Nov. 14, 1950 F. J. HENDLEY 2,530,299

ELECTRICAL TAP CLAMP

Filed July 5, 1947

Fig. 1

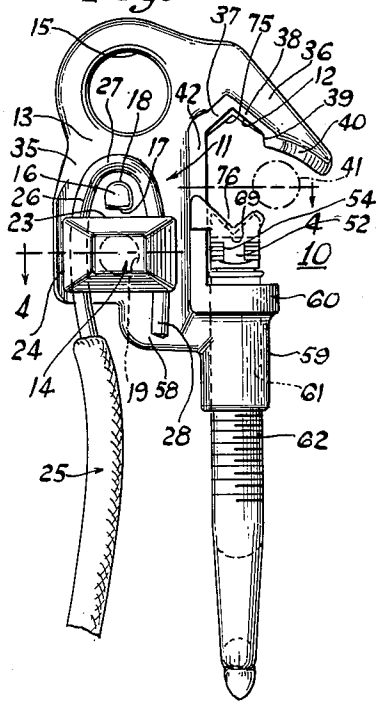


Fig. 2

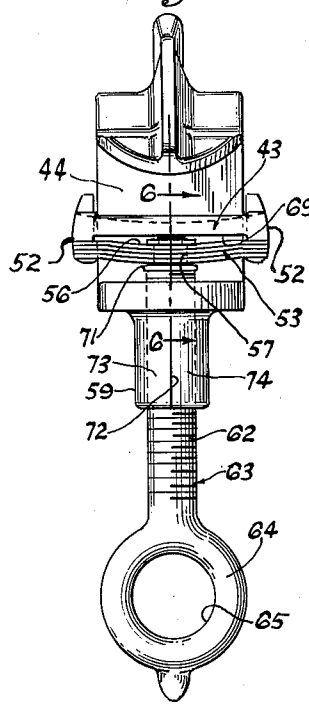


Fig. 3

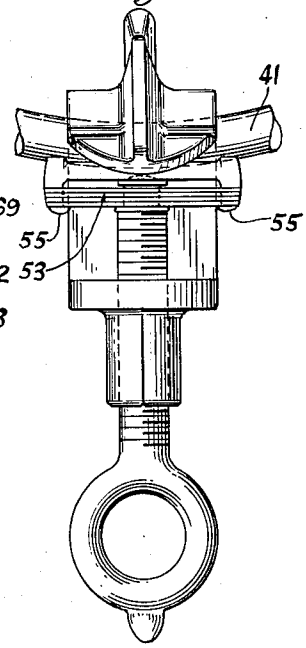


Fig. 4

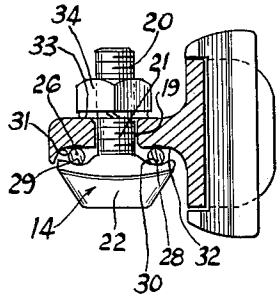


Fig. 5

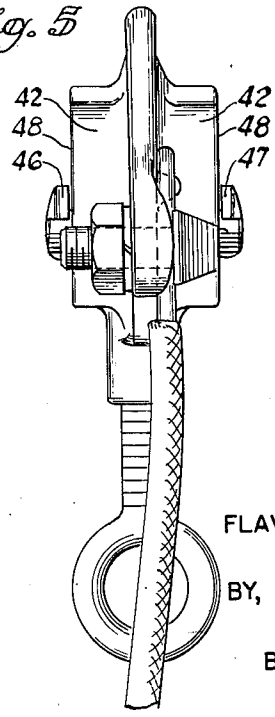
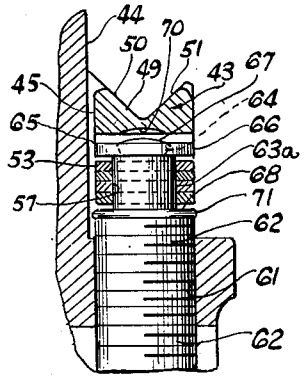


Fig. 6



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ELECTRICAL TAP CLAMP

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8 Claims. (Cl. 173—273)

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The present invention relates to electrical connectors of the tap clamp type, such as are used in connecting grounds or other leads to the electrical conductors which form a part of a power distribution system.

The tap clamps of the prior art have the disadvantage that they soon provide poor contact due to battering of the metal by vibration, flow of the metal away from the contact pressure points, mushing of conductor strands, backing off of the screw, and corrosion.

The conductors then become pitted, annealed, or otherwise ruined from faults that are caused by the tap clamps of the prior art. Thousands of dollars are spent yearly to replace clamps and bad conductors that have been ruined by the burn-downs caused by these tap clamps.

After years of service the clamps which have S. A. E. threads stick on the line. Corrosion binds the small closely fitted threads so that the clamp cannot be removed or tightened, thus becoming troublesome and dangerous. The standard threaded clamps of the prior art, when tightened up in the beginning, have a contact area of little more than a few points or short lines, and are also subject to all of the foregoing disadvantages, eventually resulting in a bad connection, heating, burning of the conductor and clamp, etc.

A loosening or spacing of one or more thousandths of an inch between the clamping members and the line reduces the contact area and increases the contact resistance considerably, and the normal currents then pit and burn the contact areas more and more, with progressive steps of loosening and burning until finally the line burns in two.

One of the objects of the present invention is the provision of an improved tap clamp of the class described which is provided with a resilient gripper jaw that follows up the flattening of the contact lines and gives a continued firm contact throughout the life of the line and clamp, with an enlarged contact area and a continued carrying capacity for normal and surge currents, substantially without the danger of burn-down of the conductor.

Another object of the invention is the provision of an improved tap clamp provided with a resilient jaw which is also adapted to be tightened to effect a rigid contact, leaving the resilient member to take up any slack that may later occur, and keeping a permanently firm contact.

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Another object of the invention is the provision of an improved tap clamp with a resilient jaw which may be provided with standard threads on a long threaded stem sleeve, the threads being fitted loosely, but the lower section of the stem being split and initially sprung inwardly to give a resilient clutching of the threaded stem for the purpose of preventing back-out.

Another object of the invention is the provision of an improved tap clamp of the class described which has its threaded members so arranged that when there is corrosion, there is plenty of tolerance to permit the threads on the threaded eye bolt to pass through the firm internal threads at the upper section of the sleeve, the threaded bolt being resiliently clamped by a lower split section of the sleeve, which will give sufficiently to prevent binding, and which will even permit a stem that is bent a small amount to be rotated to adjust the clamp without binding.

Another object of the invention is the provision of an improved tap clamp provided with gripper jaws, giving a maximum amount of contact, such as four lines of contact, the jaws being curved to match the line sag tension by having the upper jaw bulge very slightly toward the center and the lower jaw being curved downwardly toward the center to match the upper bulge.

A further object of the invention is the provision of an improved tap clamp of the class described which is provided with connection arrangements for the jumper or electrical conductor that extends downwardly from the tap clamp in such a manner that the jumper cannot pull out, being snubbed about a part of the tap clamp and in such manner that jumpers can be attached to the clamp with a snubbing connection from the top, the bottom, or the back of the clamp.

Other objects and advantages of the invention will be apparent from the following description and the accompanying drawings, in which similar characters of reference indicate similar parts throughout the several views.

Referring to the single sheet of drawings,

Fig. 1 is a side elevational view of a tap clamp embodying my invention, shown in the open position, with the line conductor in dotted lines about to enter the jaws;

Fig. 2 is a front elevational view of the tap clamp in the open position;

Fig. 3 is a view similar to Fig. 2 of the tap clamp applied to the line conductor and having its resilient members compressed until the threaded member engages the lower clamping member and provides a rigid contact, with resilient take-up;

Fig. 4 is a transverse sectional view, taken on the plane of the line 4—4 of Fig. 1, looking in the direction of the arrows, showing the connector arrangements for the jumper wire;

Fig. 5 is a rear elevational view of the tap clamp;

Fig. 6 is a fragmentary vertical sectional view, taken on the plane of the line 6—6 of Fig. 2, looking in the direction of the arrows.

The tap-off clamps **10** embodying the present invention are preferably provided with a body member **11** comprising a metal casting made of suitable electrically conducting metal, the body being formed with the upper clamping member **12** and with an integral back web **13**, which supports a jumper wire connector **14** and is provided with a lift eye **15**.

The lift eye **15** comprises a circular aperture formed in the web **13** at its upper portion. At its lower portion the web **13** is preferably provided on one side with a laterally projecting lug **16**, which may have a flat lower side **17** and a partially cylindrical upper side **18**. The web is formed with a through bore **19** located below the lug **16** and adapted to receive a screw bolt **20**, which comprises the main part of the jumper wire connector **14**.

The screw bolt **20** has a threaded shank **21** and a head **22**. The head may be substantially rectangular in plan, as seen in Fig. 1, having a pair of parallel long sides **23** and a pair of parallel short sides **24**. The longer dimension of the long sides **23** of the head **22** is for the purpose of permitting the head to span the jumper wire at two points, such as, for example, the jumper wire **25**, which has an upwardly extending portion **26**, a bend at **27** around the lug **16**, and a downwardly extending portion **28**.

The lower side of the head, which engages the jumper wire **25** at its portions **26** and **28**, is preferably formed with a pair of partially cylindrical grooves **29**, **30** formed on a radius which is large enough to receive any jumper wire that is intended to be used with the tap clamp.

The web **13** underneath the head **22** is also formed with a pair of partially cylindrical grooves **31**, **32** for receiving the portions **26** and **28** of the jumper wire. The threaded shank **21** of the screw bolt **20** passes through the bore **19** and is provided with a spring washer **33** and a nut **34**, by means of which the shank is drawn through the bore **19**, and the head **22** tightly clamps the jumper wire in the grooves **29**, **30**, **31**, **32**.

In the example selected to illustrate the invention the jumper wire is inserted from the bottom, but it may just as well be inserted from the top, or from the back, at the point **35** on the web **13** (Fig. 1). In any case, the jumper wire is preferably provided with the U-shaped end portions **26**, **27**, **28**, and it passes around the lug **18** and is clamped tightly at two points, thereby giving a large contact area and a snubbing action which prevents the jumper wire from dropping out, even if the screw bolt or nut should become loose.

The spring washer also aids in taking up any slack that may occur, and aids in preventing the nut from loosening.

The body **11** of the tap clamp has its web **13** provided with a forwardly extending, centrally located portion **36**, which forms a part of the upper jaw **12**. This jaw has a V-shaped opening formed by a pair of laterally projecting flanges **37**, **38**, which project from each side of the web portion **36** at an angle to each other to form the V-shaped trough **12**.

The flanges **38** connect to a downwardly extending short flange portion **39**, which connects to a downwardly and forwardly extending lip flange **40** on each side for the purpose of guiding the energized conductor **41** into the space between the jaws.

The body **11** also has a downwardly extending portion **42**, which projects laterally from each side of the web **13** at its front side and joins to the flange portions **37** to form a guide for the movable jaw **43**. Flanges **42** have a flat face **44** on the inside of the clamp opening; and the movable jaw **43** has a rear flat surface **45** for slidably engaging the guide surface **44**.

The movable clamp **43** also has a pair of rearwardly extending guide lugs **46**, **47**, which slidably engage the straight edges **48** of the flanges **42** for guiding the movable jaw and preventing its rotation.

The movable jaw **43** may consist of an elongated metal member, which is provided with a V-shaped trough **49**, the axis of which is substantially parallel to the V-shaped trough **12** in the fixed clamping member. The trough **49** is formed by a pair of surfaces **50**, **51** at an angle to each other, and its length may be such that it extends beyond the flanges **37**, **38** of the upper jaw on each side sufficiently to form the guide lugs **46**, **47**.

The movable jaw **43** also has a pair of downwardly extending lugs **52**, one at each end of the movable jaw **43** for securement of this jaw to a spring assembly **53**. The downwardly extending lugs **52** on the movable jaw **43** may be rectangular in cross section, and may fit into complementary slots **54**, which extend endwise into each end of the spring assembly **53**.

The slots **54** are deeper than required, to receive the lugs **52** in the position of Fig. 2, so that the bases of the slots will not interfere with the movement of the spring assembly from the bowed to the straight condition shown in Fig. 3.

The lugs **52** are riveted over at **55**, below the spring assembly, thus fixedly securing the spring assembly at each end to the movable jaw **43**. The spring assembly **53** may comprise a plurality of laminations of resilient leaf springs, such as phosphor bronze or steel, or any other suitable spring metal.

These laminations are initially curved downwardly, as shown at their central portion **56** in Fig. 2, and are provided with registering apertures so that the spring assembly has a centrally located aperture **57**.

The body **11** has its web **13** provided with a lower portion **58** (Fig. 1), which is integrally joined to a cylindrical sleeve portion **59** that extends downwardly below the movable jaw **43**. Side flanges **42** are also integrally joined to a forwardly extending bottom flange **60**, which may project laterally from each side of the cylindrical sleeve **59**.

The sleeve 59 is provided with a vertically extending threaded bore 61 for receiving the threaded shank 62 of an eye bolt 63. The threaded shank 62 supports an eye structure 64 at its lower end, which is provided with a circular aperture 65 of sufficient size so that the eye may cooperate with standard clamp stick heads.

The cross-sectional shape of the eye structure 64 which surrounds the bore 65 may be substantially circular, giving the eye 64 a toroidal shape. The threaded shank 62 is provided with a reduced cylindrical portion 63*a* at its upper end for passing through the aperture 57 in the spring assembly 53. Any number of laminations or springs may be employed, but the embodiment selected to illustrate the invention includes four separate laminations.

The reduced cylindrical portion 63*a* of the screw bolt supports a second and flatter reduced cylindrical portion 64 which provides an annular shoulder 65. A washer 66 may be mounted on the reduced cylindrical portion 64; and the upper end of this cylindrical portion may be riveted over at 67 to secure the eye bolt to the springs.

Thus the springs are secured beneath the washer 66, which provides one thrust bearing, and above the annular shoulder 68, which provides a lower thrust bearing; and the reduced cylindrical portion 63*a* provides a trunnion rotatably mounted in the bore 57 of the springs, which provides a rotating bearing.

The springs are spaced from the lower side 69 (Fig. 2) of the movable jaw 43, and this movable jaw may have a central depression 70 formed in its lower side for receiving the riveted end 67 of the screw bolt and providing a firm bearing surface between the screw bolt and the movable jaw 43 when the screw bolt is driven home, as shown in Fig. 3.

In order to prevent placing a strain on the rivet end 67 when the screw bolt 63 is backed out, this bolt may have its threaded shank 62 spun over at 71 at the annular shoulder 68 to prevent the screw bolt from being moved downwardly beyond a predetermined point.

It is preferable also to provide the threaded bore 61 and threaded shank 62 with relatively loose standard threads and to provide the front and back of the sleeve 59 with axially extending slots 72. These lower slotted portions of the sleeve 59 may then be pressed together, before the screw bolt 63 is inserted, so that the lower portions form resilient jaws 73, 74 which resiliently grip the threaded shank 62 of the screw bolt.

The loose threads will give sufficient clearance so that any corrosion will not prevent the upper part of the bore 61 from freezing to the screw bolt, and the lower resilient jaw portions 73, 74 of the sleeve 59 will not freeze to the threaded shank 62 because they can be made to give and can be loosened by inserting a screwdriver in the slot 72. Thus the present tap connector is so constructed that it will never stick on the line so tightly that it cannot be removed.

The upper jaw through 12 is preferably provided with a slight downward bulge at 75 midway between its ends to correspond to the tension sag in the electrical line and to fit the conductor 41 better. The lower movable jaw 43 may be given a complementary downwardly extending concavity 76 midway between its ends, thus curving both the upper and lower jaws to correspond to the sag in the electrical line and providing better lines of contact.

The mode of assembly of the threaded member, spring assembly, and movable jaw is as follows: The eye bolt is threaded into its bore until its reduced end projects from the upper end of the bore. The spring assembly is then placed on the reduced cylindrical portion 63*a* of the eye bolt, the washer is applied, and the further reduced end 64 is riveted over at 67.

The movable jaw may then be slid endwise, with its lugs 52 passing into the slots 54, and the assembly may be inverted and placed upon a suitable anvil having a surface which fits the angular surfaces 50, 51 of the movable jaw. As the ends of the lugs 52 then project beyond the lower flange 60, the ends of the lugs 52 may then be riveted over to secure the spring assembly and movable jaw together.

The operation of the tap clamp connector is as follows: It has already been pointed out how the jumper wire is gripped at a U-shaped portion which is snubbed around a lug 16 so that there is a maximum contact area and the jumper cannot drop out. The tap clamp is applied to the line in the same way as other clamps, by being lifted by means of a clamp stick, the screw bolt 63 being turned by means of its eye structure 64 from the position of Fig. 2 to that of Fig. 3.

As the jaws 43 and 12 engage the line conductor 41, the jaw 43 will slide upward, while the screw bolt 63 will rotate and the laminated spring assembly 53 will move from its downwardly bowed position in Fig. 2 to a substantially straight position, in Fig. 3. At this time the end 67 of the screw bolt engages the complementary bearing surface 49 on the bottom of the movable jaw 43 and enables the screw bolt to effect a rigid clamping action which assures a tight clamping action on the line 41.

Four lines of contact are provided, which extend substantially the full length of the flanges that form the jaws, from side to side of the clamp.

The present clamp provides a rigid contact which has resilience that is adapted to take up any wear or reduction in size or shape of the conductor, so that it will remain in tight clamping condition substantially throughout its full life; but it may also be removed because of the resilient locking action of the sleeve on the threaded shank and because of the relatively loose threads between the threaded shank and sleeve.

It will thus be observed that the improved tap clamp will provide a firm and low contact resistance connection on a conductor of a transmission line or any other conductor, in spite of vibration which might batter the metal of the line, and in spite of the flowing of the metal away from contact pressure points. Even though the conductor strands mush somewhat or the screw backs off somewhat, the contact will be maintained by the resilient connection between the eye bolt and the movable jaw and corrosion between the jaws and the conductor will be prevented as long as there is a tight contact. Thus bad connection, heating, pitting, burning, annealing, and burn-down of electrical conductors may be reduced or substantially eliminated by the invention.

While a preferred embodiment of the invention has been illustrated, many modifications may be made without departing from the spirit of the invention. Accordingly, limitation is sought only in accordance with the scope of the appended claims.

What is claimed is:

1. In a tap clamp of the screw type, the combination of a body member which is provided with an integral forwardly extending fixed jaw, having a trough for receiving the line conductor, said body member being provided with a threaded bore and a threaded member in said bore, a movable jaw guided on said body member into alignment with the fixed jaw, and a resilient connection between said movable jaw and said threaded member, whereby the line conductor may be resiliently clamped by said movable and fixed jaw under the influence of said threaded member in said threaded bore, said resilient connection comprising a laminated spring assembly rotatably mounted on said threaded member and having its ends secured to said movable jaw.

2. In a tap clamp of the screw type, the combination of a body member which is provided with an integral forwardly extending fixed jaw, having a trough for receiving the line conductor, said body member being provided with a threaded bore and a threaded member in said bore, a movable jaw guided on said body member into alignment with the fixed jaw, and a resilient connection between said movable jaw and said threaded member, whereby the line conductor may be resiliently clamped by said movable and fixed jaw under the influence of said threaded member in said threaded bore, said resilient connection comprising a laminated spring assembly rotatably mounted on said threaded member and having its ends secured to said movable jaw, said laminated spring assembly and threaded member being spaced from the adjacent portion of said movable jaw, whereby the application of pressure to the resilient connection by the threaded member in clamping a conductor initially tensions said resilient connection, and thereafter the threaded member fixedly engages the movable jaw and effects a fixed clamping action on the conductor.

3. In a tap clamp, the combination of a metal body provided with a rearwardly extending web and having an upper forwardly extending jaw defined by laterally extending flanges and forming a V-shaped trough, said web also carrying laterally extending flanges along its forward face for guiding a movable jaw and supporting a depending sleeve provided with a threaded bore, a threaded eye bolt in said threaded bore, said eye having its shank provided with a reduced cylindrical end portion forming a trunnion, a plurality of leaf springs forming a laminated spring assembly provided with a centrally located bore located on said trunnion and a movable jaw carried by the ends of said leaf springs, said movable jaw having a V-shaped clamping surface.

4. In a tap clamp, the combination of a metal body provided with a rearwardly extending web and having an upper forwardly extending jaw defined by laterally extending flanges and forming a V-shaped trough, said web also carrying laterally extending flanges along its forward face for guiding a movable jaw and supporting a depending sleeve provided with a threaded bore, a threaded eye bolt in said threaded bore, said eye having its shank provided with a reduced cylindrical end portion forming a trunnion, a plurality of leaf springs forming a laminated spring assembly provided with a centrally located bore located on said trunnion and a movable jaw carried by the ends of said leaf springs, said movable jaw having a V-shaped clamping surface, said threaded eye bolt having its end threaded portion deformed to prevent retraction of the eye bolt and strain on the spring supporting portion.

5. In an electrical connector of the tap clamp type, the combination of a metal body member provided with an integral forwardly extending fixed jaw, said body member having a threaded bore oppositely disposed to said jaw, a threaded member in said bore and provided with a head adapted to be actuated by means of a clamp stick or the like, a spring rotatably mounted on the end of said threaded member, and a movable jaw carried by said spring in opposition to the fixed jaw, the threaded member and spring urging the movable jaw into engagement with a conductor between said jaws, the said threaded member being initially spaced from said movable jaw by said spring and said threaded member flexing the spring until the threaded member engages the movable jaw to drive it into fixed clamping relation with said conductor, the spring remaining flexed and ready to take up any looseness between said conductor and said movable jaw, the said spring comprising an elongated flat spring having a central aperture for receiving a reduced riveted portion of said threaded member, the ends of said elongated spring engaging said movable jaw at points equally spaced from the axis of said threaded member.

6. In an electrical connector of the tap clamp type, the combination of a metal body member provided with an integral forwardly extending fixed jaw, said body member having a threaded bore oppositely disposed to said jaw, a threaded member in said bore and provided with a head adapted to be actuated by means of a clamp stick or the like, a spring rotatably mounted on the end of said threaded member, and a movable jaw carried by said spring in opposition to the fixed jaw, the threaded member and spring urging the movable jaw into engagement with a conductor between said jaws, the said threaded member being initially spaced from said movable jaw by said spring and said threaded member flexing the spring until the threaded member engages the movable jaw to drive it into fixed clamping relation with said conductor, the spring remaining flexed and ready to take up any looseness between said conductor and said movable jaw, the said spring comprising an elongated spring having a central aperture for receiving a reduced riveted portion of said threaded member, the ends of said elongated spring engaging said movable jaw at points equally spaced from the axis of said threaded member, and said spring being assisted by a plurality of similar elongated springs arranged one upon the other in a stack on said threaded member.

7. A hot line connector including a body portion provided at its upper end with the fixed element of a clamp for overlapping a conductor, an eye bolt threaded through the lower part of the body portion, a one-piece substantially rigid head constituting the movable element of the clamp pivotally connected to the adjacent end of the eye-bolt, said head provided on its underside with a centrally located recess forming a pair of inwardly facing shoulders, a bowed spring plate fitted in the recess with its opposite edges facing and normally spaced from the shoulders and said shoulders limiting the distention of the spring plate and said eye bolt provided with a flange for engaging the spring plate and acting therethrough to force the head resiliently into engagement with the underside of the conductor.

8. The connector defined in claim 7 and in which one of the conductor engaging faces of one clamp element is convex in the direction lengthwise of the conductor and the corresponding face of the other clamp element is similarly concaved, whereby the conductor is kinked by the squeeze action of the clamp elements and tends to assume the contour imposed thereon by the convex face of the first-named clamp element.

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Executrix of the Will of Flavius Josephus Hendley, Deceased.

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