July 3, 1951 J. B. CLAPP 2,559,187

LINE FIT CONNECTOR

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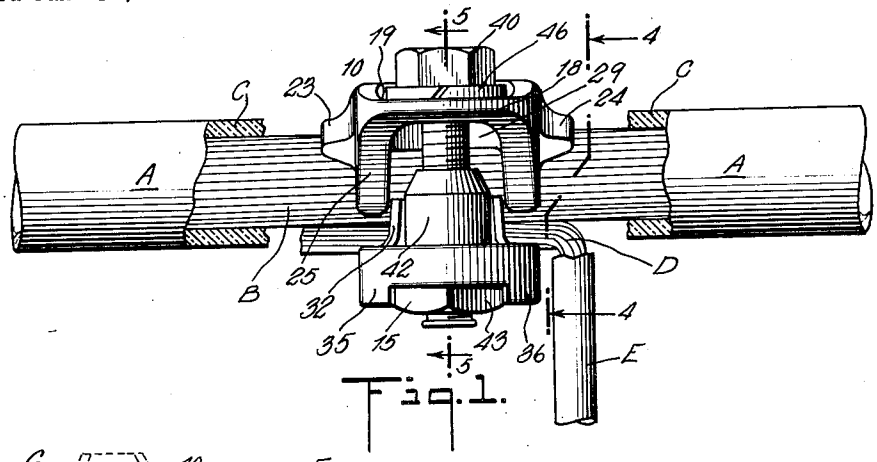


Fig. 1.

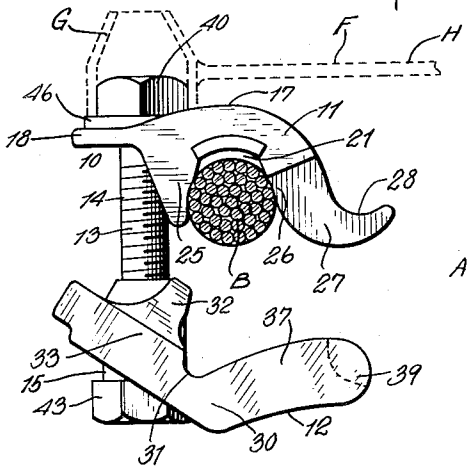


Fig. 2.

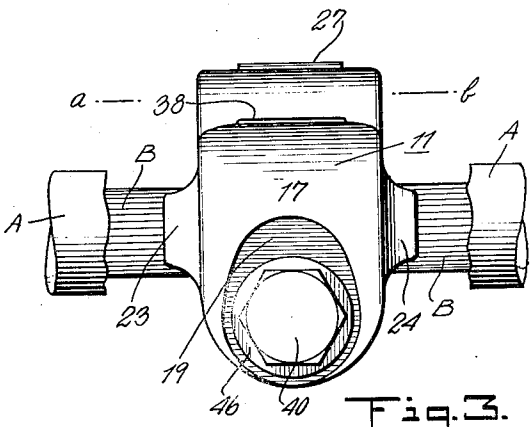


Fig. 3.

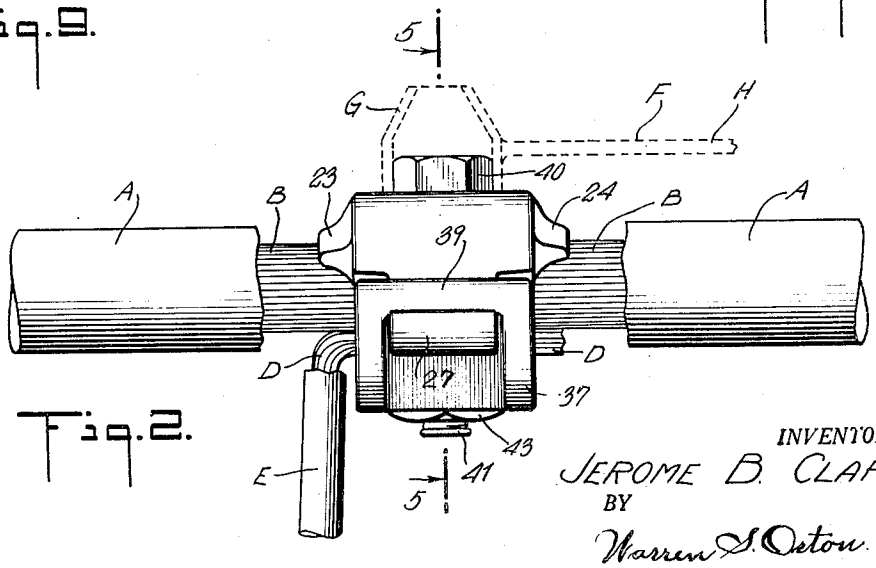


Fig. 4.

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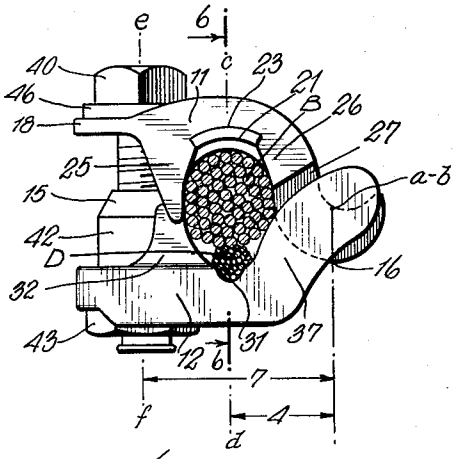


Fig. 4.

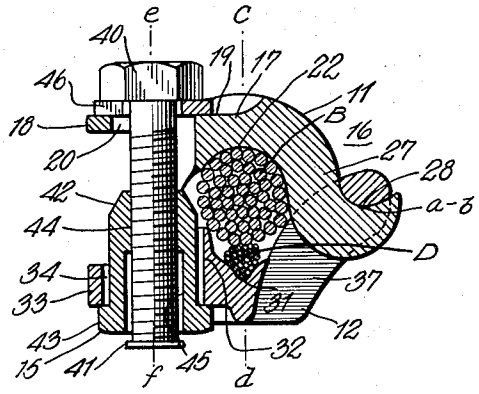


Fig. 5.

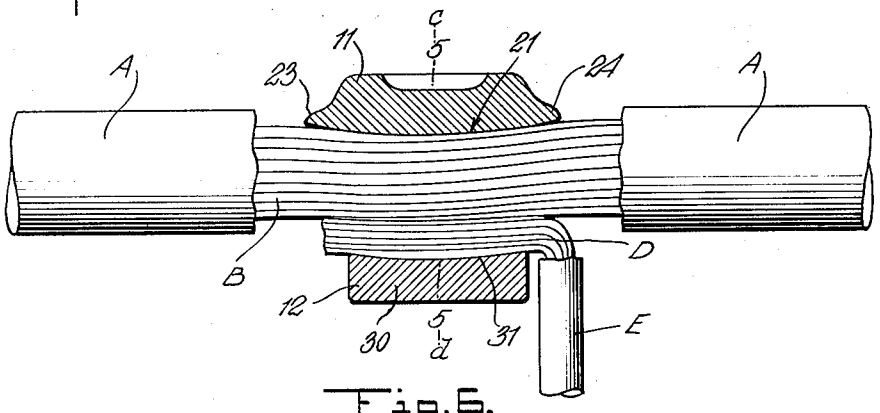


Fig. 6.

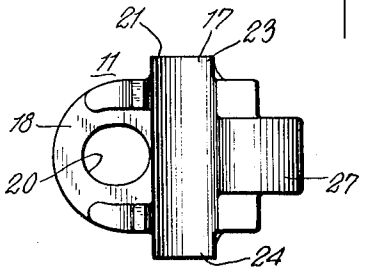


Fig. 7.

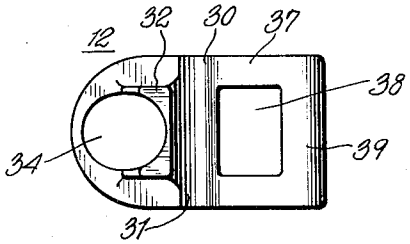


Fig. 8.

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Patented July 3, 1951 2,559,187

UNITED STATES PATENT OFFICE

2,559,187

LINE FIT CONNECTOR

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Application January 14, 1946, Serial No. 641,068

2 Claims. (Cl. 173—273)

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The invention relates to a line fit connector of the type which is employed to connect a tap to a main power line. In such situations it is usual that the diameters of the bundle of conductors which form the core of the main power line is of much greater diameter than the bundle of conductors which form the core of a tap leading therefrom, and the present disclosure is particularly designed to fit the requirements of electrically and mechanically connecting conductors of radically different cross sections of material. It has been known to clamp small diametered taps to large diametered main lines between V-face clamping jaws drawn into squeezing position by a tightening bolt, but in these devices no consideration has been given to the fact that the V's were intended to receive different diameters of conductors, and as a result the contacts of the conductors both between themselves and the connector were quite apt to be casual, often with a limited area of inter-engaging surfaces. It is the intent of the present disclosure to have the connector snugly fit the diameters of both the main line and the tap conductors for which it is intended, even to provide a precision fit between conductors and the connector and for this reason the disclosure herein is designated as a line fit connector.

The present disclosure is not particularly designed to connect two main lines of substantially equal diameter but to connect two conductors of unequal diameter. In screw actuated clamping devices now known for electrically connecting a small diametered tap with a larger diametered main line, the entire reaction to the crushing strains on the two sets of conductors comes on the screw of the tightening bolt thus placing a high degree of friction on the bolt, which, of course, renders it difficult to turn especially during the last few turns and which last few turns are necessary to distort the conductors from their original cross sectional contours into such distortion as is requisite to effect the required engagement. Any loose binding even when apparently tight results eventually in a tendency of the jaws to relax their squeezing effect on the conductors by reason of the vibration of the main line and tap in actual service. It so happens that with these known devices the fastening bolt must be engaged on the underside of the connector to operate it. This means that the linesman must manipulate his wrench while in an inconvenient position and more seriously the wrench is quite apt to become entangled in the tap falling from the connector. It must be

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appreciated that such connectors are usually installed by a linesman working high in the air while reaching out from a line pole and operating with gloved hands, often in cold and stormy weather, and having available only his muscular energy to screw down the tightening bolt.

The primary object of the invention is to provide a simple form of fit line connector of the hinged jaw clamp type which can be easily and quickly installed in position under such adverse conditions; which can be simply hung on the line with the assurance that it will stay there while the linesman is inserting the tap and tightening the jaw elements without possibility of it accidentally toppling off the line, and which tightening bolt may be operated by a wrench working in the clear space above the connector and thus free of the depending tap.

As a general rule a linesman can exert a manual torque only of about one hundred and fifty pounds pressure on such clamps, but this is not sufficient to insure the desired permanency of clamping effect on the conductors. The present disclosure features the use of a form of jaw clamp comprising levers organized to provide such a mechanical advantage that the linesman can manually exert the required powerful squeeze pressure on the conductors to insure a good mechanical and electrical connection and which connections will be permanently maintained under all usual service conditions.

The disclosure particularly features the providing of a rugged form of hinged jaw clamp preferably formed of bronze or non-magnetic stainless steel to avoid corrosion and metal relaxation, the strain transmitting jaws of which may be readily separated at their hinged connection to open the clamp and thus permit the connector to be hooked over the line, and in which the jaws form a compact system organized so that the linesman with his ordinary long wrench can manually exert such a powerful squeeze action on the conductors as will cause them to distort each other into the desired mutual fixed and binding relation necessary in connecting a tap to a main power line.

In the accompanying drawings:

Fig. 1 is a view in front elevation showing a line fit connector constituting a preferred embodiment of the invention clamped in operative position making connection between a main power line and a tap depending therefrom;

Fig. 2 is a similar view showing the disclosure of Fig. 1 in rear elevation and showing a tightening wrench in ghost outline;

Fig. 3 is a plan view looking down on the disclosure of the preceding figures;

Fig. 4 is a transverse sectional view taken on the broken line 4—4 of Fig. 1 looking in the direction indicated by the arrows and showing in side elevation the disclosure of the connector of the preceding figures;

Fig. 5 is a transverse sectional view taken on the line 5—5 of Figs. 1, 2 and 6;

Fig. 6 is a view in section longitudinally of the line and taken on the line 6—6 of Fig. 4 looking in the direction indicated by the arrows;

Fig. 7 is a plan view looking down on the lower clamp element, removed from the assembly shown in the preceding figures;

Fig. 8 is a similar view of the underside of the upper clamp element when viewed upwardly, and;

Fig. 9 is an explanatory view showing the first step in the mounting of the connector, hooked on the line before the bolt is moved towards its fully tightened position shown best in Figs. 4 and 5.

There is disclosed an electric main power line A including its bundle of main conductors B and encasing insulation C. The insulation has been cut away to expose the line connectors B and to show the connection thereto of the bent ends of the bundle of conductors D of an insulated tap E.

The tap E is connected to the main line A by means of a line fit connector 10, particularly constituting the novel feature of this disclosure, and comprises primarily three main parts; a top clutch jaw 11, a lower clutch jaw 12, and a threaded fastening means 13 therebetween, formed of a bolt 14 and a long nut 15.

The jaws 11 and 12 are hingedly connected at one side, hereinafter referred to as the rear side, by means of a readily demountable hinge connection 16 arranged to permit the jaws to articulate about a horizontal axis offset rearwardly from the main line A and herein referred to as the hinge axis *a*—*b*. The upper jaw is a rugged casting and comprises an arched cap 17 merging forwardly into a flat upper apertured bolting flange 18 having a recessed upper face 19 for receiving the head of the bolt 14 or rather the lock washer hereinafter described. The flange 18 is provided centrally thereof with a bolt hole 20 of slightly elliptical form and having its major axis extending from front to rear for loosely receiving the shank of the bolt therein. The cap is provided on the underside thereof with a main line engaging channel 21 being inverted U-shape in cross section as shown in Figs. 4, 5 and 9. Considered thus in cross section the channel is of sufficient radius to receive therein the bundle of conductors B and compared to the cross section of the bundle of tap conductors D is relatively large.

The underside of the channel 21 rounds downwardly from a top medial line 22 (see Fig. 5) and which channel is slightly convexed when considered along this medial line 22 in order to snub the line as shown in Fig. 6. A pair of shoulder pieces or dampening wings 23 and 24 project beyond the cap at opposite sides thereof to form upwardly rounded extensions of the top surface of the inverted channel 21. This structure tends to avoid the forming of sharp edges at opposite ends of the channel and tends to dampen the vibration of the main line A. The sides of the channel form two depending walls, a front wall 25 and a rear wall 26, which act to resist lateral spreading of the conductors B of the line A as best shown in Fig. 4.

The rear wall 26 is formed in part by the upstanding part of a J-shaped tongue or hook 27

of less than width than the cap 17 as shown in Fig. 2 and forms the male element of the demountable hinge connection 16. The tongue is provided on its upper side with a groove 28, a little less than half round and facing both upwardly and rearwardly and adapted to receive a hinged bar forming part of the lower jaw 12.

The front wall 25 is interrupted to form a clearance 29 best shown in Fig. 1 to permit the bolt to rock therein from front to rear without interference from any part of the top jaw.

The lower jaw 12 is likewise a rugged casting and is provided centrally thereof with a saddle 30 for receiving the bundle of conductors D of the tap. The saddle is provided with an upwardly facing groove 31 or line receiving seat disposed in opposition to the channel 21 and of materially less diameter than the channel as the cross section of the bundle of conductors D of the tap is relatively small as shown in Figs. 4 and 5. The groove 31 is more definitely V-shape in cross section than is the more rounded U-shaped channel 21. This groove 31 is slightly concaved when considered lengthwise as in Fig. 6 and coacts with the concaved channel 21 to help clinch the conductors B and D along their line of interengagement. Just in advance of the groove 31 there is an upstanding front wall 32, the inner side of which is rounded to form a half barrel when viewed in plan as shown in Fig. 8 and is designed to partially encircle the nut 15. The wall 32 fits in the clearance 29 as shown in Fig. 1 and is thus guided between the depending portions of the front wall 25 as the fastening means 16 is tightened into its jaw clamping position.

A forward extension of the saddle forms a lower bolting flange 33 underlapping the upper bolting flange 18. The flange 33 is provided centrally thereof with a bolt hole 34 of materially greater diameter than that of the nut 15 to permit a free rocking movement of the lower end of the fastening means.

The underside of the portion of the flange 33 in the part thereof containing the bolt hole 34 is recessed to provide a pair of depending sides 35 and 36 between which fits the headed end of the nut 15 and which sides thus act to resist turning of the nut relative to the lower jaw 12.

From the opposite or rear side of the saddle 30 the lower jaw extends upwardly at an angle of about 45° to form a rear extension 37. This extension is provided with a squared opening 38 best shown for receiving the J-shaped tongue 27. The opening forms at its rear end of the extension a hanging or hinge bar 39 which fits in the groove 28.

It is noted that the bolt 14 is solid and relatively short so that the full strength of the bolt is maintained and as practically the entire shank is threaded all of the threads are at some time or other engaged by the long threaded upper portion of the nut 15 and in that way all of the bolt is utilized.

The bolt 14 is provided at its upper end with a hexagonal head 40 and is provided at its other end with an upset flange 41, which avoids possibility of the bolt being entirely withdrawn from the nut. The nut includes a long barrel portion 42 terminating at its lower end in a hexagonal head 43 fashioned to fit between the sides 35 and 36 to prevent the nut from rotating as the nut is rotated to advance it upwardly into its unclamped and elevated position shown in Fig. 9. The bore of the nut is threaded only at its upper end to form threads 44 and is smooth as shown

at 45 and with a diameter to receive the upset flange 41.

A lock washer 46 is located in bearing engagement with the face 19 and between the bolt head 40 and the upper bolting flange 18.

A socket wrench or similar tool F is provided with a head G to fit over the bolt head 40 and is provided with a long handle H to provide the necessary leverage to permit the linesman to effect a powerful effect on the jaw elements which react with a mechanical advantage sufficient to squeeze the line and tap conductors B and D into position and secured mechanically and electrically as shown in Figs. 1, 4, 5 and 6.

In operation and assuming that it is desired to take current off the main line A through the tap E, the main line insulation C is stripped back to expose a portion of its conductors B. One end of the tap is prepared by stripping back its insulation to expose its conductors D which are then bent at right angles to the balance of the tap to form a terminal. The line fit connector 10 is prepared first by loosening the fastening means until the jaws 11 and 12 are fully separated an extent to permit the stripped conductors of the line A to pass freely therebetween. The top clutch jaw 11 is then hooked over the line A with the lower clutch jaw 12 hanging loose on the nut as indicated in Fig. 9. The parts are so balanced at this point that the connector is suspended in position without necessity of being fastened to the line while the linesman is completing the fastening operation.

In order to obtain this result the parts are so designed and proportioned that the center of gravity or mass of the connector is the vertical line *c*—*d* (Fig. 4) and somewhere below the axis of the bundle of conductors B so that in Fig. 9 the connector is suspended as if it were a weighted pendulum with sufficient frictional resistance between the conductors B and the sides 25 and 26 to avoid any tendency of the connector rocking on the line A. The linesman then swings the lower clutch jaw 12 to the right and upwardly from the position shown in Fig. 9 rocking the bolt counter-clockwise about the flange 18 acting as a fulcrum, and hooks the hinge bar 39 over the right end of the J-hook 27 and then with a short inward movement locates the bar 39 in the groove 28. During this movement the bolt 14 is free to swing first counter-clockwise and then clockwise as viewed in Fig. 9, by reason of the clearances provided by the bolt holes 29 and 34. As the hinge connection 16 is thus formed, the forward end of the lower clutch jaw is free to adjust itself on the bolt and nut assembly at the front of the device.

At this time the lower jaw is supported at its rear end from the hook 27 and at its front end from the lowered nut 15 and inclined downwardly from right to left, as viewed in Figs. 4, 5 and 9, thus providing a clearance between the underside of the conductors B and the top or grooved side of the saddle 33. A usual practice would be for the linesman to locate the wrench F in position and take a few turns on the bolt head 40 to practically close this clearance leaving just sufficient room to permit the insertion of the bent terminal end of the conductors D. The bent terminal forming end of the bundle of conductors D is then inserted endwise into the clearance and lowered into the groove 31.

The linesman then locates the head G of the tool F in turning engagement with the head 40 of the nut if not already there and by rotating

the tool in the proper direction causes the bolt 14 to work down into the nut 15 and by reaction lifting the left end of the lower clutch jaw 12, thus tightening the connector and incidentally causing the jaws 11 and 12 to exert a squeeze pressure on the conductors B and D with a resulting tendency of the conductors to crush into each other as suggested in Figs. 4, 5 and 6.

In this disclosure it is assumed that the connector has been selected from stock to provide a size particularly designed to fit the line A. However, taps of different sizes may be connected to that particular size of main line by the illustrated size of connector. In the illustrated showing and particularly referring to Fig. 5, it may be assumed that the bundle of conductors are of usual size and thus will bring the nut 15 to above midlength of the threaded shank of the bolt 14. For another illustration let it be assumed that the tap E is a single strand conductor and thus of relatively small diameter. The fastening means are tightened as before described with the lower clutch jaw 12 rocking a little further about the hinge axis *a*—*b* than as before with perhaps a slight bodily shifting of the jaw 12 to the left and thus a shifting inwardly of this axis and with the upper conical end of the barrel 42 moving towards and perhaps intruding into the bolt hole 20 with an incidental swinging of the bolt 14 clockwise about its head 40. On the other hand the conductors D might have a diameter almost equal to that of the conductors A and still fit the illustrated connection. In general the connector is designed to accommodate all the sizes of taps usually employed with the instant size of main line A.

Due to the fact that the opposing line engaging faces forming the channel 21 and groove 31 are respectively convex and concave and with the concave face of less length than the convex face as shown in Fig. 6, both sets of conductors are bent in the same downward direction and thus out of their respective straight lines. This has the effect of snubbing both sets of conductors relative to each other and in this way adds to the tendency of the device to defeat any possibility of either main line or tap slipping relative to the connector and thus relative to each other.

Referring to Fig. 4 for an explanation of the clamping action let it be assumed that the upper jaw is fixed in space and that the fastening means 13 is acting to rock the free forward end of the lower jaw 12 upwardly, that is clockwise, about the fulcrum at the hinge line *a*—*b*.

The bolt and nut assembly forming the fastening means 13 defines a vertical line of thrust along the axis *e*—*f* and the resistance of the conductors to being deformed from a vertical line of resistance along the axis *c*—*d*. In one physical embodiment of the invention the axis *e*—*f* is spaced seven unit distances from the vertical containing the axis *a*—*b* and the axis *c*—*d* is similarly spaced four unit distances from the axis *a*—*b*. Thus the conductors are nearer the fulcrum of the leverage system than the fastening means 13, thus forming a lever of the second class providing a mechanical advantage of 1¾:1 or almost doubling the squeeze action which the linesman can exert on the conductors assuming the same pitch of threads on the bolt 14.

It is also noted that the forces acting on the connector are substantially balanced about the almost centered plane *c*—*d* passing through the centers of the bundles of conductors B and D and this acts to avoid tendencies prevalent with

other styles of connectors which tend to twist the main line conductors during the final bolt tightening movement.

In designing the connector illustrated an effort has been made to form it as compact as possible, thus utilizing the smallest possible amount of material distributed and proportioned to give strength, particularly where most needed, and it is a feature of this disclosure to avoid as far as possible any distortion of either the jaws or the fastening means when subjected to the pressure strains for which the connector is designed, and sharp edges have been avoided so as to avoid interference with the final tape-over operation.

I claim:

1. A compact clamp for squeezing together under screw load two parallel conductors of different sizes, comprising a pair of rugged arch-shaped castings forming opposing and superposed clutch jaws, each jaw reduced in cross section of material to form at one end an outstanding bolting flange and at its other end provided with an angled extension, both of the bolting flanges having their outer faces recessed to provide outstanding parallel reinforcing side walls forming bearing faces therebetween and forming nut stops, said extensions provided at their free ends with means for hingedly connecting the jaws, said bolting flanges provided adjacent their free forward ends with aligned bolt holes, a bolt passing loosely through the bolt holes and having a head for imposing a load on the bearing face of the upper flange, and a long nut threaded on the bolt, having a head contained between the associated stop walls for imposing a load on the bearing face of the lower flange, extending through its bolt hole towards the upper flange, the upper flange provided on its under side and in close relation to its bolt hole with an inverted U-shaped depression whose crotch forms a downwardly facing channel of relatively large radius and whose sides are widely diverging from each other, the lower flange provided on its upper side and in close relation to its bolt hole with a deep recess whose crotch forms an upwardly facing groove of relatively small radius and whose sides are widely diverging, said recesses providing a space between the channel and groove for receiving the conductors, the lower flange provided between its groove and bolt hole with an upstanding reinforcing front wall of half-barrel form open at its outer side and in which barrel the nut loosely fits and projects above the same, the upper flange provided with a mutilated front wall forming a pair of depending arms spaced apart on opposite sides of its bolt hole and the space outwardly between the depending arms and outwardly of the upstanding half-barrel front wall coacting to provide a clearance for the nut as it may be moved into the same by the rocking of the bolt, said half-barrel front wall fitted between the depending arms of the mutilated front wall, said half-barrel front wall, nut and depending arms outlining the forward side of the recesses forming said conductor-receiving space, and the two angled extensions outlining the rear side of the recesses forming said conductor-receiving space.

2. The device defined in claim 1 wherein the upper jaw is provided with integral dampering wings projecting beyond its side faces forming extensions of the part of the upper jaw defining the crotch of the channel.

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