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C. H. KLEIN ET AL

2,210,587

CLAMPING DEVICE

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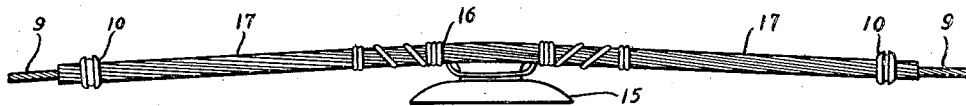


Fig 1

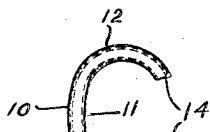


Fig 2

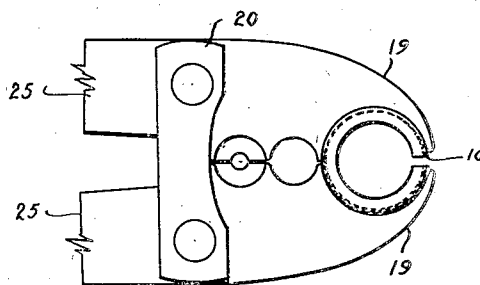


Fig 3

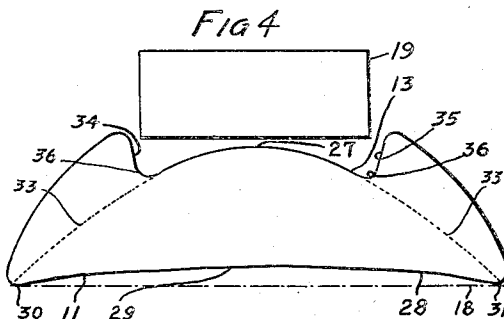


Fig 4

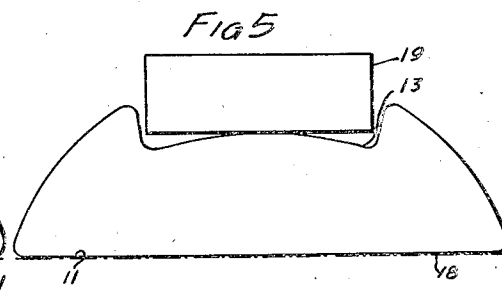


Fig 5

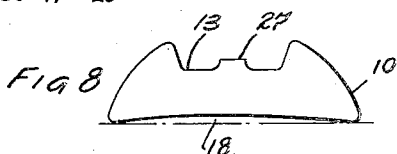


Fig 8

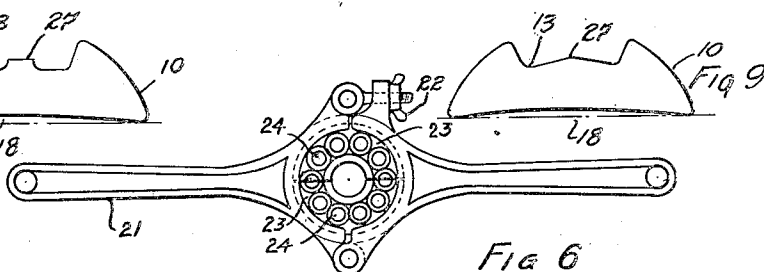


Fig 6

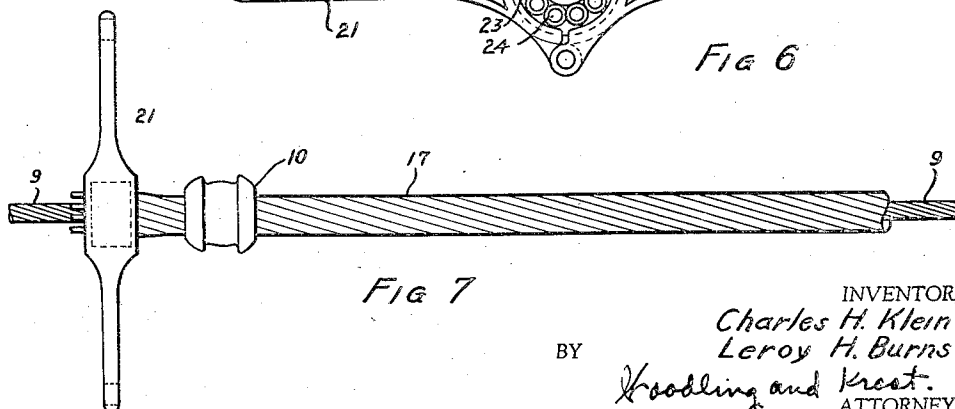


Fig 7

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2,210,587

CLAMPING DEVICE

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14 Claims. (Cl. 16—108)

Our invention relates to clamps and more particularly clamps for clamping armor rods about electric conductors.

5 An object of our invention is to provide a clamp for armor rods which can be easily placed around the armor rods and forced into engagement therewith.

10 Another object of our invention is to provide an armor rod clamp which can be readily and safely attached to electric conductors suspended above the ground.

15 Another object of our invention is to provide a C clamp with a side opening which permits the clamp to be slipped over the armor rods or wires from the side thereby enabling the clamps to be used when each end of the armor rods or wires is obstructed by a large twisting wrench.

20 Another object of our invention is the provision of a clamp which will retain itself into a clamping tool as the linesman operates the tool to depress the clamp about the armor rods or wires.

25 A further object of our invention is to furnish an armor rod attaching clamp for use with a bending tool and to provide for inserting the clamp into the tool in such a manner that the clamp will stay in the tool while it is being extended far out from the pole on which the linesman is situated.

30 Another object of our invention is to provide for easily disengaging the tool from the clamp after the clamp has been clamped onto the armor rods.

35 Still another object of our invention is to furnish a method for attaching armor rods to an electric conductor.

40 Another object of our invention is to provide a C clamp having a groove into which the bending tool fits and to provide a raised portion in the groove which insures that the bending tool contacts the center of the clamp.

45 A further object of our invention is to provide a raised portion in the retaining groove which assures that the contact between the tool jaw and the clamp is small in area.

50 Still another object of our invention is to provide a clamp for aluminum armor rods which is applied by the action of a toggle tool and to guard against crushing of the aluminum armor rods by providing a crushing zone in the clamp.

55 Another object of our invention is to provide a C clamp which distributes the force of a toggle tool substantially evenly along the inside surface of the clamp thereby reducing the danger

of crushing the cables which are held by the clamp.

A further object of our invention is to reduce stress concentrations in the C clamp and to thereby prevent the crushing of a cable inside the clamp.

Other objects and a fuller understanding of our invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing, in which:

Figure 1 is a side view of our invention showing a plurality of armor rods fastened around a conductor cable by means of our clamps.

Figure 2 is a side view of our clamp in its open condition.

Figure 3 is a fragmentary side view of a clamping tool and a clamp after the clamping tool has been operated to close the clamp.

Figure 4 is an enlarged transverse view of the outline of the clamp prior to being closed about the armor-rods and showing a part of the jaw of a clamping tool in the retaining groove but before it has come in contact with the clamp.

Figure 5 is an enlarged transverse view of the outline of the clamp after being closed about the armor rods.

Figure 6 is a front elevation of a twisting wrench which is used to wind the armor rods about the conductor cable, and

Figure 7 is a view of one of the twisting wrenches in place on the armored electric conductor cable and also showing one of our clamps in place.

Figure 8 is a view similar to Figure 4 showing another embodiment of our invention without showing the clamping tool; and

Figure 9 is a view similar to Figure 8 showing still another embodiment of our invention.

With reference to Figure 1 of the drawing, we have shown an electric conductor or cable 9 wrapped or reinforced with a plurality of armor rods or wires 17 having their ends held in the twisted position by means of our improved clamp 10. The entire assembly may be suitably fastened to an insulator 15 by tie wire means 16 in accordance with the usual practice. The armor rods 17 are preferably aluminum and may vary in length from approximately 3 to 5 feet and are designed to prevent abrasion of the conductor 9 from the tie wires and insulators, as well as reduce the fatigue from vibration. Although primarily a reinforcement, the armor rods 17 have a dampening effect which reduces the amplitude of vibration of the conductor or

cable 9 as much as 10 to 20 per cent. An additional advantage of considerable value is the protection of the cable 9 from flashover burns. The lay or twist of the armor rods 17 are in the same direction as the lay or twist of the strands of the cable 9.

The clamps 10 are open forming a C construction and are placed around each end of the armor rods 17 to snugly hold the armor rods in place. As these conductors 9 are usually upon a high pole and mounted at the ends of long cross arms it is not easy for a linesman to reach several feet out along the line to attach a clamp.

To facilitate the fastening of the clamp to the armor rods or wires, we have devised the clamp 10 which can be inserted into the jaws 19 of a tool 20 and extended out to the point where the clamp is to be attached. There the tool 20 is operated and the clamp is securely fastened.

Our clamp 10 comprises an open ring or C clamp having an internal surface 11 which is adapted to grip the armor rods or wires 17. Our clamp 10 also has an external surface 12 with a groove 13 therein adapted to receive the jaws 19 of the tool 20. An opening 14 is provided to enable the clamp 10 to slip over the armor rods or wires 17. The clamp 10 is preferably made of the same kind of metal as the armor rods or wires which it engages to prevent electrolytic corrosion.

For twisting the armor rods 17 about the electric conductor 9, we utilize a pair of twisting wrenches 21 each having a set of split dies 23 to receive the ends of the armor rods 17.

Each pair of split dies 23 are placed around the electric conductor wire 9 and then the twisting wrench 21 is fastened around the dies 23 by means of the wing nut 22. A plurality of armor rods 17 are then laid parallel to the electric conductor wire 9 with their ends through the holes 24 in the split dies. Both of the twisting wrenches are then moved inwardly and spaced apart equal to approximately one-third the length of the armor rods. The central one-third length of the armor rods 17 is then twisted until the armor-rods 17 snugly engage the electric conductor wire 9. The wrenches are then moved to the end positions and the remainder of the length of the armor rods 17 is twisted snugly about the electric conductor wire 9. The lay or twist of the armor rods 17 should be in the same direction as the lay or twist of the cable strands of the electric conductor wire or cable 9. The twisting wrenches 21 are then held in place in any convenient manner such as attaching a weight to one end of the handle to hold the armor rods or wires 17 in their twisted condition, thereby freeing both of the linesman's hands to attach the clamps 10.

The open C clamp 10 is then placed in the jaws of the clamping tool 20 where the groove 13 engages the sides of the jaws 19 to retain the C clamp therein. The clamp 10 is then placed over the twisted armor rods 17 just inside one of the twisting wrenches 21 and the handles 25 of the clamping tool are pressed to forcibly close the C clamp on the armor rods 17. Upon relieving the pressure on the handles 25 the jaws 19 of the tool will disengage from the closed C clamp and permit the easy removal therefrom. A second C clamp is then pressed into place at the other end of the armor rods 17 after which the twisting wrenches 21 may be removed.

The clamping tool 20 which is used to close the clamp 10 is a "constant movement" tool; that

is to say, the moving jaws of the tool close to a constant position. For this reason slight variations in the size of the armor wires 17 and the clamp 10 may cause excessive pressures on the aluminum armor rods and the electric conductor cable 9 when the clamp is closed to the limit of the tool movement. Crushing of the aluminum armor rods and the electric conductor cable 9 may also occur if the tool 20 is adjusted too tight. The crushing of the aluminum rods 17 and of the electric conductor cable 9 is undesirable due to the possibility of vibration fatigue failure at the crushed points. The clamp 10 has been designed to obviate this possibility.

One safety feature of our clamp 10 is the raised central portion 27 of groove 13 which centers the pressure from the jaw 19 of the tool 20 and provides a limited area of contact between the tool 20 and the clamp. The limited area of contact establishes a crushing zone about the raised central portion 27. The crushing zone 27 reduces the danger of crushing the aluminum armor wires 17 when the clamp is closed about the rods because if any crushing takes place, it will occur in the crushing zone 27 and relieve the pressure on the armor rods 17.

Another feature of our clamp is the longitudinally arcuate internal surface 28 which is divided into a left end engaging zone 30, a right end engaging zone 31 and a central engaging zone 32; see Figure 4 where the surface of the armor rods or wires is indicated by the dash-dot line 18. As the clamp 10 is closed about the armor rods or wires 17 by the action of the clamping tool 20 the end engaging zones 30 and 31 engage the armor rods 17 first to create what might be called a "two zone engagement." After the end engaging zones are in firm contact with the armor rods 17, pressure from the clamping tool 20 causes the clamp 10 to depress radially until the central engaging zone 32 firmly engages the armor rods 17, (see Figure 5) to create what might be called a "three zone engagement." At this point the clamping tool 20 should have reached the closed end of its constant movement. If, however, the tool 20 has not reached the end of its compressive movement, the crushing zone around the central point 27 will crush instead of the internal surface 11 damaging the aluminum armor rods 17 and the electric conductor cable 9 as the tool 20 is closed to its limit. On the other hand, should slight variations in the clamping tool 20, the clamp 10, the armor rods 17 and the electric conductor cable 9 combine to prevent the tool from firmly clamping the central engaging zone 32 against the armor rods 17, then in this case the clamp 10 still firmly engages the armor rods as both of the end engaging zones 30 and 31 are depressed tight against the armor rods 17 establishing "two zone engagement."

It is to be seen, therefore, that our clamp 10 provides safety features to insure a good clamping action regardless of slight variations in the clamp, the armor rods and the electric conductor cable 9. Should the variations result in the "constant movement" clamping tool 20 depressing the clamp too hard over and above that required to make a firm "three zone engagement," then the crushing zone 27 functions to relieve the armor rods and the electric conductor cable 9 from being damaged. Should the variations manifest themselves in the reverse manner, the clamp 10 still makes a good firm engagement because a positive "two zone engagement" is effected even

though the "constant movement" clamp may not depress the central engaging zone 29 against the armor rods.

A further feature of our invention is the shape of the raised central portion 27. We prefer an arcuate central portion although a triangle or a raised block as shown respectively in Figs. 8 and 9 is within the disclosure. We prefer the arcuate central portion because it evenly distributes the pressure which is exerted on the zone 27. The construction line 33 shows the approximate path of the stress distribution from the raised central portion 27 to the end engaging zones 30 and 31.

To retain the clamp 10 in the jaws 19 of the tool 20 while the linesman is extending the tool from a high pole over to the armor rods 17, we provide the groove 13 with side walls 34 and 35. The side walls 34 and 35 extend from the external surface 12 to the curved bottom of the groove 13. The width of the jaws 19 of the clamping tool 20 is less than the width of the groove 13. The tool jaws 19 are adapted to fit into the groove 13 and, upon being closed slightly, will retain the clamp 10 in engagement therewith while the linesman is placing the clamp about the armor rods. The side walls 34 and 35 constitute stops which prevent the clamp 10 from slipping sideways out of the clamping tool jaws 19. The walls 34 and 35 preferably converge inwardly as they extend from the surface 12 downwardly toward the bottom of the groove 13. The converging of the walls 34 and 35 prevents binding of the clamping tool as the clamp is bent around the armor rods 17. Sufficient clearance is maintained between the tool jaws 19 and the side walls 34 and 35 to prevent the jaws 19 from wedging between the walls 34 and 35.

The junction between the side walls 34 and 35 of the groove 13 and the curved bottom of the groove is well rounded as may be seen at points 36. The rounding of the corners 36 strengthens the clamp at those points and avoids sharp corners.

A further feature of our invention is the absence of sharp corners on our clamp 10 which tends to prevent corona discharges. The absence of sharp corners also serves to reduce the damage to the insulating cover which the linesmen put over high potential conductors, armor rods and the clamps when working upon the pole.

Although we have described our invention with a certain degree of particularity, it is understood that the present disclosure has been made only by way of example and that numerous changes in the details of construction may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

We claim as our invention:

1. A clamp arranged for use with a clamping tool and adapted for fastening armor wire around a conductor comprising, an open and expanded metallic C clamp having an external surface with a groove therein for receiving said clamping tool, said groove having a curved bottom extending outwardly toward the said external surface and converging side walls extending from the external surface to the curved bottom, the juncture between the side walls and the curved bottom being arcuate to strengthen the said juncture, said side walls retaining said clamp in engagement with said clamping tool and said curved bottom centering the pressure from said clamping tool and providing a limited area of contact between said clamp and said clamping tool to es-

tablish a crushing zone, said clamp having a longitudinally arcuate internal surface creating end engaging zones and a central engaging zone, said clamp being arranged to close radially upon pressure from said clamping tool and force said end engaging zones and said central engaging zone into engagement with said armor wires, the end engaging zones engaging first and the central engaging zone engaging second and functioning to distribute the pressure from said clamping tool substantially evenly along the internal surface of the said clamp.

2. A clamp arranged for use with a clamping tool and adapted for encircling wire comprising, a metallic C clamp having an external surface with a groove therein for receiving said clamping tool, said groove having a bottom with a raised portion adapted to receive pressure from said clamping tool and distribute it throughout said clamp and provide a limited area of contact between said clamp and said clamping tool to establish a crushing zone to prevent pressure from said clamping tool from damaging said wire, and said groove having side walls for retaining said clamp in engagement with said clamping tool.

3. A clamp arranged for use with a clamping tool and adapted for encircling wire comprising, a metallic C clamp having an internal surface adapted to be engaged by said wire by the compression of said clamp under pressure of said clamping tool, an external surface with a groove therein adapted to receive said clamping tool, said groove having raised means providing a limited area of contact between said clamp and said clamping tool and establishing a crushing zone to prevent said internal surface from damaging said wire.

4. A clamp arranged for use with a clamping tool and adapted for encircling wire comprising, an open and expanded metallic C clamp having an external surface with a groove therein for receiving and retaining said clamping tool, a longitudinally arcuate internal surface creating end engaging zones and a central engaging zone, said clamp being arranged to close radially upon pressure from said clamping tool and force said end engaging zones and said central engaging zone into engagement with said wire, the end engaging zones engaging first and the central engaging zone engaging second thereby assuring good end zone engagement.

5. A clamp arranged for use with a clamping tool and adapted for encircling wire comprising, an open metallic C clamp having an external surface with a groove therein for receiving said clamping tool, said groove having a bottom with a raised portion adapted to receive pressure from said clamping tool and distribute it substantially evenly throughout the width of the said clamp.

6. A clamp arranged for use with a clamping tool and adapted for encircling wire comprising, an open C clamp having an external surface with a groove therein for receiving said clamping tool, said groove having a bottom with an arcuate raised portion adapted to receive pressure from said clamping tool and distribute it through the said clamp for compressing same about the wire.

7. A clamp arranged for use with a clamping tool and adapted for encircling wire comprising, an open C clamp having an external surface with a groove therein for receiving said clamping tool, said groove having a bottom with a substantially triangular raised portion adapted to receive pressure from said clamping tool and dis-

tribute it through the said clamp for compressing same about the wire.

8. A clamp arranged for use with a clamping tool and adapted for encircling wire comprising, an open C clamp having an external surface with a groove therein for receiving said clamping tool, said groove having a bottom with a substantially rectangular raised portion adapted to receive pressure from said clamping tool and distribute it through the said clamp for compressing same about the wire.

9. A clamp arranged for use with a clamping tool and adapted for fastening wires together comprising, a clamp having an internal surface adapted to engage said wires and an external surface with a groove therein for receiving said clamping tool, said groove having bottom means and side wall means, said bottom means comprising portions relatively near said internal surface and portions relatively farther away from said internal surface, said side wall means extending from the said external surface to the portions of the bottom means which are relatively near said internal surface, said internal surface being longitudinally arcuate to create end engaging zones and a central engaging zone, said central engaging zone being substantially beneath the portion of the bottom means which is relatively farther away from the said internal surface and the said end engaging zones being outside of the said side wall means.

10. A clamp arranged for use with a clamping tool comprising, a body having an internal surface adapted to engage the material to be clamped and an external surface adapted to be engaged by said clamping tool, said internal surface being arcuate to create end engaging zones and a central engaging zone, the end engaging zones being adapted to engage the material to be clamped before the central engaging zone, said external surface having a groove therein adapted to receive said clamping tool, said groove comprising side wall means converging toward the said internal surface and bottom means, said bottom means comprising portions joining said side wall means and a raised portion to establish a limited area adapted to engage the said clamping tool.

11. A clamp arranged for use with a clamping tool comprising, a body having an internal surface and an external surface, said internal surface being adapted to engage a material to be clamped and said external surface having a groove therein adapted to receive said clamping

tool and means in said groove adapted to center pressure from said clamping tool and transmit it throughout the width of the internal surface of the said clamp.

12. A clamp arranged for use with a clamping tool comprising a body having an internal surface adapted to engage a material to be clamped, said internal surface being longitudinally arcuate to create end engaging zones and a central engaging zone, and an external surface having a groove therein substantially radially outwardly from said central engaging zone, said groove having a bottom with a portion thereof raised to establish a limited area for contacting said clamping tool and for centering the pressure from the said tool, said groove also having side walls adapted to retain said clamp in engagement with said clamping tool, said side walls converging toward said internal surface to prevent the clamp from binding the tool as pressure from said tool bends said clamp to cause the said central engaging zone to engage the material to be clamped.

13. A clamp arranged for use with a clamping tool and adapted for encircling wire comprising, an open C clamp having an external surface with a groove therein for receiving said clamping tool and an internal surface adapted to engage said wire to be clamped, said groove comprising side wall means and bottom means adapted to cooperatively retain said C clamp in said clamping tool while said C clamp is being closed about said wire and said bottom means transmitting the pressure exerted by said clamping tool to said internal surface for compressing same about the wire.

14. A clamp arranged for use with a clamping tool and adapted for encircling wire comprising, an open C clamp having an external surface with a groove therein for receiving said clamping tool and an internal surface adapted to engage said wire to be clamped, said groove comprising side wall means and bottom means adapted to cooperatively retain said C clamp in said clamping tool while said C clamp is being closed about said wire and said bottom means transmitting the pressure exerted by said clamping tool to said internal surface for compressing same about the wire, the juncture between the side wall means and the bottom means being arcuate.

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