This invention relates to power conductor suspension assemblies and more particularly to an improved heavy-duty type featuring ruggedness coupled with high strength and lightweight as well as an improved cable clamping jaw. More particularly, the invention relates to a bundling type clamping assembly by means of which a plurality of high tension power conductors are supported by a common metallic assembly pivotally supported at the lower end of the insulator assembly, thereby increasing the effectiveness of the power line to carry high voltages without risk of arc or flashover and making it feasible to eliminate control shields heretofore considered necessary under heavy loading conditions.

Recent studies of limitations on the load carrying ability of power have established definite advantages attending the division of the load between two or more conductors in spaced-parallel relation and held in rigidly spaced relation by a common clamping assembly known as a bundling clamp. Among the advantages of this practice is the fact that a given insulator assembly to operate safely at appreciably higher voltages without accelerated corrosion damage to insulators and the production of localized corona so conducive to the generation of radio interference voltages. A major reason for the improved operating characteristics is the fact that the separation of the power cable into several cables reduces the field intensity over a sizable region surrounding the conductors. This enables the conductors themselves to perform part of the control functions of the commonly used control shields.

The present invention provides a relatively simple, high efficiency bundling suspension assembly so designed as to support two or more conductors in vertically spaced alignment with the axis of a suspension insulator. To this end, the assembly comprises an ungrounded main body having a clevis connection with the lower end of the insulator and having an eyelet at its lower end for supporting an anti-sway weight or its equivalent. Pivotally connected to the main body on vertically spaced horizontal axes are separate keeper jaws shaped complementarily to secundarily conductor strands formed integral with the main body of the clamp and projecting from the opposite sides thereof. Each of the jaws preferably includes a pair of elliptically shaped clamping screw openings having novel means for holding these screws captive therein. The threaded ends of the screws engage with cooperating threaded bores provided in the main body to the end that the conductors can be rigidly and firmly clamped in place substantially throughout their circumference. The smaller diameter non-threaded shank portion of the screws cooperate with restrictors at the outer ends of the supporting openings for these screws. These restrictors have shallow threads engageable with the threaded ends of the screws in a manner requiring skilled manipulation before permitting assembly and disassembly of the screws with respect to the jaws and operating normally to hold the screws captive assembled to the jaws. This safeguard makes it feasible to operate and replace the clamping jaws throughout long-handled wrenches manipulated from a remote point such as the ground without risk of the screws becoming unintentionally detached from the jaws.

A further feature and safeguard is that the length of the mounting openings for the screws is as great and preferably greater than the length of the threaded portion of the screws. In consequence assurance is provided that the screws will become disengaged from the threaded bores in the main body of the clamp before the shank end of the screws can engage in the threads in the restrictor holding the screws captive with the jaw. Other features and advantages of the assembly will be pointed out in detail below.

Accordingly, it is a primary object of the present invention to provide an improved cable suspension assembly useful in connecting high tension power conductors to transmission line insulators. Another object of the invention is the provision of an improved cable suspension assembly having a cable seating saddle together with a clamping jaw therefor featuring threaded fastener means for clamping the jaw to the cable and including simple, highly effective means for holding the fastener means loosely but captive assembled to the clamping jaw.

Another object of the invention is the provision of an improved, rugged bundling-type suspension clamp by which a plurality of conductors can be supported in spaced-parallel relation below an insulator.

Another object of the invention is the provision of a bundling cable suspension assembly having a main body pivotally supporting a plurality of clamping jaws for the separate components of a single leg of a power transmitting cable.

These and other more specific objects will appear upon reading the following specification and claims and upon considering in connection therewith the attached drawings to which they relate.

Referring now to the drawings in which a preferred embodiment of the invention is illustrated.

FIGURE 1 is a side elevational view of a preferred embodiment of a bundling clamp according to the present invention designed to support two power transmitting cables in vertically spaced relation below and from a suspending insulator.

FIGURE 2 is a transverse sectional view taken along the broken line 2—2 on FIGURE 2;

FIGURE 3 is a fragmentary transverse sectional view through the upper end of the assembly and taken along line 3—3 on FIGURE 2;

FIGURE 4 is a view taken generally along line 4—4 on FIGURE 1 but showing the upper clamping jaw in open position and the power cable removed; and

FIGURE 5 is a sectional view on an enlarged scale taken along line 5—5 on FIGURE 4 showing details of the restrictor for the clamping screws and effective to hold these screws captive assembled to the clamping jaw unless properly maneuvered for disassembly therefrom.

Referring more particularly to FIGURES 1 and 2, there is shown a preferred embodiment of a bundling clamp designated generally 10 and incorporating the invention features. The three principal parts of this assembly include an elongated main body 11 and a pair of identical hinging keeper jaws 12, 13 held assembled to the main body by separate hinge pins 14, 14.

Main body 11 comprises a unitary casting of high strength lightweight metal, such as aluminum alloy or the like, and is provided at its upper end with a clevis 16 held pivotally assembled to a high strength tang 17 depending from the lower end of a high tension, multiple component insulator train 20 of conventional construction. A clevis pin 21 extends through aligned openings of the clevis and tang and is secured in place as by a cotter pin 22. Integral with the lower end of main body 11 and in vertical alignment with insulator tang 17 is an eyelet loop 25 useful in supporting an anti-sway device for the power line, as, for example, a weight. As is well known, these weights tend to counteract the influence of
high winds acting from the side of the cable and tending to swing the conductors. Desirably, main body 11 of the suspension assembly is shaped for maximum strength using a minimum amount and weight of material. From a consideration of FIGURES 1, 2, and 4, it will be recognized that the main body portion is of H-shape in cross section, there being a pair of parallel side flanges 28, 28 connected together by a centrally disposed integral web 29. This vertical web lies substantially in a plane common to the longitudinal axes of both conductors 30, 30, side flanges 28, 28 lying normal to web 29 and to either side of a vertical mediant plane passing through the axis of clevis 16, as is best shown in FIGURE 1.

Referring now to FIGURES 3 and 4, it is pointed out that the main body 11 of the assembly includes substantially identical conductor seating or saddle members 31, 32. These saddle members comprise an elongated, horizontally disposed, semicircular support preferably contoured, and positioned and disposed to embrace one lateral side of the respective conductors 30, 30. The open faces of these saddle members lie substantially in a vertical plane closely adjacent the longitudinal axis of the assembly and open outwardly toward the respective clamping jaws 12, 13. The opposite lower ends of members 31, 32 preferably curve downwardly and outwardly away from one another, as indicated at 33, and have rounded and slightly thickened lips for greater strength. These rounded surfaces and lips avoid risk of injury to the cables while being serviced and as assembled within assembly 10. Referring to FIGURE 3, it is pointed out that one edge area of one lip is preferably provided with an opening 35 in axial alignment with hinge pin 14 and facilitating the assembly and disassembly of this pin for reasons readily apparent from a consideration of FIGURE 5.

The identical clamping or keeper jaws 12, 13 are contoured as shown in FIGURES 1, 2, and 4. In general, these comprise horizontally elongated members of semicylindrical shape and having an inner surface the radius of which corresponds to that of the inner surface of saddle members 31, 32 and with that of the conductor to be supported. The exterior or outer side of the jaws include arcuate but radially disposed reinforcing ribs 37 having their lower ends (FIGURE 1) spaced laterally to either side of flanges 28, 28 of the main body. The lower ends of these ribs constitute lugs forming part of the hinge connections between the jaws and the main body. Co-operating with these lugs for this purpose is a pair of shorter lugs 38 positioned against the interior side walls of flanges 28. These two pairs of lugs as well as the intervening portion of main body flanges 28 are provided with aligned openings 39 having a rotating fit with hinge pin 14 and preferably held in assembled position by a single cotter pin 40 extending through a transverse opening in the center of the pin (FIGURE 3).

As will be best shown by reference to FIGURE 4, opening movement of keeper jaws 12, 13 is limited by a stop 42 projecting from the outer side of the jaws and positioned to engage the adjacent edge of flange 28 as the opening movement of the jaw reaches the upwardly inclined position shown in FIGURE 4. While so rigidly supported, the semicircular interior of the jaw lies in a position to cradle and hold a conductor captive until the jaw is re-closed. As will be apparent, the upward pivotal movement of the jaw serves to cam the conductor upwardly and inwardly toward seating engagement with the surfaces of saddle members 31. Contrariwise, opening the jaw from closed clamping position allows a conductor present in the assembly to gravitate outwardly into the open jaw where it is more readily lifted away from the suspension assembly. Desirably, the arcuate movement of the jaws between their fully open and closed positions is somewhat less than 90 degrees. However, as will be appreciated, this path of movement may be increased or decreased to suit the needs of a particular application and the particular disposition of the open face of the saddle members.

The means for clamping the jaws snugly against movement lengthwise of the cable will now be described. For this purpose, each of jaws 12, 13 is provided with a pair of bosses 45 integral with its lateral edge and spaced closely to the outer sides of main body flanges 28, 28. Extending centrally through these bosses are noncircular and preferably elliptical bores 46 loosely receiving the shanks of threaded clamping fasteners for the jaws, such as cap screws 47. The threaded ends 48 of these screws are mateable with the threaded bores of bosses 45 integral with main body 11. The longer axis of the elliptically shaped passages 46 lies in a vertical plane whereas the minor axis extends generally horizontally. This minor diameter is sufficiently greater than the diameter of threaded end 48 as to permit free and unrestricted movement of the cap screws within passages 46.

Referring more particularly to FIGURE 5, it is pointed out that the inlet or outer end of passages 46 is provided with restrictor means such as inwardly projecting, radially shallow narrow lips 51, 51 having their adjacent inner edges spaced closer together than the crest diameter of the threaded end 48 of the screws. It is further noted that the spacing between the inner edges of lips 51 is slightly greater than the reduced diameter of the nonthreaded shank 52 of the screws. Accordingly, it will be recognized that these shanks are free to move freely axially of opening 46 past restrictor lips 51 until the lips engage the rearmost ends of threads 48. Provision for the assembly and disassembly of the screws past lips 51 is had by cutting a shallow thread in these surfaces thereby permitting the screws to be threaded past these restrictors. This is done most simply by using the screw itself to cut the requisite shallow threads on the restrictors. Once this is accomplished, the screw is free lengthwise of passages 46 without interference from restrictor lips 51.

Additionally, it is pointed out that the axial length of threads 48 is no greater than the unrestricted length of passages 46 and preferably slightly shorter. This assures that the screw threads will be fully disengaged from main body bosses 49 before the rear ends of threads 48 can possibly engage the shallow threads in restrictor lips 51. Also, it is desirable that the threads in lips 51 be formed near the upper ends of these lips or close to the upper half portion of passages 46. This is accomplished by the operator deliberately lifting the screw into the upper portion of these passages in order to engage threads 48 with the threads of the restrictor thereby providing further assurance against accidental displacement and loss of the screws from the clamping jaws.

It is also pointed out that the substantially continuous support and rigid clamping of the conductor about its entire circumference and particularly from its sides, as distinguished from its upper and lower sides as commonly done prior to this invention, has important advantages. For example, cross winds or other disturbances may cause lateral oscillation of the conductors between towers. If the sides of the conductors are not tightly clamped and supported at their sides, the wires in these sides are alternately slackened and tensioned and this leads to rupture and failure of these wires. Soon thereafter the conductor itself fails at the clamping assembly. Such failure is positively safeguarded against in the present clamping assembly because of the rigid supporting action along the sides as well as about the entire conductor for reasons made clear by FIGURE 2.

While the particular power cable suspension assembly herein shown and disclosed in detail is fully capable of attaining the objects and providing the advantages hereinbefore stated, it is to be understood that it is merely illustrative of the presently preferred embodiment of the invention and that no limitations are intended to the details of construction or design herein shown other than as defined in the appended claims.
I claim:
1. A suspension clamp assembly for use in releasably supporting heavy-duty power cables from a supporting structure, said clamp having a main body member provided with means at the upper and thereof for pivotally connecting the same to a supporting insulator, said main body including as an integrally cast portion thereof means formed with a horizontally elongated semicylindrical cavity shaped to seat snugly against one vertically disposed lateral side of a power cable, an elongated one-piece keeper jaw member having an elongated semicylindrical cavity facing said first mentioned cavity and contoured oppositely thereto and adapted to seat against the other vertically disposed lateral side of a power cable, means pivotally connecting said keeper jaw to said main body on a horizontal axis beneath and parallel to the axis of a power cable clamped in said elongated cavities, stop means between said main body and keeper jaw members limiting the opening movement of said jaw away from said main body to an arc such that when open said jaw is effective to receive and support the cable in a captive position therein temporarily and whereby the upward pivotal movement of said jaw toward said main body is effective to elevate and transfer the cable partially into the first mentioned elongated cavity, threaded fastener means together with means for holding the same captive assembled to one of suspension clamp members while said jaw is released for pivoting, said fastener means being threadedly engageable with the other of said suspension clamp members to force said jaw member to pivot toward said main body member to grip a power cable between the opposite vertical sides thereof, and said main body including as an integral part thereof eyelet means underlying said cable seating and clamping cavities and adapted to seat anti-sway and swing-stabilizing means therein.

2. A bundling type high-tension cable suspension assembly adapted to be suspended from the lower end of an insulator, said assembly comprising an elongated main body having means at its upper end for pivotally connecting the same to the lower end of an insulator and eyelet means at its opposite lower end for the attachment of anti-sway stabilizer means, said main body including a plurality of elongated semicylindrical cable seating saddles extending transversely thereof and in spaced-apart parallel relation between the opposite ends of the main body with unrestricted open sides lying in a generally vertical plane along the longitudinal center of said suspension assembly, a semicylindrical keeper jaw for each of said seating saddles having hinge means connecting the same individually to said main body along the lower side of the associated one of said seating saddles, said jaws supplementing said saddles in supporting and clamping separate cables therewith, and cooperating threaded fastener means including means for holding the fastener means captive assembled to said suspension assembly and independently operable to tighten each of said keeper jaws toward said main body to clamp separate cables to said assembly with the clamping action taking place in a generally horizontal plane and crosswise of the cables.

3. A bundling type high-tension cable suspension assembly adapted to be suspended from the lower end of an insulator, said assembly comprising an elongated main body adapted to hang vertically and having a plurality of tubular cable seating members extending transversely thereof within space vertically below the associated cable seat, means limiting opening movement of said keeper jaws to an arc such that the open jaw is rigidly supported laterally of said main body and in position to receive and retain a cable cable being serviceable, said jaw being adapted for clamping tightly between said seating members, and a plurality of threaded fastener screws carried loosely but captive in openings through the upper edges of said jaws and receivable in threaded bores of said main body to clamp a cable firmly between said main body and said jaws as said screws are tightened, the inner ends of the threads of said screws being engageable with the openings in said jaws and cooperating therewith to prevent unintended disassembly of said screws from said jaws when the latter are in open position.

4. A cable suspension clamp assembly for use on a high tension power line in suspending power cable means from the lower end of an insulator, said assembly comprising two principal cast metal components including a main body and a keeper jaw pivoted thereto on a transverse axis positioned generally horizontally when the assembly is in use, said main body having an upwardly opening integral clevis at its upper end for attaching said assembly pivotally to an insulator, said keeper jaw having stop means cooperating with stop means on said main body to limit opening of said jaw away from the main body to provide an upwardly inclined gap between the upper lateral edge of said jaw and said main body to freely pass a cable and effective to hold the cable captive while resting by gravity action in the open keeper jaw and supported directly by said jaw, the portion of said main body facing said keeper jaw having cable seating means projecting laterally from either side thereof and shaped to seat against one vertical side of a cable and on the opposite side thereof from said keeper jaw, a plurality of fastener screws mounted loosely in openings extending through the upper lateral edge of said keeper jaw and having threaded engagement with said main body in the closed position of said jaw for clamping said jaw and said main body rigidly against the opposite sides of power cable means seated therebetween, and means integral with said keeper jaw adjacent the head end of said fastener screws engageable with the threads on cap screws only when the cap screws are disengaged from said main body to prevent accidental and unintended detachment of said screws from said keeper jaw.

5. A suspension clamp assembly as defined in claim 4 characterized in that the openings in said keeper jaw for said fastener screws are noncircular in cross section with their longer dimension lying generally vertically and with the shorter dimension lying generally horizontally and permitting limited loose play with respect to the non-threaded shank portion of said screws, and the outer ends of said noncircular openings adjacent the heads of said screws having an axially-narrow radial inwardly-projecting rib having a shallow thread mateable with the screw thread and cooperating therewith to permit detachment of the screw from said noncircular opening only by rotation of said screw along said shallow thread thereby to hold said screws captive assembled to said keeper jaw until deliberately maneuvered as required to effect their detachment therefrom.

6. A power line cable suspension assembly adapted to be suspended at its top to the bottom of an insulator, said assembly comprising an elongated cast metal main body of generally H-shape in cross section and with the web portion thereof extending vertically between its two side flanges and parallel to the longitudinal axis of a cable when supported by said assembly, said main body having cable saddle means integral therewith of semicylindrical contour arranged horizontally transversely of said main body and having its unrestricted vertically-disposed open face lying generally in alignment with said web and opening laterally away from one face thereof, elongated keeper jaw means having a plurality of legs projecting downwardly from the lower lateral edge thereof and positioned to lie closely beside the faces of said main body side flanges, said legs and said flanges having aligned horizontal openings therethrough seating a hinge pin effective to hold said jaw means pivotally assembled to said main body, the upper lateral edge of said jaw means having openings therethrough of generally elliptical shape in cross section.
registrable with threaded bores formed in said main body, a fastener screw seated loosely in each of said openings and cooperative with said threaded bores to clamp said jaw means to said main body with a power cable rigidly clamped between said saddle means and said jaw means, the smaller transverse dimension of said openings being slightly less than the diameter of the threads of said threaded fastener and slightly greater than the unthreaded shank of the fastener.

7. A cable suspension assembly as defined in claim 6 characterized in the provision of restrictor means at the outer end of said elliptically shaped openings in said jaw means having a loose sliding fit with the unthreaded shank ends of said fastener screws, the crest diameter of the threaded end of said screws being sufficiently greater than the width of the passage past said restrictor means as to hold said screws captive, and said restrictor means having threads mating with the threads of said screws when maneuvered into registration therewith to permit disassembly of said screws from said jaw means.

8. A cable suspension assembly as defined in claim 7 characterized in that the axial length of the threaded portion of said fastener screws is less than the axial length of said openings through the edge of said jaw means whereby the inner or shank end of said threads is mateable with the threads in said restricted means only after said fastener screws have been disengaged from said main body.

9. A cable suspension assembly as defined in claim 7 characterized in that said saddle means has its opposite lower portions curved downwardly away from one another to provide arcuate support lips overlying the opposite ends of said hinge pin, and an assembly opening extending through at least one of said arcuate support lips in alignment with said hinge pin and through which said hinge pin may be assembled and disassembled.

10. A cable suspension assembly as defined in claim 7 characterized in the provision of a single keeper extending through a transverse opening of said hinge pin intermediate the ends thereof and between two of said lugs and cooperating therewith to hold said hinge pin in assembled position.

11. In a cable suspension assembly for use in holding a power cable coupled to a supporting insulator and of the type having a cable held clamped in a supporting saddle by a relatively movable clamping jaw, that improvement in said suspension assembly which comprises threaded fastener means for releasable holding said jaw clamped against a cable seated in said supporting saddle, said clamping jaw having a passage therethrough normally supporting the nuthreaded shank end of a fastener screw loosely mounted therein with ample clearance to permit limited swinging movement of the clamping jaw relative to said supporting saddle during tightening of the clamping jaw against a cable, the end of said opening adjacent the head end of said fastener screw being relatively narrow in one dimension and closely spaced to the opposite nuthreaded sides of said shank, said shank being of smaller diameter than the maximum diameter of the threaded end of said cap screw, the narrow end of said fastener mounting passage having a thread mateable with the threads of said fastener screw to permit assembly and disassembly of said fastener screw relative to said fastener mounting passage when brought into proper alignment therewith and otherwise being effective to prevent disassembly of said fastener screw therefrom.

12. A power line cable suspension assembly for use in holding a power cable releasably supported from an insulator and rigidly clamped substantially throughout the entire circumference of the cable in the assembled condition thereof, said assembly having a vertically elongated main body casting having clevis means at its upper end for suspending the same from the lower end of an insulator, the lower portion of said main body having a semi-cylindrical cable seat opening through one vertically disposed face of said main body and including flaring extensions projecting laterally and horizontally from either side of said main body and parallel to the axis of said cable seat with the open face of said seat disposed vertically, a clamping jaw having a semi-cylindrical cable seat with flaring opposite ends, said clamping jaw having hinge means along its lower edge pivotally connecting said jaw to said main body for limited pivotal movement about a horizontal axis below and parallel to the axis of said cable seat in the closed position of the jaw, threaded fastener means releasably holding said jaw closed, the cable seats in said jaw and in said main body cooperating to grip the exterior of a cable seated therein substantially throughout its entire circumference and length of said seats whereby all conductors forming the cable are placed under transverse clamping pressure and held against flexure during sway and undulations occurring in portions of the cable to either side of the clamping assembly.

13. A cable suspension assembly as defined in claim 12 characterized in the provision of means permitting said jaw to open away from said main body when said fastener is loosened sufficiently to provide an access opening substantially greater than the diameter of a cable to be supported thereby and including means to limit opening movement to enable the open jaw to support and retain the cable captive in the cable seat thereof.

14. A cable suspension assembly as defined in claim 13 characterized in that one pair of contiguous lateral edges of the cable seats in said main body and in said jaw are contoured to merge smoothly with one another in both the closed and all open positions of said jaw, and in that said jaw is effective to elevate and transfer the cable into seating engagement in said main body seat as an incident to closing the jaw toward the clamping position thereof and without risk of injury to the cable.

15. A cable suspension assembly as defined in claim 12 characterized in that said main body is provided with a plurality of substantially identical cable seats and a separate and independently operable clamping jaw for each arranged in vertically spaced apart relationship along said main body.

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