March 1, 1932. A. O. AUSTIN 1,847,461

CONDUCTOR SUPPORT

Filed Jan. 31, 1929

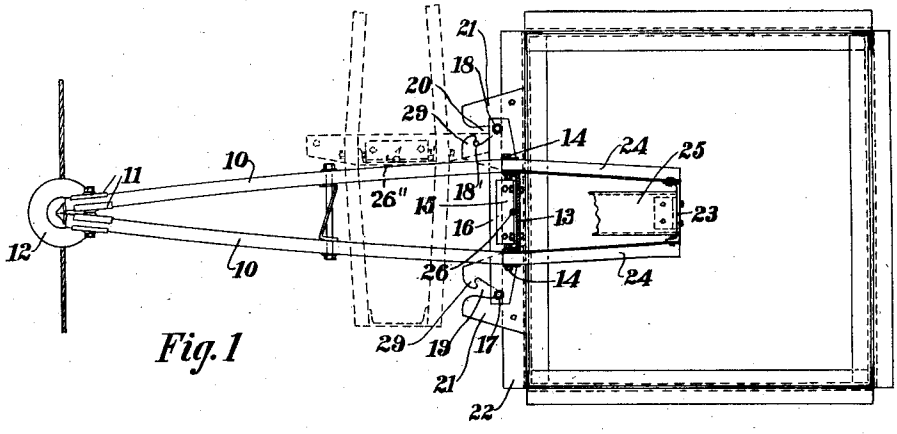


Fig. 1

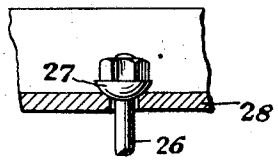


Fig. 5.

Fig. 2

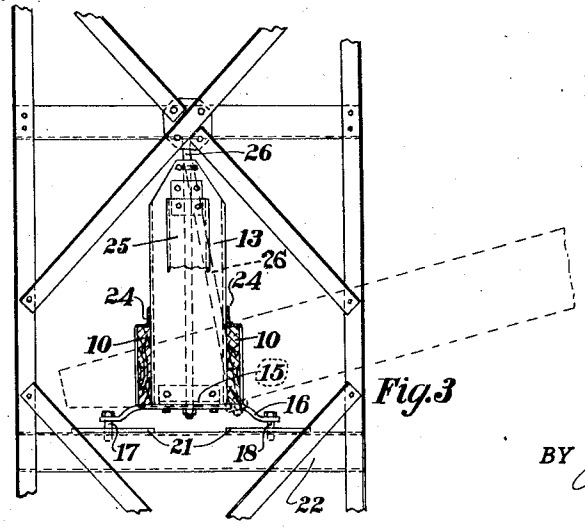


Fig. 3

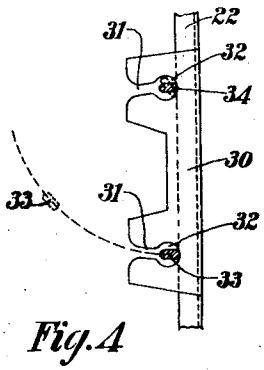


Fig. 4

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UNITED STATES PATENT OFFICE

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CONDUCTOR SUPPORT

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This invention relates to supports for electrical conductors and has for one of its objects the provision of a conductor support which will withstand unbalanced stress in the conductor without injury to the support. A further object is to provide a cross arm which will withstand small unbalanced longitudinal stresses in the conductor without displacement but which will yield to larger unbalanced stresses. A further object is to provide a cross arm mounting suitable for a wood cross arm and which will permit maximum utilization of the insulating properties of the wood. A further object is to provide a cross arm mounted to swing upon its support but having means for providing a limited degree of stability for withstanding small unbalanced stresses without moving upon its pivotal support. A further object is to provide a cross arm support having spaced pivots which may be selectively disconnected but which cannot both be disconnected simultaneously. Other objects and advantages will appear from the following description:

The invention is exemplified in the combination and arrangement of parts shown in the accompanying drawings and described in the following specification, and it is more particularly pointed out in the appended claims.

In the drawings:

Figure 1 is a plan view showing a conductor support embodying one form of the present invention.

Figure 2 is an elevation with parts in section showing the support of Figure 1.

Figure 3 is an elevation looking from the right in Figure 1 with parts in section.

Figure 4 is a fragmentary plan section showing a modified construction.

Figure 5 is a fragmentary section on line 5—5 of Fig. 2.

In electrical transmission lines, it is advisable to use high voltage for the sake of economy. This requires considerable insulation. Where the line traverses districts subject to lightning, the transmission line may also be subject to very high potentials produced by the lightning so that the transmission conductors have to be insulated not only for the voltage used in the transmission of power, but for the abnormal voltage caused by lightning as well. In addition to these disturbances, lines are subject to switching surges. Another source of trouble on transmission lines is due to birds.

Where the excessive voltages tending to cause flashover occur at a high frequency or with a steep wave front, or where the duration of the stress is exceedingly short, material which will ordinarily not insulate the line may be quite effective. By using insulators such as porcelain to carry the normal voltage, it is possible to support these insulators from wood cross arms so that for abnormal surges or transients the flashover voltage will be greatly increased. In many cases the flashover voltage of the insulator may be more than doubled by mounting it on a wood cross arm.

Where the mechanical loads are light, wood has been effectively used to afford high flashover voltage so as to prevent arcs to ground. Where the mechanical loads are heavy, however, the problem of supplying sufficient mechanical strength in the wood is more difficult, particularly where clearance is an important factor. In my present invention it is possible to take advantage of the great increase in flashover voltage due to the use of wood and at the same time eliminate to a very large degree the mechanical limitations of the wood itself. It is also possible to increase the insulation furnished by the wood members without increasing the mechanical loads upon the towers or main supporting structure to which the cross arms are attached.

A cross arm having wood members 10 is provided with end fittings 11 to which an insulator string 12 is attached. The cross arms are attached to a vertical channel 13 by suitable bolts 14. The vertical member 13 is provided with a bottom flange 15 having a horizontal plate 16 secured thereto upon which the wood members 10 rest. The member 16 is provided with pins 17 and 18 which fit into slots 19 and 20 respectively in plates 21 secured to one of the tower members 22.

The wood members 10 are extended back into the basket of the tower and secured together by a spacer member 23. The member 23 is attached to angle bars 24, which are connected to the main channel member 13, and to brace 25 the upper end of which is secured to channel member 13.

The object of the several members 23, 24 and 25 together with the member 13 is to form a rigid structure which will support the mechanical load imposed upon the arm by the insulator string 12. The channel member 13 is secured to and supported by a pin 26 which takes the vertical load produced by the arm and furnishes an axis or rotation. With this arrangement it is possible to utilize practically the entire length of the arm projecting beyond the face of the tower for insulation as the main bracing is placed inside the tower, although it is evident that this bracing could be applied outside of the face of the tower equally as well from a mechanical standpoint which would permit the use of a shorter arm, but would cut down the insulation for a given extension of the arm beyond the face of the tower. The pin 26 is supported at its upper end by a rounded head 27, the pin being passed through a perforation in a flange 28 secured to the tower and the head being arranged to permit rotation of the pin and also limited transverse swinging in all directions as will be more apparent from Fig. 5.

With the arrangement shown in Fig. 1, the small unbalanced longitudinal loads in the conductor will produce no movement of the cross arm but it is necessary that the unbalanced longitudinal stress be sufficient to relieve the horizontal component on one of the pins 17 and 18 before rotation of the cross arm on its pivotal support can start. The downward component produced by the weight of the insulator and conductor as well as the arm tends to produce a horizontal component acting inwardly toward the face of the tower. Since the pins 17 and 18 are spaced well apart, they are capable of setting up a considerable moment which will tend to resist rotation of the arm. When, however, the unbalanced longitudinal pull of this conductor becomes sufficient to overcome the inward component on one of the pins 17 or 18, the cross arm will tend to rotate toward the position shown in broken lines in Figs. 1 and 3. Such rotation takes place about an axis extending from the upper end of pin 26 to pin 17 or 18 depending on the direction of rotation. Since the line joining the upper end of the pin 26 with the pin 18 is inclined, as will be apparent from Fig. 3, the arm 10 will swing about an inclined axis which will tip the outer end of the arm upwardly as it swings. The lower end of the supporting pin 26 is spaced from the lower end 18 of the inclined axis of rotation so that the lower end of the pin 26 will swing outwardly and laterally toward the position 26″, Fig. 1, and the pin 26 will swing toward the position 26′, Fig. 3. The upper end of the pin 26, as explained above, is supported in the flange 28 in a manner to permit the transverse swinging movement imparted to the pin 26.

If a very heavy unbalanced load exists, the arm may be rotated entirely into the position shown in broken lines. Before reaching this position however, the thrust on the pin 18 becomes parallel with the face of the tower. The slot in the lower plate permits the pin to move into the position 18′ where it will be arrested by a stop 29. The weight of the arm and conductor will tend to hold the pin tightly in this position and owing to the shape of the stop 29, it will not be possible for the pin to jump out and thereby lose the benefit of the lower bearing. This is quite important for if the cross arm swings against the face of the tower, the momentum might readily force the pin out of the slot. If the unbalanced longitudinal stress is relieved, the arm will tend to assume its normal position, as the relation of the bearings is such that the outer end of the arm is raised materially in being thrown out of normal position. By properly spacing the bracing members in the tower with respect to the location of the cross arm, it is possible to utilize practically the entire portion extending from the face of the tower for insulating purposes and, at the same time, use a portion extending into the tower for gripping the wood members. Where the portion inside the tower has the proper relation in regard to the opening in the face of the tower, it is possible to permit this portion to swing out through the opening without coming in contact with any of the tower members. It will be seen that with this type of construction it is possible to use long arms and, at the same time, limit the torsional stress imposed upon the tower. As the arm swings, the tension in the conductor is greatly reduced and the tower relieved of the stress which may save it from destruction owing to the breaking of the conductor or to heavy sleet loads. The construction has the further advantage that the arm does not oscillate with any slight change in load, making it difficult to work upon the arm. The construction is such that it may be applied to many existing structures to improve the effective insulation, particularly from lightning or to eliminate bird trouble.

The general construction is equally suitable for steel arms as well as wood arms. There are a number of ways of producing the equivalent results embodying the above principles. The invention makes it possible to take advantage of the rigid arm and the swinging arm and also permits utilizing the insulation

to a maximum for a given clearance between the conductor and tower body.

In the modification shown in Figure 4, the plate 30 is used in place of the plate 21 and is provided with slots 31 having enlarged circular openings 32 at the inner ends thereof. Each slot 31 is arranged in an arc struck about the center of the opposite enlarged opening 32. The pins 17 and 18 are replaced by pins 33 and 34 which are elongated in cross section so that each pin will move outwardly through its slot 31 when the cross arm is rotated about the opposite pin but so that each pin when rotated upon its own axis will be moved crosswise of the slot as shown in broken lines in the figure. It will be apparent therefore that when the cross arm is swung about one pin as an axis, that pin will be locked in its opening 32 but the other pin will be swung out of its slot to permit the cross arm to swing into the direction of the pull on the line.

I claim:

1. In combination a supporting structure, a cross arm mounted on said structure, a transmission line carried by said cross arm, said cross arm being pivoted to move in the direction of the transmission line under unbalanced load and having horizontally spaced pivotal points about one of which said cross arm swings when moved in the direction of the transmission line.

2. A conductor support comprising a supporting structure cross arm mounted on said structure and two sets of pivotal connections between said cross arm and said supporting structure, said pivotal connections providing different axes of rotation for said cross arm, said cross arm being arranged to swing in opposite directions about said different axes in rotation respectively.

3. A conductor support comprising a supporting structure, a cross arm mounted on said structure and arranged to swing in opposite directions from an initial position about different axes of rotation, said axes of rotation being inclined to the vertical to cause the supporting end of the cross arm to rise when rotated in either direction.

4. In combination a supporting structure, a cross arm mounted on said structure and having a conductor carried at the outer end thereof, said cross arm having three points of pivotal connection with said structure, two of said pivotal connections being spaced from each other in a direction transverse to their pivotal axes.

5. In combination a supporting structure, a cross arm mounted on said structure, a pair of pivotal connections between said cross arm and the structure, about which said cross arm is arranged to swing selectively, depending upon the direction of movement of said cross arm, each connection being arranged to separate when said cross arm swings about the other connection.

6. In combination a supporting structure, a cross arm mounted on said structure, a pivotal connection between said cross arm and structure and two supplementary, separable, pivotal connections between said cross arm and structure, said supplementary connections being spaced from each other in a direction transverse to the axis of said first named pivotal connection, each of said supplementary pivotal connections being arranged to become detached when said cross arm is swung upon said supporting structure about the other supplementary pivotal connection.

7. In combination a supporting structure, a cross arm mounted on said structure, a pivotal connection between said cross arm and structure, two supplementary pivotal connections between said cross arm and structure, said supplementary pivotal connections being spaced at opposite sides of the axes of rotation of said first named pivotal connection, each of said supplementary pivotal connections being arranged to separate when said cross arm swings about the other supplementary pivotal connection and means for preventing separation of each of said supplementary pivotal connections when acting as the pivot about which said cross arm swings.

8. In combination a supporting structure, a cross arm mounted on said structure, a pivotal support for said cross arm, a pair of spaced pin and slot connections between said cross arm and structure, each slot being arranged to permit its pin to escape therefrom when said cross arm is swung about the other pin as a pivot and means for preventing escape of each pin from its slot when the cross arm is swung about that pin as a pivot.

9. In combination a supporting tower, a cross arm pivotally mounted on said tower at one side thereof, said cross arm projecting into the interior of said tower beyond said pivotal support, and bracing means for said cross arm connected with the inwardly projecting portion thereof, and disposed within the contour of said tower for normal position of said cross arm, said inwardly projecting portion and bracing means being arranged to swing through the side of said tower when said cross arm is swung upon its pivotal support.

10. In combination a supporting structure, a cross arm carried by said structure and having horizontally spaced pivotal connections therewith, each of said connections being separable to permit horizontal pivotal movement of said cross arm about the other connection, and means for preventing separation of one of said connections when said cross arm is swung about that connection away from normal position.

11. In combination a supporting structure, a bearing means mounted on said structure

and having horizontally spaced pivot slots, a cross arm, spaced pivot pins mounted on said cross arm and engaging said slots, each of said pins being movable outwardly through its slot when said cross arm is swung about the other pin, and means for preventing escape of a pin from its slot when said cross arm is moved about that pin away from its normal position.

12. In combination, a supporting tower, a cross arm extending away from said tower, a conductor carried by said cross arm, a pivotal connection between said cross arm and tower disposed substantially in the central vertical plane of said cross arm, braces extending laterally from said cross arm and having pivotal connections with said tower at opposite sides of the central vertical plane of said cross arm, each of said pivotal connections being arranged to permit outward movement of the brace connected therewith when said cross arm is rotated toward the side thereof adjacent the other pivotal connection.

13. In combination a skeleton tower, a wood cross arm projecting away from said tower and having the inner end thereof extending into the interior of said tower, metal bracing for said cross arm connected with the portion thereof extending into the interior of said tower, a pivotal support for said cross arm disposed substantially in the central vertical plane of said cross arm, and means fixed to said cross arm at opposite sides of the central vertical plane thereof having pivotal contact with said tower and held in engagement with said tower and forming pivotal connection between said cross arm and said tower by the weight of said cross arm for stabilizing said cross arm in its normal central position but arranged to permit pivotal movement of said cross arm when subjected to a transverse unbalanced load of predetermined minimum magnitude.

14. In combination a supporting tower, a cross arm having a portion extending into the interior of said tower and having bracing disposed within the tower, a transmission line carried by said cross arm and spaced from said tower, said cross arm having pivotal connection with said tower in a position to permit said bracing and inwardly extending portion of said cross arm to swing outwardly from said tower when said arm is rotated on its pivotal connection to permit said cross arm to assume the direction of a pull on said line.

15. In combination a supporting tower, a wood cross arm movably supported on said tower, said cross arm having a portion thereof extending into the interior of said tower, and metallic bracing for said cross arm, said bracing holding said cross arm against vertical movement and being disposed within the interior of said tower to permit maximum utilization of the insulating properties of the portion of the cross arm projecting beyond the tower.

16. In combination a supporting tower, a cross arm movably mounted on said tower, horizontally spaced pivots for said cross arm, said cross arm being arranged to swing about one of said pivots when moved in one direction from its normal position and to swing about the other of said pivots when moved in the opposite direction from its normal position, and means arranged to be brought into operation by the movement of said cross arm for locking against transverse displacement, the pivot about which said cross arm is swung.

17. In combination a supporting tower, a cross arm movably mounted on said tower, horizontally spaced pivots for said cross arm, said cross arm being arranged to swing about one of said pivots when moved in one direction from its normal position and to swing about the other of said pivots when moved in the opposite direction from its normal position, and means automatically operated by the pivotal movement of said cross arm for locking against transverse displacement, the pivot about which said cross arm is swung.

18. In combination a supporting tower, a cross arm movably mounted on said tower, horizontally spaced pivots for said cross arm, said cross arm being arranged to swing about one of said pivots when moved in one direction from its normal position and to swing about the other of said pivots when moved in the opposite direction from its normal position, and means operated by a movement of said cross arm, additional to its pivotal movement, for locking against transverse displacement, the pivot pin about which said cross arm is swung.

In testimony whereof I have signed my name to this specification this 29th day of January A. D. 1929.

ARTHUR O. AUSTIN.