductor of any of the above sizes is passed through the apertures in the front and rear walls of the frame and allowed to rest upon the incising edges, and the screw has been advanced downwardly to the maximum possible amount, that portion of the conductor which bridges said edges will form a depending U-shaped bight of a depth such that, at is lowest point, the full diameter of the core wire will be below a line joining the lowest points of said incising edges.

3. A connector according to claim 2, wherein the screw shank is of an outside diameter of approximately 3/16 inch; the incising edges are approximately 17/32 inch below the upper surface of the top member of the frame; and the length of the screw shank is such that, when

the screw is fully advanced, the tip of the screw is approximately 9/16 inch below the top member of the frame.

4. A connector according to claim 2, wherein the side walls of the frame are spaced apart, on that diameter of the screw shank which is parallel to the apertured walls, a distance such that the space between said walls and the periphery of the screw shank is less than the diameter of the solid copper core wire of a standard No. 14 insulated conductor.

5. A connector according to claim 2, wherein the side walls of the frame are integrally connected to one of said apertured walls but converge toward the other apertured wall and have portions which pass through the aperture in said latter wall and terminate in tabs which overlap and are spaced from the outer surface of said latter apertured wall.

6. A connector according to claim 2, wherein the apertured front wall is integrally connected, by outwardly directed U-shaped bends to the respective side walls; the side walls, between their junctions with the front wall and the apertured rear wall, being approximately parallel and spaced apart a distance substantially equal to the diameter of the screw, and the extremities of the side walls which are located outside of the rear wall turning rearwardly and contacting the rear wall.

7. A connector according to claim 2, wherein the apertures in the front and rear walls are each of a height above the corresponding incising edge such that the permanently formed U-shaped bend, resultant from the action of the screw, may be withdrawn from said interior chamber through one of said apertures, but only after the screw has been fully retracted thereby to disconnect the conductor from the connector.

8. A connector according to claim 2, wherein the conductor-deforming screw is provided with a head having a flat lower surface and the top member of the frame has a surface between which and the head of the screw an eye-bend of the bare wire of a standard core conductor of a size not greater than No. 18 may be clamped, while the screw is concomitantly retaining a solid core conductor in assembled relation with the connector.

9. A connector for use with solid-core insulated copper wire of from No. 14 to No. 10 size, said connector comprising a sheet metal frame having a top wall, side walls and parallel front and rear apertured walls but being wholly open at its bottom, the top wall having a screw-threaded aperture approximately midway between its front and rear edges, a conductor-deflecting screw engaging said aperture with its head above the upper surface of the top wall, the lower edges of the apertures in the front and rear walls constituting insulation-cutting elements, the shank of the conductor-deflecting screw being of a length such that, when it is fully advanced so that its head contacts the top surface of the top wall, its free end will be below a line connecting said cutting elements by approximately 1/32 inch, the front and rear walls being spaced from the periphery of the screw a distance at least as great but not substantially greater than the diameter of the copper core of a No. 10 solid-core insulated conductor, and each of the side walls, at a transverse plane through the axis of the screw, being spaced from the periphery of the screw a distance less than the diameter of the solid copper core wire of a No. 14 insulated conductor, and the height of each respective aperture above its cutting edge, in the front and rear walls, being approximately double the outside diameter of the insulation of a rubber-covered No. 12 solid-core conductor.

10. A connector for use with solid copper-core insulated wire of from No. 14 to No. 10 size, said connector comprising a sheet metal frame having a top wall, side walls and parallel front and rear apertured walls but being open at its bottom, the top wall having a screw-threaded aperture approximately midway between its front and rear edges, a conductor-deflecting screw engaging said aperture with its head above the upper surface of the top wall, the lower edges of the apertures in the front and rear walls constituting insulation-cutting elements, the shank of the screw being of such length and the cutting elements being so spaced from the periphery of the screw that, when a No. 14 solid-core insulated conductor, bridging said edges, has been downwardly deflected by advancing the screw until its head contacts the top wall of the frame, the resultant downwardly directed bight in the conductor will be of a depth such that the slope of the axis of the core wire, between its lowest point, and the point where said axis intersects the plane of the apertured wall, will be of the order of 45°.

11. An electrical connector for use with a solid-core insulated conductor, said connector comprising a frame consisting of sheet metal and having spaced parallel, front and rear walls, side walls and a top member, but being bottomless, the top member having a screw-threaded hole, each of the front and rear walls having an aperture for the reception of an insulated solid-core conductor, of a size at least as great as a conventional No. 12 conductor, said apertures being aligned with each other, the aperture of each front and rear wall having an insulation-penetrating lower edge, a screw having a threaded shank disposed in the threaded hole in the top member and whose axis is approximately midway between said front and rear walls of the frame, said lower edges being so spaced apart that the distance between each edge and the periphery of the screw shank is at least as great as the diameter of the solid-core of the conductor with which the connector is to be used, said screw having a head disposed above said top member of the frame, the head having a flat undersurface operative to clamp a bare, stranded conductor of size No. 18 or smaller against the upper surface of said top member, the length of the screw shank, below the lower surface of its head, being such that when a solid-core insulated conductor is arranged to rest upon said insulation-penetrating edges so as to bridge the space between said edges, the screw can be advanced to apply force sufficient to cause the lower edges of said apertures to penetrate the insulation and engage the metal core of said insulated conductor before the downward motion of the screw is limited by contact of its head with a bare stranded conductor of size No. 18 or smaller resting on the upper surface of the top member of the frame, the side walls of the frame being so closely spaced as to prevent lateral deflection of the insulated conductor in response to the pressure of the end of the screw—the end of the screw which engages the conductor being so shaped that, as the screw is advanced downwardly, sufficiently far to cause said edges to penetrate the insulation, that portion of the conductor which bridges the space between the walls is gradually bowed downwardly so that the incisions formed in the insulation make acute angles with the axis of said metal core, the height of each aperture being such that, after a conductor has been so bent down, it may be removed from the frame only after retraction of the screw.

12. An electrical connector for use with insulated solid-core conductors of standard code dimensions within the size range of from No. 14 to No. 10—said connector comprising a unitary frame of hard sheet brass approximately 1/32 inch in thickness and comprising parallel front and rear walls, side walls and a top wall collectively defining a chamber which is open at its bottom, each of the front and rear walls having an aperture of a width at least equal to the outside diameter of a rubber-insulated No. 12 conductor, the lower edges of said apertures constituting insulation-incising elements, said edges being spaced from the upper surface of the top wall a distance of approximately 17/32 inch—the top wall having a centrally located, screw-threaded aperture, a conductor-deflecting screw having a threaded shank engaging the internal threads of said aperture and having a head located above said top mem-

ber, the length of the screw shank, below its head, being approximately 9/16 inch—each of the insulating-incising edges being spaced approximately 7/64 of an inch from the periphery of the screw shank, and the inner surfaces of the side walls of the frame being spaced apart a distance approximately equal to the diameter of the screw shank, each of said apertures being of a height, above the corresponding insulation-incising edge, a distance of approximately 3/8 of an inch.

13. An electrical connector for use with a solid-core conductor, said connector comprising a metal frame including spaced front and rear members and an upper part having therein a screw-threaded hole, a screw, whose axis is vertical, having threaded engagement with the hole in the upper part, each of said front and rear members, respectively, having an insulation-cutting edge, said edges collectively constituting a support for a length of conductor arranged to bridge the space between said edges, the axis of the screw being midway between said edges and the latter being so spaced from the periphery of the screw that, as the screw is advanced downwardly so as to apply pressure to the middle of the bridging portion of the conductor, the said bridging portion will be gradually bowed downwardly between said edges thus increasing the length of the bridging portion of the conductor and causing the insulation-cutting edges to form incisions in the insulation which make acute angles with the axis of the metal core, and means operative to prevent horizontal deflection of the conductor in response to the downward pressure exerted by the screw.

No references cited.