

Nov. 4, 1969

D. J. STUART

3,475,874

REINFORCING MEMBERS FOR A WOODEN POLE

Filed June 14, 1967

3 Sheets-Sheet 1

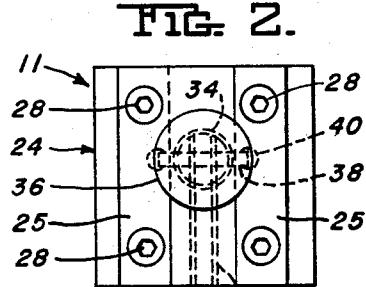
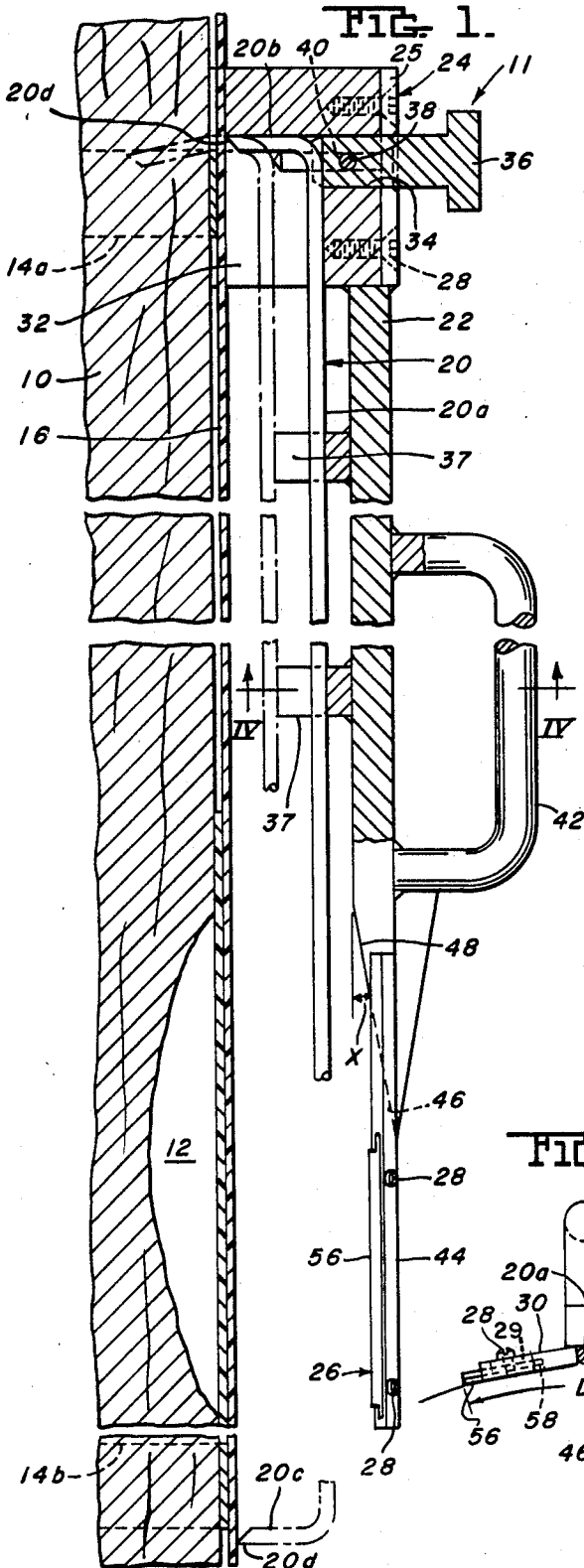


FIG. 4.

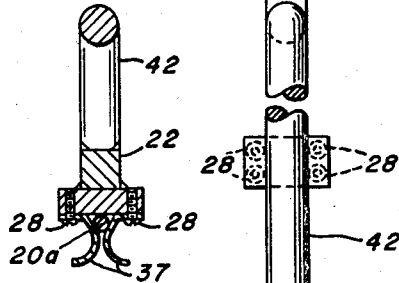
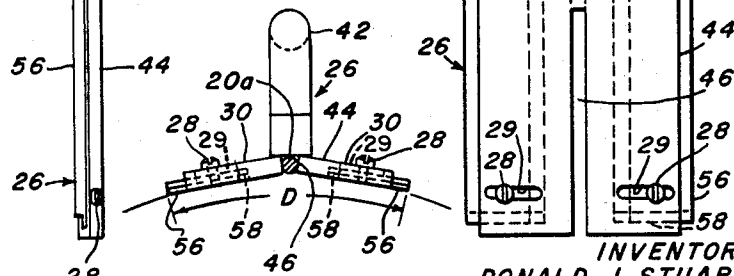


FIG. 5.



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3 Sheets-Sheet 2

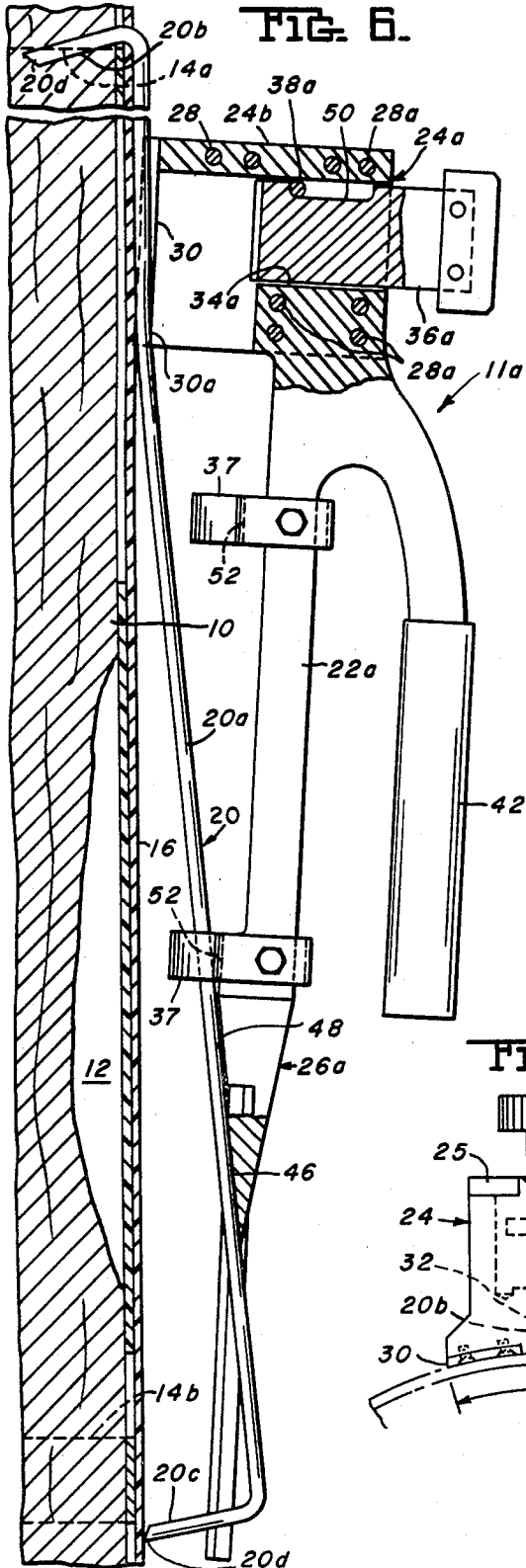


FIG. 6.

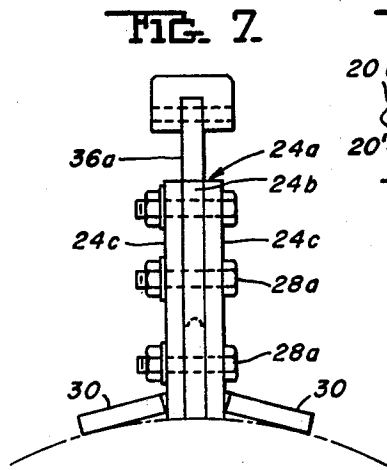


FIG. 7.

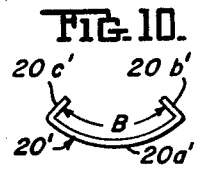


FIG. 10.

FIG. 11.

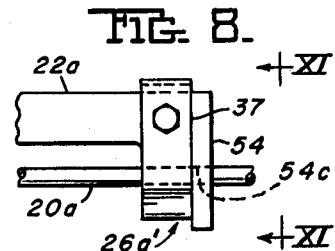
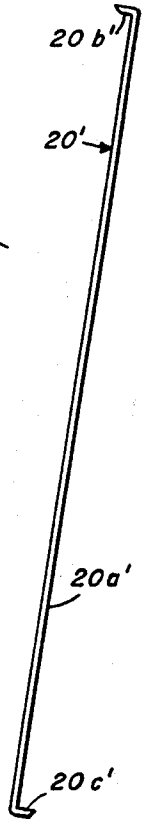


FIG. 8.

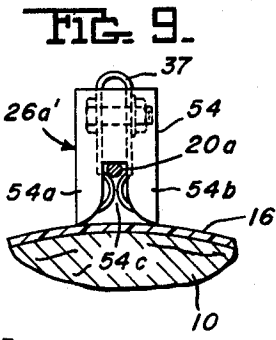


FIG. 9.

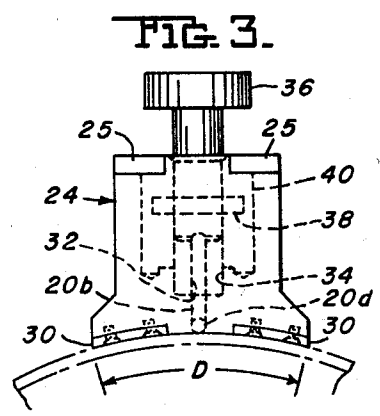


FIG. 3.

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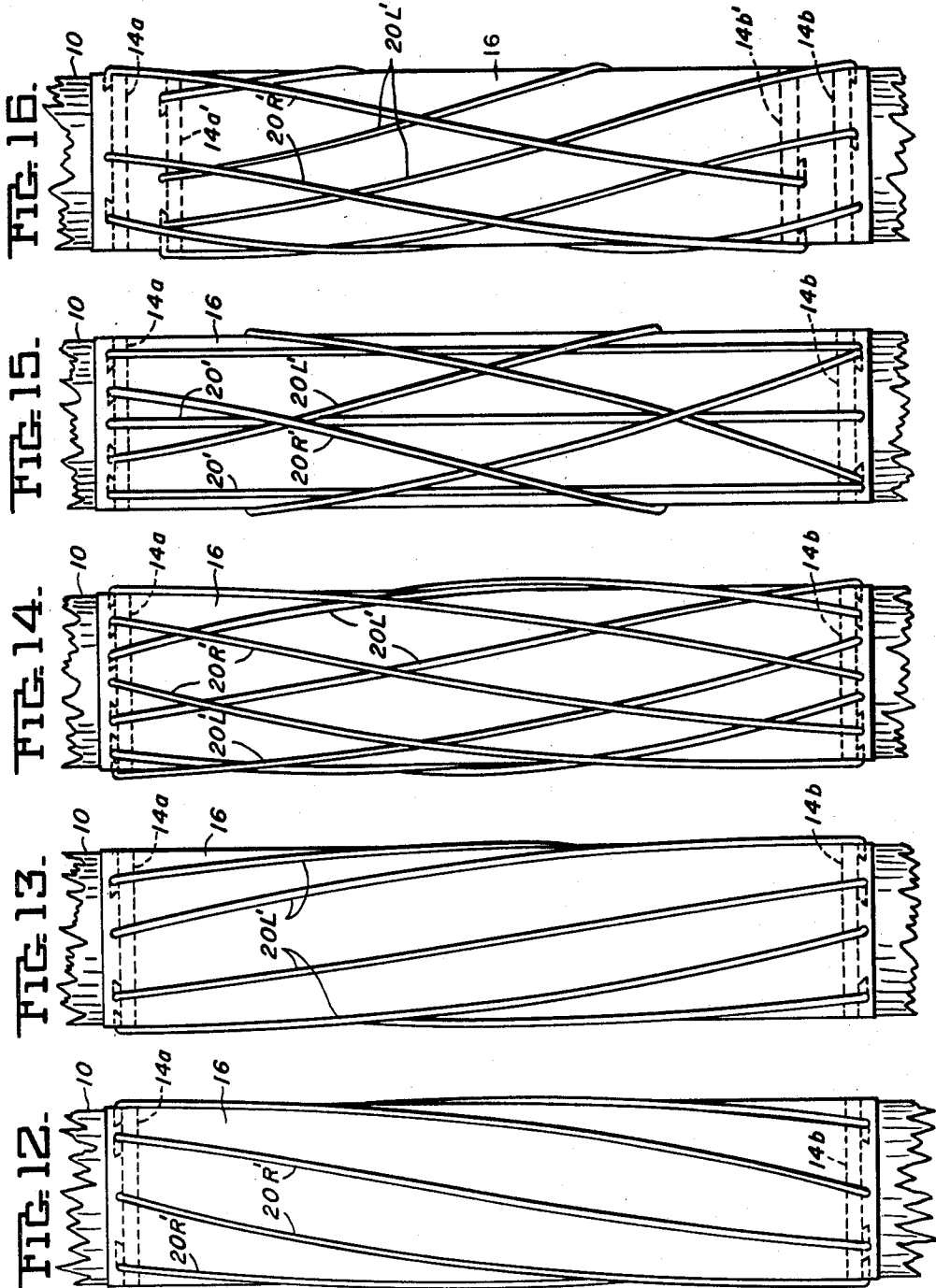
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REINFORCING MEMBERS FOR A WOODEN POLE

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3 Sheets-Sheet 3



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3,475,874

**REINFORCING MEMBERS FOR A WOODEN POLE**  
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Int. Cl. E04g 23/02; E02d 37/00; E04h 12/04  
U.S. Cl. 52—514

8 Claims

## ABSTRACT OF THE DISCLOSURE

A combination of reinforcing members is provided for a wooden pole having a zone of weakness, each reinforcing member having an elongated body portion, a first leg and a second leg. The combination has a first reinforcing member having its first leg embedded in the wooden pole above the zone of weakness and its second leg embedded in the wooden pole below the zone of weakness in axial registry with the first leg, and a second reinforcing member having its first embedded in the wooden pole adjacent the first leg of the first reinforcing member, its elongated body portion disposed across the elongated body portion of the first reinforcing member in a helix and its second leg embedded in the wooden pole.

### Background of the invention

Heretofore, wooden poles, such as wooden utility poles, utilized for carrying wires for electrical power transmission and telephone and telegraph communication have been treated or impregnated with a preservative, such as creosote, pentachlorophenol, sodium chloride or the like prior to being set in place. Despite this treatment the wooden poles are subject to attack by insects, fungi and bacteria and physical damage caused by vehicles, fire, vandalism, lightening and the like, particularly in a zone of weakness adjacent the ground level.

A process for repairing such damaged wooden poles is described in United States patent application Ser. No. 401,502, filed Oct. 5, 1964, now Patent No. 3,390,951 by J. H. Finger et al. and assigned to Penn Line Service, Inc., the assignee of a partial interest therein from the assignee of this application. This process includes the steps of:

- (a) Removing damaged material from the wooden pole,
- (b) Applying a sterilizing or preservation agent, such as cresote or the like, to the sound wood adjacent the zone of weakness,
- (c) Applying tightly a adhering circumferential metal upper locating band to the wooden pole above the zone of weakness and a similar lower locating band to the wooden pole below the zone of weakness,
- (d) Applying a glass fibrous sleeve and a resin to the wooden pole intermediate the upper locating band and the lower locating band,
- (e) Driving longitudinal metal reinforcing members into the wooden pole and hooked around the upper locating band and the lower locating band,
- (f) Applying additional circumferential bands over the reinforcing members and intermediate the upper locating band and the lower locating band,
- (g) Applying an additional glass fibrous sleeve and a resin over the reinforcing members, additional bands and the upper locating band and the lower locating band, and
- (h) Finally applying a spiral covering and an ultraviolet protective coating to the materials so applied to the wooden pole.

A reinforced wooden pole is contemplated in such application as an article of manufacture having:

- (a) A pair of spaced metal circumferential locating bands clamped to the wooden pole above and below the zone of weakness,

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(b) A resin impregnated glass fibrous sleeve adhered to the wooden pole and extending substantially between the upper locating band and the lower locating band,

(c) Longitudinal metal reinforcing or tension members attached to the wooden pole, hooked around the upper locating band and the lower locating band and overlying the glass fibrous sleeve,

(d) Additional circumferential metal bands clamped about the tension members between the upper locating band and the lower locating band,

(e) An additional resin impregnated glass fibrous sleeve about the additional bands, the locating bands and the reinforcing members, and

(f) A spiral covering impregnated with an ultraviolet protective coating overlying the additional fibrous sleeve. Conventional tools of the type contemplated by this invention are shown in the following patents:

U.S. Patents Nos. 2,107,555, Feb. 8, 1938; 2,589,075, Gravis, Mar. 11, 1952; 2,637,030 Wickman et al., May 5, 1953; 2,691,908, Lamberth, Oct. 19, 1954; 2,994,818, Abrahamsen, Aug. 1, 1961; 3,060,441, Henning, Oct. 30, 1962.

### Objects of the invention

The general object of this invention is to provide a helical reinforcing member which:

- (a) redistributes axial stress in the Fiberglas sleeve thus providing a higher moment of resistance at the groundline of the wooden pole, and
- (b) offsets the loading torque in a wooden pole having twisted grains.

### Brief summary of the invention

The aforesaid objects of this invention, and other objects which will become apparent as the description proceeds, are achieved by providing a product, such as a combination of reinforcing members for a wooden pole having a zone of weakness, each reinforcing member having an elongated body portion, a first leg and a second leg. The combination has a first reinforcing member having its first leg embedded in the wooden pole above the zone of weakness and its second leg embedded in the wooden pole below the zone of weakness in axial registry with the first leg, and a second reinforcing member having its first leg embedded in the wooden pole adjacent the first leg of the first reinforcing member, its elongated body portion disposed across the elongated body portion of the first reinforcing member in a helix and its second leg embedded in the wooden pole.

Although the principles of the present invention are broadly applicable to the reinforcing of fibrous members, this invention is particularly adapted for use in conjunction with the reinforcement of wooden poles having a zone of weakness and hence it has been so illustrated and will be so described.

### Brief description of the several views of the drawings

For a better understanding of this invention reference should be had to the accompanying drawings, wherein like numerals of reference indicate similar parts throughout the several views and wherein:

FIGURE 1 is a side elevational view in cross section of a portion of a wooden pole having a zone of weakness or deterioration and showing the apparatus for aligning and driving the reinforcing member in solid lines and positioned on the wooden pole preparatory to driving the first leg of the reinforcing member into the wooden pole and the reinforcing member in dotted lines partially driven into the wooden pole;

FIGURE 2 is a side elevational view of the apparatus shown in FIGURE 1 with the reinforcing member and the wooden pole eliminated for clarity;

FIGURE 3 is a top elevational view of the head end of the apparatus of FIGURE 1;

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FIGURE 4 is a horizontal cross sectional view taken along the line IV—IV of FIGURE 1 in the direction of the arrows and showing the details of the handle and the holding or clip means;

FIGURE 5 is an elevational view of the guide means on the tail end of the apparatus taken from a position similar to the bottom of FIGURE 2, and showing the guide member resting on the wooden pole with the reinforcing member partially inserted in the wooden pole;

FIGURE 6 is a view similar to FIGURE 1 of an alternative embodiment of the apparatus showing the first leg of the reinforcing member embedded in the wooden pole and the second leg of the reinforcing member aligned and secured by the apparatus preparatory for the driving operation;

FIGURE 7 is a top elevational view of the head end of the apparatus of FIGURE 6;

FIGURE 8 is a fragmentary side elevational view of an alternative embodiment of a tail end for the apparatus;

FIGURE 9 is a view taken along the line IX—IX of FIGURE 8 in the direction of the arrows;

FIGURE 10 is a plan view of an alternative embodiment of a reinforcing member having its second leg offset  $\beta^\circ$  from its first leg;

FIGURE 11 is a side elevational view of the reinforcing member shown in FIGURE 10;

FIGURE 12 is a fragmentary side elevational view of reinforcing members embedded in a wooden pole in the form of right handed helices;

FIGURE 13 is a view similar to FIGURE 12 of the reinforcing members embedded in the wooden pole in the form of left handed helices;

FIGURE 14 is a view similar to FIGURES 12, 13 of the reinforcing members embedded in the wooden pole in the form of criss-crossing right and left handed helices;

FIGURE 15 is a view similar to FIGURES 12, 13, 14 of the reinforcing members embedded in the wooden pole in the form of criss-crossing axial members, and right and left handed helices; and

FIGURE 16 is a view similar to FIGURES 12, 13, 14, 15 showing the right and left handed helical reinforcing members offset axially to reduce the peripheral notching or weakening offset in the wooden pole.

#### Detailed description

With specific reference to the form of this invention illustrated in the drawings, and referring particularly to FIGURES 1, 6, 9, 12-16, a wooden pole, such as a wooden utility pole having a zone of weakness 12, is indicated generally by the reference numeral 10.

The damaged or rotten material on this wooden pole 10 has been removed from the zone of weakness 12. A sterilizing or preservation agent, such as creosote or the like, has been applied to the sound wood adjacent the zone of weakness 12. Tightly adhering circumferential metal first and second locating bands 14a and 14b (FIGURES 1, 6) have been secured to the wooden pole 10 above and below respectively the zone of weakness 12. A sleeve 16 (FIGURES 1, 6, 12-16) of fibrous material and resinous material covers the first locating band 14a, the zone of weakness 12 and the second locating band 14b preparatory for the insertion of reinforcing members 20 (FIGURES 1, 6) into the wooden pole 10.

The sleeve 16 has a laminate, such as non-woven fiberglass matting with randomly oriented fiber concentration of the glass fiber at about 1½ ounces per square foot. A resin (such as International Company Resin No. 1C1660), a low-viscosity, fast-cutting thixotropic rapid-setting polyester in a styrene monomer and modified with cobalt naphthalene as a promoter and methyl ethyl ketone peroxide as a catalyst represents about sixty-five percent of the sleeve 16. The locating bands 14a, 14b are standard steel strapping having a nominal tensile strength of about 122,000 p.s.i. and about a 4000 pound breaking strength at the clip. The reinforcing members 20 are hard-drawn mechanical spring wire having a gen-

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erally U-shaped configuration, an elongated body portion 20a (FIGURES 1, 4, 5, 6, 8, 9) of predetermined length, a first leg portion 20b (FIGURES 1, 3, 6) and a second leg portion 20c (FIGURES 1, 3, 6). Each leg portion 20b, 20c has a pointed end 20d (FIGURES 1, 3, 6) and the legs 20b, 20c are substantially parallel or unskewed.

#### Apparatus

The apparatus 11 (FIGURES 1, 2) has an elongated frame 22 (FIGURES 1, 2, 4) having a head end 24 (FIGURES 1, 2, 3) and a tail end 26 (FIGURES 1, 2). The head end 24 is a forging (FIGURES 1, 2, 3) having two wear plates 25 (FIGURES 1, 2, 3) secured to the head end 24 by screws 28 and readily disassembled to permit cleaning of deposited resin therefrom. Such head end 24 has positioning means, such as the arcuate shoes 30 (FIGURE 3) having a contact distance D, adapted to slide on the wooden pole 10 and contoured to the circumference of the wooden pole 10 to firmly position the apparatus 11 on the wooden pole 10 for the aligning and driving of the first leg portion 20b or the second leg portion 20c of the reinforcing member 20. The head end 24 is provided with a leg-locating slot 32 (FIGURES 1, 2, 3) for positioning the pointed end 20d of the first leg 20b in position on the wooden pole 10 to engage the first locating band 14a. As shown in FIGURE 1, the pointed end 20d digs into the sleeve 16 so as to positively contact the first positioning band 14a. The head end 24 is provided with a ram slot 34 (FIGURES 1, 2, 3) in communication with said leg-locating slot 32.

Holding means, such as spring clips 37 (FIGURES 1, 4, 6) are mounted by screws 28 to the elongated frame 22 for securing the reinforcing member 20 in the apparatus 11 and for retaining the first leg 20b positioned in the leg-positioning slot 32.

A ram 36 (FIGURES 1, 2, 3) having a circular cross-sectional area is reciprocable in the ram slot 34 and is operable by external means, such as a manually-operated hammer or automatic means (not shown) to drive the pointed end 20d of the first leg 20b through the sleeve 16 and into the wooden pole 10 and to hook the first leg 20b around the first locating band 14a. For the purpose of retaining the ram 36 in the ram slot 34, such ram 36 carries pin or guide means, such as the pin 38 (FIGURES 1, 2, 3), which pin 38 rides in extension slots 40 of the ram slot 34 (FIGURES 2, 3).

To permit handling of the apparatus 11, it is provided with a handle 42 (FIGURES 1, 2, 4, 5). As shown in FIGURES 1, 2, 5, the tail end 2 is provided with guide means, such as the guide 44, which guide 44 is contoured to slide along the wood pole 10 and is provided with tapered slot 46 disposed at an angle X of about 10° from the axis of the elongated frame 22 (FIGURES 1, 2, 5) and for sliding on the body portion 20a of the reinforcing member 20. The apparatus 11 rides on the reinforcing member 20 as it moves from the position, shown in FIGURE 1, to the position shown in FIGURE 6 with the weight of the apparatus 11 and hand pressure, thereby preventing crowning or bowing of the reinforcing member 20 and permitting the tight tensioned insertion of the reinforcing members into the wooden pole 10.

When the apparatus 11a is tilted into the position shown in FIGURE 6, the arcuate shoes 30 on the head end 24 are resting by means of their rearward portions 30a on the sleeve 16 on the wooden pole 10 and the slot 46 bears on the elongated portion 20a of the reinforcing member 20 with the pointed end 20d of the second leg 20c resting on the sleeve 16 adjacent the second locating band 14b preparatory for the driving of the second leg 20c into the wooden pole 10 and the hooking of such second leg 20c around the second locating band 14b.

#### Alternative embodiments

It will be understood by those skilled in the art that alternatively, as shown in FIGURE 6, the apparatus 11a (FIGURES 6, 7) is provided with a head end 24a having

two side plates 24c and end plate 24b connected by bolts 28a together and to the elongated body 22a. The ram 36a (FIGURES 6, 7) having a rectangular cross section is provided with an elongated slot 50 (FIGURE 6) and the head end 24a has pin or guide means, such as the pin 38a extending into the slot 50 to retain the ram 36a in the ram slot 34a. Further the spring clips 37 (FIGURE 6) can be mounted about stops 52 on the elongated frame 22a to position the elongated body 20a of the reinforcing member 20 against the stop 52 (FIGURE 6), rather than the underside of the elongated body 22 (FIGURE 4). In addition the closed handle 42 (FIGURE 1) can be replaced by the open handle 42a (FIGURE 6).

In FIGURES 8, 9, the tail end 26a' is a supporting member 54 having legs 54a, 54b (FIGURE 9) and is provided with a guide slot 54c for the elongated body 20a of the reinforcing member 20. When the arcuate shoes 30 tilt backwardly onto the rearward portion 30a into the position of FIGURE 6, the supporting member 54 (FIGURE 9) rests on the sleeve 16 on the wooden pole 10.

Referring to FIGURES 2, 3, 5, the shoes 30 (FIGURE 5) and the guide 44 (FIGURE 2, 5) respectively are provided with extensions 56 (FIGURE 5) which are slidable in dovetail slots 58 in the shoes 30 and guide 44 respectively and are fixed in the desired position by screws 28 in slots 29 (FIGURE 2) in guide 44 to provide the desired distance D, which distance D is used to space adjacent reinforcing members 20 on the wooden pole 10.

#### Product

Referring to FIGURES 10, 11, the helical reinforcing member 20' has its leg portions 20b', 20c' disposed at an angle  $\beta$  (about 90–120°) from each other. In FIGURE 12 the reinforcing members 20r' are arranged in right-hand helices. FIGURE 13 shows left-handed helices 20l'. FIGURE 14 shows a combination of criss-crossing right and left-hand helices 20r' and 20l'. In FIGURE 15 criss-crossing axial reinforcing members 20, right-hand helices 20r' and left-hand helices 20l' are shown. In order to reduce notching or weakening of the cross section of the wooden pole 10 (FIGURE 16), the right-hand helices 20r' are axially offset from the left-hand helices 20l'.

The helical reinforcing members 20r', 20l' redistribute the axial stresses on the Fiberglas sleeve 16, thus imparting a higher moment resistance at the groundline of the wooden pole 10, and offset loading torque in a wooden pole 10 which has twisted wood grains.

#### Summary of the achievement of the objects of the invention

It will be recognized by those skilled in the art that the objects of this invention have been achieved by providing an improved helical reinforcing member which redistributes axial stress in the sleeve, thereby providing a higher moment of resistance at the groundline of the wooden pole and which offsets the loading torque in wooden poles having twisted wood grains.

While in accordance with the patent statutes, preferred and alternative embodiments of this invention have been illustrated and described in detail, it is to be particularly understood that the invention is not limited thereto or thereby.

#### I claim:

1. A combination of reinforcing members for a wooden pole having a zone of weakness, each reinforcing member having an elongated body portion, a first leg and a second leg, said combination having:

- (a) a first reinforcing member having its first leg embedded in said wooden pole above said zone of weakness and its second leg embedded in said wooden pole below said zone of weakness in axial registry with said first leg, and
- (b) a second reinforcing member having its first leg embedded in said wooden pole adjacent said first leg of said first reinforcing member, its elongated

body portion disposed across the elongated body portion of said first reinforcing member in a helix and its second leg embedded in said wooden pole.

2. The combination recited in claim 1 wherein said first leg of said first reinforcing member is offset axially from said first leg of said second reinforcing member.

3. A combination of reinforcing members for a wooden pole having a zone of weakness, each reinforcing member having an elongated body portion, a first leg and a second leg, said combination having:

- (a) a first reinforcing member having its first leg embedded in said wooden pole above said zone of weakness and its second leg embedded in said wooden pole below said zone of weakness in axial registry with said first leg,
- (b) a second reinforcing member having its first leg embedded in said wooden pole adjacent said first leg of said first reinforcing member, its elongated body portion disposed across the elongated body portion of said first reinforcing member in a helix directed in one direction and its second leg embedded in said wooden pole, and
- (c) a third reinforcing member having its first leg embedded in said wooden pole adjacent said first leg of said first reinforcing member, its elongated body portion disposed across the elongated body portions of said first reinforcing member and said second reinforcing member in a helix directed in a direction opposite to said one direction and its second leg embedded in said wooden pole.

4. The combination recited in claim 3 wherein one of said first reinforcing member, said second reinforcing member and said third reinforcing member has its first leg offset axially from the first leg of another of said first reinforcing member, said second reinforcing member and said third reinforcing member.

5. The combination recited in claim 3 wherein one of said second reinforcing member and said third reinforcing member has its first leg offset axially from the first leg of the other of said second reinforcing member and said third reinforcing member.

6. For a wooden pole having a zone of weakness, a reinforcing assembly disposed about said zone of weakness and having:

- (a) a pair of spaced locating bands secured to said wooden pole above and below said zone of weakness,
- (b) a sleeve secured to said wooden pole and extending substantially between said upper locating band and said lower locating band, and
- (c) a reinforcing member having an elongated body portion, a first leg and a second leg at opposite ends of said body portion,
  - (1) said reinforcing member having its first leg extending through said sleeve and into said wooden pole and hooked around one of said locating bands, its elongated body portion disposed across said wooden pole in a helix and its second leg extending through said sleeve and into said wooden pole and hooked around the other of said locating bands.

7. The reinforcing member recited in claim 6 wherein said helix is right handed.

8. The reinforcing member recited in claim 6 wherein said helix is left handed.

#### References Cited

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JOHN E. MURTAGH, Primary Examiner

U.S. Cl. X.R.

21—7; 227—101; 52—128