May 14, 1940. H. W. BODENDIECK 2,200,380

ELECTRICAL CONNECTOR

Filed Nov. 12, 1938

Fig. 1.

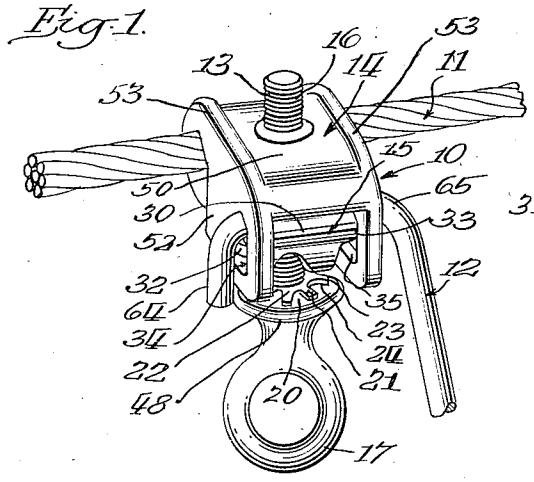


Fig. 2.

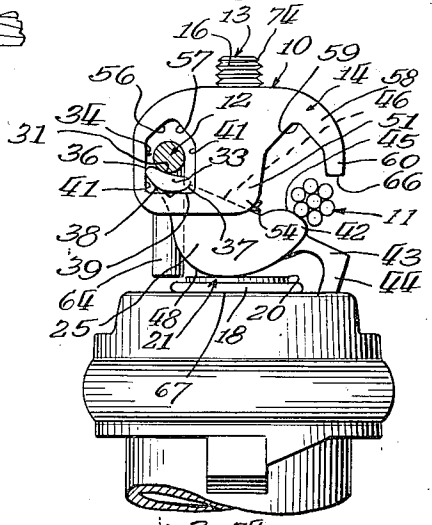


Fig. 3.

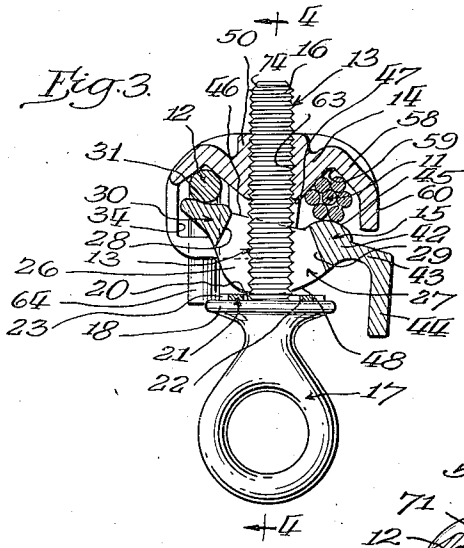


Fig. 4.

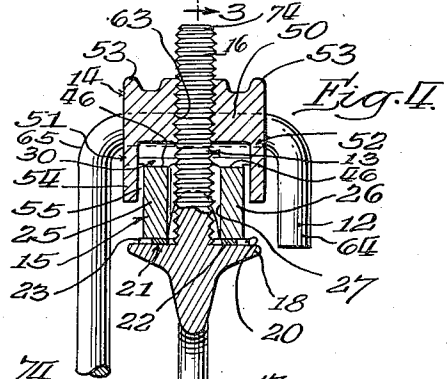


Fig. 5.

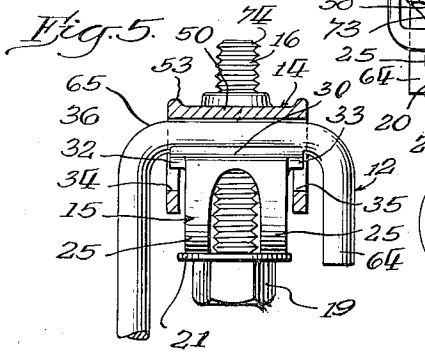
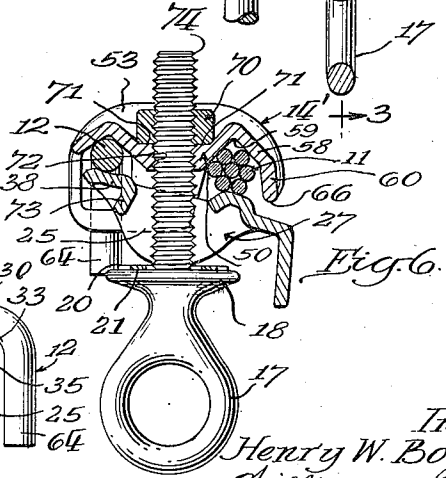


Fig. 6.



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UNITED STATES PATENT OFFICE

2,200,380

ELECTRICAL CONNECTOR

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Application November 12, 1938, Serial No. 239,912

4 Claims. (Cl. 173—273)

The present invention relates to electrical connectors and is particularly concerned with tap-off clamps adapted to be used for effecting a connection between high tension electrical transmission or distribution lines and other electrical devices.

One of the objects of the invention is the provision of an improved tap-off clamp of the type adapted to be applied to a high tension line by means of a clamp stick which is of such simple structure that it is adapted to be manufactured at a very low cost, yet which is also adapted to be utilized with various sizes of main conductors and tap-off wires.

Another object of the invention is the provision of an improved tap-off clamp of the class described, which is so constructed that by means of a single threaded member the gripping member of the clamp may be opened or closed for simultaneously clamping both the jumper wire and the main conductor.

Another object of my invention is to provide supports to the ordinary parallel groove clamp, thereby controlling or limiting the downward movement of one end of the lower jaw to permit the opposite or free end of the jaw to open to allow easy application to a transmission line and to effect proper positioning of the controlling lug into the end of the operating stick for unitary rotation of the clamp and clamp stick, and at the same time provide a temporary holding means for a tap-off wire. I am aware of various parallel groove clamps now on the market, but none with the support limiting the movement of one end of the movable jaw which makes this clamp safely usable for applying tap-off wires and jumpers to energized lines with the ordinary live line clamp stick.

Another object of the invention is the provision of a tap-off clamp of the class described, which is provided with a controlling threaded member for effecting the clamping action and with means for engaging the clamp stick comprising a depending lug by means of which the clamp stick may be locked or unlocked and by means of which the tap-off clamp may be twisted, if necessary, to effect alignment of the clamp with the main wire, even though the jumper wire must be bent.

Another object of the invention is the provision of an improved tap-off clamp of the class described, which is provided with an interchangeable screw so that the clamp may be used with any type of clamp stick.

Another object is the provision of an improved tap-off clamp having means for locking the operating screw in place so that the clamp will not be loosened after it has once been placed in position.

Another object of the invention is the provision of an improved tap-off clamp structure, the body and jaw of which are adapted to be constructed either from a casting or a stamping so that the clamp can be manufactured at a minimum cost and placed within the means of a larger number of the purchasing public.

Another object of the invention is the provision of an improved tap-off clamp structure which is adapted to be constructed of such metal that galvanic action between the clamp and the wires usually used for main wires is reduced to a minimum, thereby preventing its corrosion, such as takes place on clamps of the prior art and maintaining a better connection with the devices constructed according to the invention.

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

Referring to the single sheet of drawings accompanying this specification:

Fig. 1 is a view in perspective of a tap-off clamp constructed according to the invention shown in connection with a main wire and a tap-off wire;

Fig. 2 is a side elevational view with the wires in section and the clamp in open position, showing a clamp stick also;

Fig. 3 is a vertical sectional view, taken on a vertical plane 3—3 of Fig. 4 passing through the axis of the accompanying screw, with the screw in elevation and the clamp in clamping position;

Fig. 4 is a vertical section, taken on the plane of the line 4—4 of Fig. 3, looking in the direction of the arrows;

Fig. 5 is a rear elevational view of a modification in which the screw is provided with a hexagonal head; and

Fig. 6 is a view similar to Fig. 3 of a modification which is constructed of sheet metal by stamping operations.

Referring to Figs. 1 to 4, 10 indicates in its entirety the new tap-off clamp which is shown in connection with a main wire 11 of a high tension line and a jumper wire 12. The tap-off clamp preferably comprises three main parts, such as the actuating screw 13 and the two clamping members 14 and 15, the upper one of which, 14, may be considered a fixed clamping member as its position is determined by engagement with the

main wire 11, and the lower one of which, 15, may be considered as a pivoted or movable clamping member.

The screw 13 preferably comprises a metal member having a threaded shank 16 carried by a head 17 and having a radially extending thrust flange 18 between the head and the threaded portion 16. The head 17 may be of the screw eye type, as shown in Figs. 1 to 4 and 6, or of hexagonal shape, as shown at 19 in Fig. 5. The shape, structure and size of the heads 17 and 19 are such that the tap-off clamp is adapted to be operated by ordinary clamp sticks now on the market.

The thrust flange 18 is provided with a flat thrust surface 20 on the side toward the threaded portion 16 for engagement with the pivoted clamping member 15, and a lock washer 21 of the type having a central circular body 22 and radially extending locking flanges 23 with downwardly extending sharp edges 24 formed by twisting the flanges 23, is interposed between the pivoted clamping member 15 and the thrust surface 20. The sharp edges of the lock washer 21 bite into the thrust surface 20 and into the engaging portions of the clamping member 15 and hold the screw against turning backward to opened or loosened condition. The lock washer assures the holding of the clamp in tight condition irrespective of any vibration or movement of either of the wires 11 or 12 to which it is applied.

The lower or movable pivoted clamping member 15 comprises a metal member provided with a pair of spaced vertical body flanges 25, 26 which may be substantially rectangular in cross-section and which are spaced by the intermediate slot 27 of such a size that it is adapted to receive the threaded shank 16 of the screw 13 with a suitable clearance. The length of the slot 27 in the clamping member 15 is such as to permit a maximum amount of rocking movement and also to save metal. Thus, the slot 27 extends at the left of Fig. 3 to the surface 28 and at the right to the surface 29, which surfaces slope upwardly radially toward an imaginary rocking center of the clamping member 15.

At the rear or left end in Fig. 3 the clamping member 15 has its vertical flanges 25 and 26 joined by a yoke 30 which also serves as the engaging member for the jumper wire 12. Therefore the yoke 30 is provided with partially concave engaging surface 31 for engaging the jumper wire, the latter serving as a pivot for the movement of the clamping member 15. The yoke 30 is provided with lateral pivotal extensions 32, 33 which extend beyond the exterior surfaces of the vertical body flanges 25 and 26 and are adapted to be received in the apertures 34, 35 formed in the fixed or upper clamping body 14.

The extensions 32, 33 are formed substantially like a portion of an annulus with rounded edges at 36, 37. The lower convexly curved surface 38 of each extension is adapted to have pivotal engagement with the bottom 39 of the apertures 34 or 35 when the clamp is wholly open and ready to receive a jumper wire 12. The thickness of the body of each extension 32 or 33 is such, in respect to the size of the apertures 34 or 35, that there is still room enough in the apertures above the extensions 32 or 33 for any size or jumper wire which is apt to be used. The width of each extension 32, 33 is such that it has a clearance with respect to the sides 41 of each aperture 34, 35, so that the clamping member may pivot freely upon the extensions 32, 33.

At the opposite end of the clamping member 15 the side flanges 25 and 26 are joined by a second yoke 42 having a forwardly extending arm 43 and a downwardly extending lug 44. The lug 44 is adapted to be engaged in a slot in a rotating cap carried by the clamp stick for the purpose of rotating the cap from left to right, or vice versa, with respect to the stick by turning movement on the lower end of the stick, the cap being held in fixed position by means of the clamp and its main wire 11. When the clamp is in locked condition, the slot mentioned and lug 44 and the stops with which the clamp stick cap is provided, may also be used for exerting a rotative force on the tap-off clamp 10 to bend the jumper wire 12 and bring the clamp into position to engage the wire 11.

The present tap-off clamp is adapted to be applied to an energized wire by means of a clamp stick of the type shown in my prior application Serial No. 23,957, filed May 28, 1935, and the description of the clamp stick enclosed in said application is hereby incorporated by reference thereto. The yoke 42 of the lower movable clamping member 15 is also provided with an upwardly convex surface 45 located below the main wire 11, in such position to engage the main wire 11. The surfaces 31 and 45 on the movable clamping member 15 may be provided with surface slots and/or teeth for increasing the holding capacity of these surfaces against the wires 11 and 12.

The upper edges of the side flanges 25 and 26 may be substantially flat, as indicated at 46, and depressed below the wire engaging surfaces 31 and 45 so as to eliminate interference between this portion of the movable clamping member 15 and the inner surface 47 of the upper clamp. The lower edges of the body flanges 25 and 26 of the movable clamp 15 are convexly curved at 48 for pivotal engagement with the thrust surface 20 and lock washer 21 when the screw 13 is actuated to drive the clamp into clamping position. It will also be observed that the depth of the body flanges 25 and 26 is increased at the middle of the clamping member 15 where the greatest stress is placed upon the clamping member by means of the screw 13.

The upper or fixed clamping member 14 also comprises a metal body which may be made of cast metal or sheet metal. A sheet metal embodiment is shown in Fig. 6.

Referring to Figs. 1 to 4, the upper clamping member has a central and relatively thick body portion 50 which is provided with a pair of upwardly and downwardly projecting side flanges 51, 52. The upwardly projecting portions 53 of the flanges 51 and 52 serve as reinforcing members for increasing the strength of the fixed clamping member 14.

The downwardly extending portions 54 of the side flanges 51 and 52 are adapted to serve as guides for maintaining the alignment of the lower clamping member 15 with the coacting clamping surfaces on the upper clamping member 14. The depending flange portions 54 are spaced from each other a distance suitable to receive the lower clamping member 15 and to provide a generous clearance 55 which may be necessary in the cast metal embodiment for the insertion of the movable clamping member 15 with its extensions 32, 33 into the apertures

34, 35, by tilting the movable clamping member 15.

In the sheet metal embodiment this clearance may be eliminated as the side flanges 54 may be pressed over or bent together during the assembly of the two clamping members, thereby eliminating any necessity for tilting of the movable clamping member in its insertion. The side flanges 54 of the fixed clamping member 14 are also provided at the left or rear end with the enlarged apertures 34, 35, the apertures being in alignment with each other and of a width suitable to receive the pivotal extensions 32, 33.

Apertures 34 and 35 each may have a bottom 39 which contributes to support or hinge the movable clamp member 15 to the extensions 32 and 33, which permits the free end of movable clamp member 15 to continue in its downward movement, as the screw 13 is rotated in a direction to open the clamp members to receive the wire 11, thus allowing easy application to a transmission line and to effect proper positioning of the controlling lug 44 into the end of the operating stick to effect unitary rotation of the clamp and clamp stick and at the same time provide temporary holding means for the tap-off wire. The apertures 34 and 35 have side walls 41 and a pair of diagonally upwardly extending top walls 56, 57, making the top of each aperture of substantially V shape. Thus, the jumper wire 12 is adapted to be centered in the V shape top portion of each aperture 34, to which position it is pressed by the lower clamping member 15. The length of the apertures 34, 35 in the vertical direction in Fig. 2 is such as to provide ample room for any size jumper wire which might be used and the excess space is taken up by the upward movement of the clamping member 15 under the influence of the screw member 13.

The forward end of the fixed clamping member 14, that is, the right side of Figs. 2 and 3, is provided with a hook-like extension 58 having a V-shaped trough 59 on its lower side located above the convex cable engaging surface 45 of the lower clamp 15. The V-shaped trough 59 is of sufficient size to receive any size of main wire or cable with which the clamp is to be used and the extension 58 is preferably provided with a depending substantially vertical lip or flange 60 serving also to retain the cable 11 in the trough 59. The central body portion 50 of the upper clamping member 14 is provided with a centrally located bore 63 which is threaded to receive the threaded end 16 of the screw 13.

Referring to Fig. 6, this is an embodiment which has all of the elements previously described with respect to the cast metal embodiment of Figs. 1 to 5. It also may be constructed in the screw eye type or hexagonal head type. In this embodiment the sheet metal body portion 50 of the upper clamp may be provided with sufficient metal to withstand the stresses placed upon the threads by the screw member 13. Thereafter an ordinary metal nut 70 is provided on the upper side of the upper clamping member 14' of this embodiment and is housed between the side flanges 53 thereof. The nut 70 may be spot welded at 71 to the main body of the upper clamping member 14' to hold it in place and the nut supplements the holding action of the threaded bore 72 in the body of the upper clamping member 14'.

The lower clamping member may be substantially as previously described, except the yoke 30 is provided with a depending reinforcing flange 73 and both of the clamping members of the sheet metal embodiment (Fig. 6) are formed by stamping operations. In all of the embodiments the threaded member 13 preferably has its upper and outer end deformed as at 74 after assembly of the parts, so that the screw cannot be removed due to the deformation of the threads at the end of the screw. Thus, there is no possibility of any of the parts becoming lost.

The mode of use and operation of the tap-off clamp is as follows. The jumper wire 12 is inserted through the apertures 34, 35 and its extreme end 64 is bent laterally at right angles so that the jumper wire cannot again be removed without straightening that portion of the wire. The jumper wire 12 is also preferably bent downward at right angles as at 65 on the other side of the clamp, in order that the jumper wire 12 may extend in a direction downward away from the wire 11 to which the clamp is to be attached and the tap-off clamp is secured to the jumper wire by the bent portions thereof, so that it cannot become disconnected from the jumper wire.

At this point the clamp is in the open position of Fig. 2 and the opening at the point 66 (Fig. 2) is large enough to receive any main wire with which the clamp is intended to be used. The pivotal extensions 32 and 33 are then resting on the bottom of apertures 34 and 35, which unbalances the movable jaw, permitting the free end to continue to open up to receive wire 11 as shown in Fig. 2. The screw eye 17 or hexagonal head 19 is placed in an appropriate clamp stick head, as described in my prior application above mentioned, and locked therein by turning the cap of the clamp stick. The opposite end of the jumper wire 12 is attached to the desired electrical apparatus or to ground, if intended to be used for that purpose, and thereafter the clamp is in condition to be applied to the wire 11. This is done by lifting the clamp upward by means of the clamp stick, the eye 17 or head 19 being locked in the clamp stick and the lower side 67 of the screw flange 18 resting on the top end of the clamp stick head. In this condition the screw threaded portion 16 holds the upper clamping member above the lower clamping member, the latter resting on the thrust flange surface 20 with the trough 59 open at 66 to receive the wire 11.

The lug 44 then depends into a slot, such as the slot 18 of my prior application clamp stick, in such manner that by means of the clamp stick the tap-off clamp 10 may be twisted if necessary to bring the trough 59 into alignment with the wire 11, whereupon the clamp is placed over the wire and by pulling down on the clamp stick the wire is driven up into the V-shaped trough 59. The downward pull upon the clamp stick then enables the operator to cause the eye 17 or head 19 to engage complementary shoulders in the clamp stick head so that by pulling down on the clamp stick and turning it toward the right, the screw 13 is actuated to drive the clamping members 14 and 15 together. During this movement the lower clamping member 15 pivots about the wire 12 which it first engages and the lower clamping member 15 is simultaneously driven into tight clamping engagement with both the wires 11 and 12.

Thereafter the clamp stick may be pushed upward to engage the lug 44 and the cap being held by the lug 44, the stick may be rotated relative to the cap to unlock the clamp stick from the head of the screw and the clamp stick may be removed, leaving the clamp on the wire.

The specific structure of the clamp having the lateral extensions 32—33 resting on the bottom of the apertures 36 and 35 specifically limits the amount of opening of the clamping member with respect to the V-shaped groove 56, 57. It it were not for this structure it would be a very difficult matter to apply this clamp to a wire with a high line clamp stick, because the movable jaw might otherwise open up too far on the jumper side of the clamp and release the jumper wire. The present tap-off clamp is adapted to assure retainment of the jumper wire in the clamp at all times while the clamp is being manipulated and placed upon the line wire.

The present tap-off clamp may be constructed of brass, if desired, but I prefer to construct the tap-off clamp of any sheet material having high electrical conductivity and provided with a steel nut, the complete clamping members being galvanized after construction. In some embodiments the clamping members may be made of sheet iron or sheet steel and galvanized. I find that there is little or no galvanic action between the zinc covering used for galvanizing and the aluminum wires used for high tension transmission lines, and thus there is practically no tendency toward the corrosion of the connector due to galvanic action, which is experienced with the devices of the prior art not having this galvanizing coating. The result is a better contact for a longer period of time and a more durable electrical connector is thus provided.

It will thus be observed that I have invented an improved tap-off clamp which may be constructed either of castings or stampings and in either case the tap-off clamp involves the use of a minimum number of parts and a single threaded member. In the case of the sheet metal construction made by stamping, the tap-off clamp members involve a minimum amount of machine work as the threaded member may be provided by spot welding a nut of ordinary construction purchased on the open market, to one or the other of the clamping members.

My tap-off clamp may be used with jumper wires or main wires of various sizes, large and small, and is adapted to be applied by the use of ordinary clamp sticks of the prior art. When it is galvanized as described, corrosion is resisted and a better connection secured for a longer period of time than with any of the devices of the prior art.

While I have illustrated and described a preferred embodiment of my invention, I do not wish to be limited to the specific details shown, but desire to avail myself of all changes within the scope of the appended claims.

Having thus described my invention, I claim:

1. In a tap-off clamp for transmission lines, the combination of a threaded member having a clamp-stick-engaging head, a thrust surface, and a threaded shank, with a metal clamping body comprising a metal member having a centrally located threaded bore, a pair of conductor-receiving grooves on the opposite sides of said bore in substantially parallel relation to each other, formed in said body, a pair of guide flanges carried by opposite sides of said body, and said guide flanges extending transversely to said grooves, each of said guide flanges being provided with apertures communicating with one of said grooves, and a clamping member comprising a metal member having a pair of substantially parallel spaced flanges, said flanges being joined together at each end by transversely extending wire-engaging portions, said portions being spaced from each other, and said threaded shank being located between said portions and said latter parallel flanges, one of said wire-engaging portions being elongated and extending into the apertures of the first-mentioned parallel flanges, wherein they are pivotally mounted, and the second-mentioned parallel flanges engaging said thrust surface.

2. In a tap-off clamp for transmission lines, the combination of a threaded member having a clamp-stick-engaging head, a thrust surface, and a threaded shank, with a metal clamping body comprising a metal member having a centrally located threaded bore, a pair of conductor-receiving grooves on the opposite sides of said bore in substantially parallel relation to each other, formed in said body, a pair of guide flanges carried by opposite sides of said body, and said guide flanges extending transversely to said grooves, each of said guide flanges being provided with apertures communicating with one of said grooves, and a clamping member comprising a metal member having a pair of substantially parallel spaced flanges, said flanges being joined together at each end by transversely extending wire-engaging portions, said portions being spaced from each other, and said threaded shank being located between said portions and said latter parallel flanges, one of said wire-engaging portions being elongated and extending into the apertures of the first-mentioned parallel flanges, wherein they are pivotally mounted, and the second-mentioned parallel flanges engaging said thrust surface, said second-mentioned parallel flanges being provided with convexly curved surfaces for pivotal movement on said thrust surface.

3. In a tap-off clamp for transmission lines, the combination of a threaded member having a clamp-stick-engaging head, a thrust surface, and a threaded shank, with a metal clamping body comprising a metal member having a centrally located threaded bore, a pair of conductor-receiving grooves on the opposite sides of said bore in substantially parallel relation to each other, formed in said body, a pair of guide flanges carried by opposite sides of said body, and said guide flanges extending transversely to said grooves, each of said guide flanges being provided with apertures communicating with one of said grooves, and a clamping member comprising a metal member having a pair of substantially parallel spaced flanges, said flanges being joined together at each end by transversely extending wire-engaging portions, said portions being spaced from each other, and said threaded shank being located between said portions and said latter parallel flanges, one of said wire-engaging portions being elongated and extending into the apertures of the first-mentioned parallel flanges, wherein they are pivotally mounted, and the second-mentioned parallel flanges engaging said thrust surface, said body having a standard nut fixedly secured to its outer side, with its threaded bore in registry with the threaded bore in said body.

4. In a tap-off clamp for transmission lines, the combination of a threaded member having a clamp-stick-engaging head, a thrust surface, and a threaded shank, with a metal clamping body comprising a metal member having a centrally located threaded bore, a pair of conductor-receiving grooves on the opposite sides of said bore in substantially parallel relation to

each other, formed in said body, a pair of guide flanges carried by opposite sides of said body, and said guide flanges extending transversely to said grooves, each of said guide flanges being provided with apertures communicating with one of said grooves, and a clamping member comprising a metal member having a pair of substantially parallel spaced flanges, said flanges being joined together at each end by transversely extending wire-engaging portions, said portions being spaced from each other, and said threaded shank being located between said portions and said latter parallel flanges, one of said wire-engaging portions being elongated and extending into the apertures of the first-mentioned parallel flanges, wherein they are pivotally mounted, and the second-mentioned parallel flanges engaging said thrust surface, said clamping member also having a downwardly extending lug for engagement with actuating shoulders carried by a clamping stick.

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