

July 21, 1931.

C. L. STROUP

1,815,598

INSULATING MEMBER FOR HIGH TENSION CONSTRUCTION

Filed April 19, 1929

2 Sheets-Sheet 1

Fig. 8.

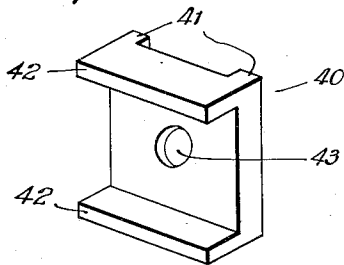


Fig. 1.

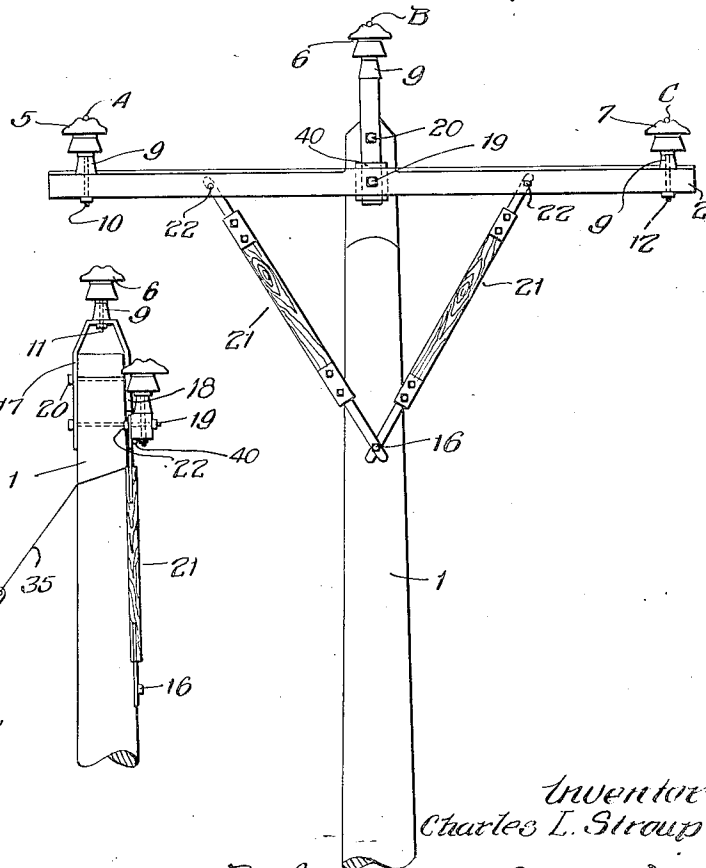
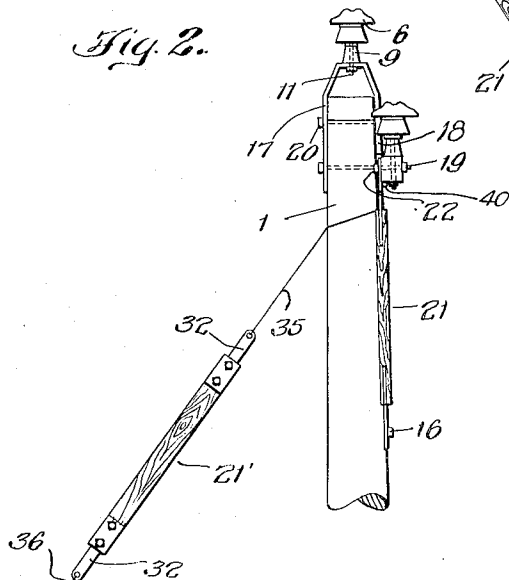


Fig. 2.



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2 Sheets-Sheet 2

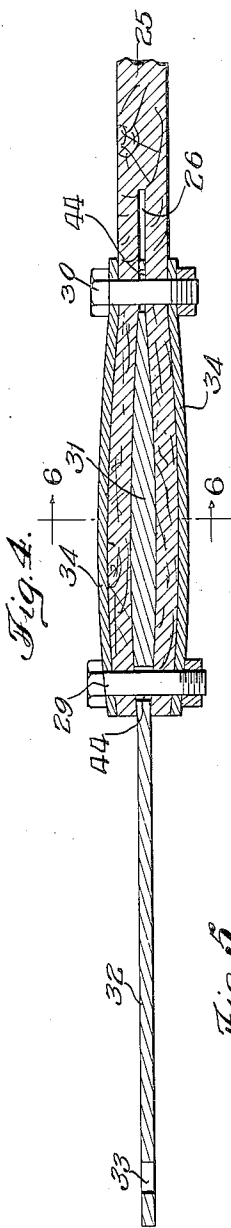
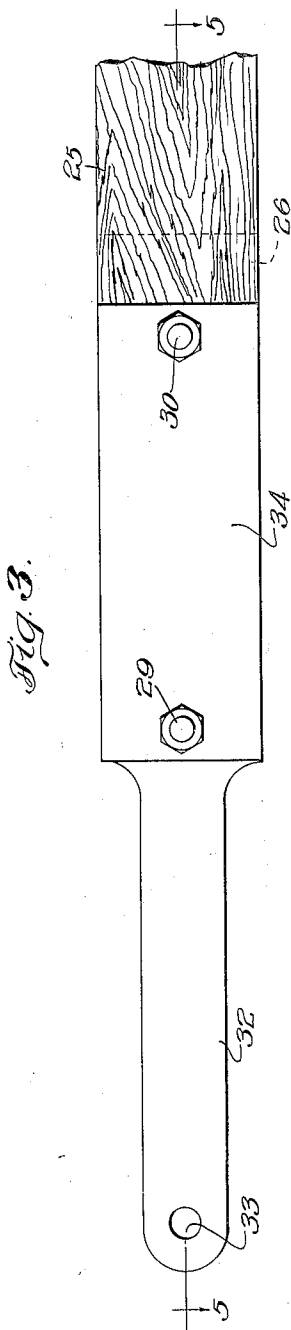


Fig. 5.

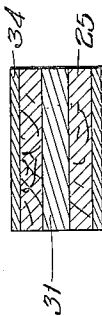


Fig. 6.

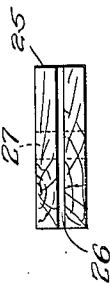
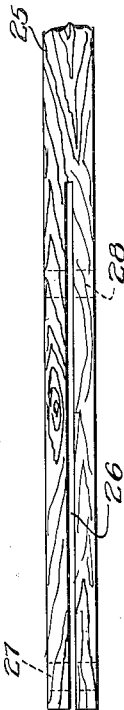


Fig. 7.



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INSULATING MEMBER FOR HIGH TENSION CONSTRUCTION

Application filed April 19, 1929. Serial No. 356,492.

My invention relates to transmission lines and more particularly to pole and cross arm construction for mounting high tension power transmission conductors.

5 In the types of construction involving wooden poles and wooden cross arms, it is customary to mount the insulators upon metal pins and to brace the cross arms by metal braces connected between the cross
10 arm and the pole.

Upon the occurrence of transient high voltages or impulse voltages, it is not unusual to have the insulators flash over from the high tension conductor to the metal pins and
15 because of the proximity of the metal pins to the braces, the insulating value of the wooden cross arms is largely lost and damage to the line may result.

If the metal brace is attached adjacent to
20 insulators supporting separate phase wires or phase and ground wires respectively, the insulating qualities of the wooden cross arms between them is practically of no value, and an undesirable condition is created.

25 According to the present invention, I provide a novel form of brace which, when used in conjunction with the wooden pole and wooden cross arm, avoids the short-circuiting effect of the known construction. This
30 brace is made mainly of a relatively long shaft of wood with metal fittings on the ends to adapt it for attachment to the pole and cross arm or to any other supporting member and, at the same time, to provide sufficient
35 strength and rigidity to sustain the arm and itself in position. Also, the relatively great length of the wooden shaft prevents the discharge of transient or impulse voltages along the same.

40 The form of pole top construction which I employ with the brace of my invention permits of maximum spacing of the phase conductors without affecting the insulating
45 effect of the wooden cross arms. Where wooden cross arms and wooden poles are employed, they are supposed to have a certain definite insulating value, which is not secured by steel construction, but in steel construction,
50 the steel is grounded and hence the relation of

the several phase conductors to each other and to ground is very definitely regulated.

The insulating brace is preferably employed in tension and it affords a very high strength in that manner. It may be used
55 in compression, but because of the length of the shaft, it acts as a slender column and hence is less stable. It is so strong in tension that it may be used satisfactorily as a strain insulator and, when so used, affords
60 a high degree of protection against the passage of transient or impulse voltages.

It has a greater impulse voltage flash over than other insulators of equal cost.

I am aware that strain insulators of wood
65 with metal end pieces or fittings broadly are known, but so far as I am aware, no means for thereby bracing a cross arm with respect to a wooden pole or the like has previously been
70 provided. The brace of my invention presents a novel means for fastening a flat plate or bar to a wooden shaft of oblong section. By means of this method of attachment, I am
75 able to employ wood pieces which are rectangular or oblong in cross section, hence gaining the maximum strength from standard commercially available stock.

The preferred method of making the connection to the wooden shaft is to saw or otherwise split the end of the wooden bar to provide
80 a kerf or slot parallel to the faces of larger area of the shaft. The kerf or slot is then widened by spreading the ends and a double faced wedge member is inserted between the
85 two end parts of the wooden shaft. By means of a pair of clamping plates which bear against the outer faces of the two legs on opposite sides of the wedge member, the slit
90 parts of the ends are clamped upon the sides of the wedge member. The wedge member is thereby gripped between the ends of the wooden piece. The two legs produced by the slot are held in compression against the side
95 of the wedge by means of bolts in tension only. Endwise stress on the wedge member is translated into pressure upon the legs and this in turn results in increased tension in the bolts. The bolts have sufficient clearance with respect to the wedge member that for all stresses within the capacity of the device they are not
100

put into shear. Hence there is no splitting action on the wood. The wood sustains only compression on its sides and tension endwise. The end of the wedge may have a lug or ear of suitable shape for attachment to any desired supporting structure.

To distribute the compression over the side area of the legs, suitable metal plates may be employed. The bolts apply the necessary force to the plates which distribute it to the wood legs. While the bolts pass through or intersect the wedge member the holes through which they pass have sufficient clearance to prevent engagement and hence no shear is placed on the bolts or the wood through which they pass.

Where the brace is to be used for bracing a cross arm with respect to a wooden pole, the wedge member is preferably continued as a flat bar or plate with a suitable bolt hole therein, the plate or bar being of sufficient length to adapt the same to reach to the center of the wooden cross arm or the wooden pole in the diagonal position in which the brace is adapted to lie.

Now, in order to acquaint those skilled in the art with the manner of constructing and operating a device embodying my invention, I shall describe in connection with the accompanying drawings a specific embodiment of the same.

Fig. 1 is a similar side view of a construction embodying my invention;

Fig. 2 is an end view of the same, showing also a guy wire containing a strain insulator of my invention;

Fig. 3 is a side view of the brace of my invention;

Fig. 4 is a longitudinal section taken on the line 4—4 of Fig. 3;

Fig. 5 is a cross section taken on the line 5—5 of Fig. 4;

Fig. 6 is an end view of the wooden shaft slotted and drilled to receive the wedge;

Fig. 7 is an edge view of the same; and

Fig. 8 is an isometric view of the saddle piece employed in Fig. 1.

Referring to the drawings, it is known to employ a wooden pole 1 with a wooden cross arm 2 fastened to the upper end of the pole, as by means of a notch or kerf in which the central part of the cross arm rests and is supported by a through bolt and washer, the bolt extending through the cross arm and pole.

Insulators such as 5, 6 and 7 carrying the three phase conductors A, B and C are mounted upon metal pins upon the cross arm, these pins being held by bolts such as 10, and 12 in place upon the cross arm. The bolts extend down through the cross arm and are provided with nuts at their lower ends on the bottom of the cross arm. In the usual construction a metal brace member is secured at its outer end to the bottom of the

cross arm and at its inner end is secured to the side of the pole as by means of a lag screw at 16. The outer end is bolted to the cross arm by a vertically disposed bolt extending through the cross arm. In like manner, a second brace is connected between the lag screw or bolt and the other side of the cross arm. The two arms of the brace may be made of a single piece if desired.

Due to the fact that the metal brace is disposed adjacent the bolts, such as those for the insulators, any impulse voltage which tends to flash over the insulator is substantially in conductive relation to the braces in view of the short gap which lies between these parts.

If a grounding wire is mounted on a pin on the cross arm, as is frequently done, or if a phase wire is carried in that position, it can be seen at once that if the bolt lies very close to the brace arm and in case of a flash over of the insulator due to impulse voltage, there is substantially a direct electrical connection to the metal pin 9 of the insulator for the ground wire.

Where a phase wire is carried in the usual position of the grounding wire, as may sometimes occur, the braces serve to conduct impulse current from one phase wire through the brace to the other phase wire and this is likely to result in an interphase fault which may lead to serious consequences. At all events, the value of the wooden cross arm as an insulating medium which is definitely counted upon in constructions of this type is largely obviated by the use of the metal brace. To increase the length of the brace arms will not altogether avoid the difficulties, but increases the expense of the construction. If the brace of my invention were applied to this customary construction instead of metal braces the construction would be satisfactory.

As shown in Figures 1 and 2, the form of construction which my invention provides includes the pole 1 and the cross arm 2 with insulators 5, 6 and 7 for carrying the phase conductors A, B and C. These insulators have the metal pins 9, 9 and 9 by which they are mounted and suitable bolts 10, 11 and 12 for supporting them. The two outer insulators 5 and 7 are supported upon the ends of the cross arm 2, whereas the center insulator 6 is supported upon a saddle or bracket member 17 which is a U-shaped piece of bar iron placed in inverted form over the top of the pole 1. A flat platform is provided by the upper part of the bight of said bracket and the insulator 6 has its pin 9 mounted by means of the bolt 11 upon said metal platform.

The cross arm 2 is not morticed or kerfed into the side of the pole, but is bolted against the outside surface of the leg 18 of the bracket 17 by means of a through bolt 19. A saddle piece 40 having flanges 41—41 for embracing

ing the side of the bracket 17 and flanges 42—42 for embracing the cross arm 2 is interposed between these members. This saddle piece may be cast or stamped. It has the hole 43 for the bolt 19.

Another through bolt 20 extends through the upper end of the pole and thereby holds the bracket 17 firmly in vertical position upon the top of the pole.

The cross arm 2 is braced with respect to the body of the pole 1 by means of the braces 21, 21, which are constructed as two separate pieces of like construction, secured at their upper ends by bolts 22, 22 passing through the ends of the braces and extending horizontally through the cross arm 2. At their lower ends, the braces 21, 21 are connected to the body of the pole 1 as by bolt or lag screws 16. These braces 21, 21 extend downwardly at relatively acute angle and because of their length provide a relatively great flash over distance between their metal ends against impulse voltages.

The construction of these braces 21, 21 is shown in detail in Figures 4 to 7. In practice, I prefer to make the brace approximately three feet, eight inches long when used on a ten foot cross arm. The bolts 22 are spaced out approximately two feet and one inch from the center line of the pole and a clear length of the wood shaft between the metallic end parts is approximately two feet.

In the manufacture of the brace, I employ a stick of hickory wood or wood of equal grade, in cross section approximately one inch by two and one-half inches and of a length approximately three feet one and a half inches. The ends are then slit or slotted by saw kerfs, as indicated at 26 in Figures 5, 7 and 8, these kerfs extending towards the center from each end about nine and one-half inches. The ends of the stick 25 are also drilled or bored, as indicated at 27 and 28, later to receive the bolts 29 and 30.

I provide a flat double tapered wedge piece 31 which is provided with holes or slots 44—44 spaced on the same centers as the holes 27—28. The holes or slots 44—44 provide sufficient clearance endwise to permit the full stress on the wood to be applied to the wedge member without putting the bolts in shear. Hence there is no shearing stress on the wood which would tend to split the same. The outer end of the wedge piece is formed as a flat lug or plate 32 having an eye or opening 33 by which it is adapted to be attached to a connected part.

Metal plates 34 of the full width of the stick 25 are provided and these plates are drilled to the same centers as the holes 27 and 28 in the stick. The stick is then subjected to steaming, particularly at the ends where the kerfs 26 are formed and then the wedge member 31 is inserted in the kerfs by bending the forked ends outwardly and around the dou-

ble tapered portion of the wedge piece 31. The clamping plates 34, 34 are applied and the bolts such as 29 and 30 are then drawn up tight to bend the bifurcated end parts about the wedge member to secure a grip against movement of the wedge piece 31 with respect to said end pieces in either direction.

Additional bolts, particularly at the outer end on each side of the bolt 29 may be provided for insuring the clamping down of the outer forked end of the wooden bar. If they are used they likewise should have the necessary clearance in respect to the holes in the wedge member 31 to prevent stress on the wedge piece from being transmitted to the bolts or rivets and thereby to the wood. The end piece or lug 32 may be carried out the full width of the stick 25 or it may be reduced in width or formed in any desired manner.

When used as a cross arm brace, as shown in Fig. 1, the major axis of the oblong section of the stick 25 lies in the plane of the greatest stress. The braces 21, 21 shown in Fig. 1 may be considered as tension members since they present greater strength in that direction. The brace such as 21 shown in Figure 1 may obviously be employed to sustain compression as well as to sustain tension, and the device of my invention may be employed as a strut for supporting an alley cross-arm, for example. As shown in Fig. 2, the brace 21' is employed as a guy strain insulator. The ends of the strain cable 35, 36 are connected to the end pieces such as 32, 32 and the structure is employed in tension. In view of the relatively great length of the intermediate part of the stick, which is covered with a preservative covering such as bituminous paint, the device affords a high degree of protection against impulse voltages. The wood is a poor conductor, being thus an insulator of currents caused by impulse voltages and because of the length of the shaft of wood between the metallic end pieces, sufficient insulating value is provided by the device herein shown for moderately high voltages.

The bending of the forked end of the shaft about the doubled tapered wedge member and the secure clamping of the same provides an attachment of the terminal piece 32 through the wood shaft 25, which brings into play substantially the entire tensile strength of the cross section of the bar 25. This is secured by the grip which the forked ends of the bar 25 have upon the wedge member free of any stress upon the bolts except straight tension caused by the wedging action of the member 31.

Obviously, I do not intend to be limited to the precise details herein shown and described, as modifications will be apparent to those skilled in the art.

While I have shown the wedge piece as being double tapered, it is to be observed that

the active part in tension is largely the inverted wedge portion, that is, the part lying between the thickest cross section of the wedge portion and the outer end or lug 32.

5 The inner wedge portion might be cut off if the brace were to be used only in tension at all times, although a certain part of the strength would be lost. It will also be apparent to those skilled in the art that the slots
10 might be formed with a certain enlargement or belly in the central portion thereof, but this would be cutting away a part of the body of the wood bar and a part of the strength would thereby be lost. Obviously, also, other
15 means for securing the plates 34, 34 upon the outside might be employed as, for example, rivets instead of bolts, or having bolts or rivets lying outside of the body of the bar 25.

By disposing the bolts completely outside
20 the bar and wedge piece it will be seen at once that the proper action of the device is dependent upon the clamping force and not upon the sheer strength of the bolts nor the strength of the wood against splitting.

25 I claim:—

1. In combination, a wooden pole, a wooden cross arm, insulators for carrying high tension conductors mounted on said cross arm, and a pair of diagonal braces connecting
30 said cross arm and said pole, said braces comprising a wooden shaft and metal end pieces bolted to the pole and to the cross arm.

2. In combination, a wooden pole having an inverted U-shaped bracket embracing the
35 top of the pole, a wooden cross arm, a bolt passing through the center of the cross arm and the pole, and through both legs of the bracket, insulators mounted on metal pins bolted onto the outer ends of the cross arm,
40 an insulator mounted on the top of said bracket, and diagonal braces secured at their lower ends to the pole and at their upper ends to the cross arm on each side of the pole.

3. In combination, a wooden pole having
45 an inverted U-shaped bracket embracing the top of the pole, a wooden cross arm, a bolt passing through the center of the cross arm and the pole, and through both legs of the bracket, insulators mounted on metal pins
50 bolted onto the outer ends of the cross arm, an insulator mounted on the top of said bracket, and diagonal braces secured at their lower ends to the pole and at their upper ends to the cross arm on each side of the pole, said
55 braces comprising relatively long bars of wood having metal lugs attached to the ends thereof.

4. In combination, a wooden shaft of oblong cross section having an end slotted to
60 bifurcate the same, a double tapered wedge piece of metal disposed in said slot, the bifurcated ends embracing opposite sides of both tapered parts of the wedge piece, and bolts holding said bifurcated ends firmly in en-
65 gagement with said wedge piece and against

movement in any direction with respect thereto.

5. In combination, a wooden shaft having an end slotted to bifurcate the same, a double tapered wedge piece disposed in said slot,
70 the bifurcated ends embracing opposite sides of both tapered parts of the wedge piece, plates lying upon the outside of the bifurcated ends and bolts holding said plates and the bifurcated ends firmly together upon
75 said wedge piece.

6. In combination, a wooden shaft having one end thereof slotted to bifurcate the same, a double tapered wedge piece having an extending attaching lug, said wedge piece be-
80 ing disposed between the bifurcated ends, and bolts holding said bifurcated ends firmly in engagement with the sides of said wedge piece.

7. In combination, a wooden shaft of oblong cross section the end of said shaft being
85 slotted on the major axis of its cross section, a metal piece tapering from its central portion towards the ends lying in said slot, the wood on each side of the slot being bent around and into contact with the sides of said
90 piece, and means for holding said bent parts of the ends firmly in engagement with the side faces of said piece to hold said piece against movement with respect to said shaft.

8. In combination, a wooden shaft having an end thereof slotted to form two legs, a double tapered wedge piece disposed in the
100 slot, the legs of the piece being bent around said wedge piece, and bolts extending through the legs and through the wedge piece for holding the legs firmly in engagement with the sides of the wedge piece.

9. In combination, a wooden shaft having its end slotted to form legs, a double tapered
105 wedge piece disposed between the legs, said legs being bent against the sides of the wedge piece, plates lying against the outer sides of the legs and bolts passing through the plates, the legs and the wedge piece for holding all
110 of these parts firmly together.

10. In combination, a wooden shaft of oblong cross section having one end thereof
115 slotted on the major axis of the section to form two thin legs of the width of the section, a double tapered wedge piece of the width of the section disposed in the slot, the legs being bent about the sides of the wedge piece, said
120 wedge piece having an extended attaching lug and bolts holding said legs firmly in engagement with the sides of the wedge piece.

11. In combination, a wooden shaft of oblong cross section having an end thereof
125 slotted to provide two legs, an attaching piece having a portion disposed between said legs, said portion being thicker at the center than at the ends, the legs being bent about said thicker portion and firmly clamped
130 against said piece.

12. In combination, a relatively flat bar having a double tapered wedge portion, a wooden bar having its end slotted to form legs, the legs being bent about and embracing the tapered sides of the wedge portion, and means holding said bent legs in contact with said portion.

13. As an article of manufacture, a double inclined wedge member having an extending ear, said ear being perforated, said wedge having holes at its opposite ends for loosely passing bolts therethrough.

14. In combination with a wooden pole, a wooden cross bar joined to the pole and having electric power conductor supporting means thereupon, and a diagonal brace connecting the cross-arm and the pole, said brace having a shaft of wood, metallic coupling means at each end of the brace binding the ends of the shaft and serving to couple the ends of the brace to the pole and to the cross-arm and bolts extending through a part of each coupling means and serving to secure the ends of the brace to pole and to the cross-arm respectively.

In witness whereof, I hereunto subscribe my name this 17th day of April, 1929.

CHAS. L. STROUP.