STRENGTHENING, PRESERVATION, AND EXTENSION OF LIFE OF WOODEN POLES
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11 Claims. (Cl. 21—7)

This invention relates to strengthening, to restoration of strength and to treatment for preservation of wooden poles. The invention is particularly adapted to the treatment of wooden utility poles to avoid and overcome the consequences of rot and to repair such poles which have been, apparently damaged or shredded.

It has been common practice for utilities to carry wires for power, telephone and telegraph upon a series of spaced apart wooden poles. The poles are set at intervals in the ground and the wires or cables string between them from hangers or cross arms attached to the poles. While the poles are customarily treated by impregnating them with a preservative prior to being set in place, it has been found that they are subject to attack by insects, fungi and bacteria, particularly at the ground level, where the presence of moist earth provides such attack. A common development is for the attack to begin at the surface of the ground and to go downwardly along the pole beneath the ground. The attack is ordinarily most severe at about the surface and becomes progressively less severe as the distance below the surface increases, except that it is weakened and is unable to carry the necessary load. It becomes necessary to replace a pole when it has been weakened below a minimum strength. Sometimes the pole becomes damaged and weakened from physical damage caused by vehicles, fire, vandalism, lightning, and the like.

Replacement of a pole is, however, an expensive operation, particularly if it carries a substantial number of lines and hardware, as is commonly the case in high-density urban areas. In many instances, the anticipated life of the pole line is short, because plans to change to underground service or because of plans to relocate the line because of street and highway changes. The present invention enables the life of poles which have been treated to be extended for a substantial period of time while restoring them to substantially full strength at a small fraction of the cost of removing the old pole and installing a new one. The invention may also be employed to connect the butt ends of two pole sections to form a single pole of longer length than either of the two sections. In some cases an existing pole may be completely severed or ruptured by impact of a vehicle or the like. In other cases, pole sections of shorter than desired length may be produced by sawing or by reason of the original tree being too short to enable a pole of desired length to be cut. In such a case, two short pole sections may be joined end to end to form a pole of desired length. The area of damage to a pole or the point of juncture of two pole sections are referred to herein as the "zone of weakness" or "weakened zone."

We strengthen poles having a zone of weakness by applying band means to the pole above the weakened zone and below the weakened zone, surrounding the weakened zone with a fibrous material and a resinsos material and connecting tension means to the pole extending from a point adjacent the upper band means to a point adjacent the lower band means from the pole adjacent the zone of weakness. We preferably band the pole by tightly adhering steel bands in clamping engagement to the pole above and below the zone of weakness. We further preferably apply resin impregnated fibrous material to the pole intermediate said band means, applying tension means to the pole by connecting the tension means to the pole adjacent the upper band means and adjacent the lower band means and extending therebetween. We then prefer to apply additional band means from which tightly surround and clamp the tension means intermediate the upper band means and lower band means. We preferably apply a sterilizing and preservative agent to sound wood exposed by removal of damaged wood fibers before commencing application of resinous and fibrous material to the pole. We further prefer to apply additional fibrous material and resinsos material overlying the tension means and band means after application of the tension means and band means and prefer to place a protective coating over all of the previously applied materials.

Other details, objects and advantages of our invention will become more apparent as the following description of a present preferred embodiment thereof proceeds.

In the accompanying drawings we have illustrated the repair and restoration of a rotted wooden utility pole, showing progressive steps in which:

FIGURE 1 is a view of a rotted utility pole in which the earth has been dug from around the base of the pole, exposing the rotted material;

FIGURE 2 is a view of the pole with the rotted material removed and a preservative agent applied to sound wood adjacent the zone of rot;

FIGURE 3 is a view of the pole with a barrier applied over the preservative agent substantially conforming to the original diameter of the pole, and with a band applied to the pole above the area of rot and below the area of rot;

FIGURE 4 is a view showing resin-impregnated fibrous glass mat material being applied to the pole and tension means placed thereover;

FIGURE 5 shows the intermediate bands applied over the tension means and fibrous material; and

FIGURE 6 illustrates the application of the final wrapping and coating of the area of repair.

A utility pole 1 is illustrated in FIGURE 1. The pole is one which has been set in the earth for some time and has partially rotted away. The lower end extends into the earth below the surface of the ground 2. The ground has been excavated around the pole to a depth of perhaps two feet. Various fungi and bacteria in the ground have attacked the pole over a period of years, causing wood in the pole to become rotted as indicated at 3. The zone of rot starts at about the surface of the ground and extends downwardly into the ground. In the ordinary case, the attack is quite pronounced at about ground level and becomes less severe as the depth increases. Accordingly, the rotted area goes almost directly and radially inwardly at the ground level and then becomes gradually less pronounced at increasing depths.

After excavation around the pole has been completed, the rotted material 3 is removed from the zone of rot and the remaining sound wood is wire brushed to remove any remaining rotted fibers. Several cores are then taken from the pole at various points near the ground to be sure that the pole is sound except for the rot and that it may be successfully repaired. If the pole is sound except for surface rot, a preservative is applied to sound wood adjacent the zone of rot as indicated at 4. Various commercial preservatives, such as those which include creosote, pentachlorophenol and sodium fluoride may be employed. Thereafter, a barrier 5 is applied over the preservative to prevent contamination of it by other materials and to restore substantially the original diameter of the pole in the damaged area. A cavity is formed behind
In some cases, it is desirable to fill the cavity with a non-compressible material. Next, bands 6 and 7 are applied tightly around the pole 5. These bands are formed from heavy-duty steel strapping of the type which is customarily used for packaging a wide variety of materials. Their free ends of each strap are drawn tightly together and held together by a clamp as indicated at 7a. Strap 7a is positioned so that the protective is exposed above strap 6 and below the protective. After steel straps 6 and 7 are applied to the pole above and below the zone of rot, a fibrous material 8 is wrapped around the pole and impregnated with plastic resin. The fibrous material is preferably a mat of glass fibers. Glass fiber material may be obtained in rolls and pieces cut from the end of the roll to desired size to form a mat which is wrapped around part of the circumference of the pole. A second mat is then wrapped around the pole from the opposite side, overlapping the ends of the first mat. A third sheet of fibrous material is then applied in the same manner and successive sheets may also be applied in the same manner. The resin is preferably a thermosetting resin which is mixed with a catalyst immediately before application to cause rapid polymerization of the resin. The resin is preferably applied to the pole, covering the mats 6, 7, and all of the impending tension means to application of the mats of fibrous material. As the mats of glass fiber are positioned, they soak up and become impregnated with the resin. The wood fibers of the pole likewise become impregnated with the resin. In this manner the mats and the sleeve as a whole become integrative with the pole. After the mats have been positioned, additional resin may be brushed on them, so that the glass fibers become fully saturated. Thereafter, a series of tension members 9 are placed in position surrounding and overlying mats 8. The tension members are connected to pole 1 just above and just below bands 6 and 7. The tension members are preferably formed from high tensile strength wire whose ends are turned at an angle to their axis and pointed so that the points may be driven into the wood of the pole. The spacing between bands 6 and 7 has previously been fixed so that the points of tension members 9 will just span across bands 6 and 7. Bands 6 and 7 thereby lock the tension members against slipping and rupturing of the fibers. The tension members are placed around the circumference of the pole paralleling the axis of the pole. Spacing of the tension members is determined by the extent of damage and class of pole. For example, if the pole has a deep cut on one side, the tension members may be more closely spaced adjacent the pocket. After all of the tension members have been placed, additional straps or bands 10 are applied over the tension members and pulled up tight. Upper and lower bands 10 are preferably offset slightly from straps 6 and 7 to lock the tension members more effectively into a unitary whole with the bands. The bands and tension members are compressed into the fibrous mats and resin for maximum subsequent bonding of the whole into a structure unitary with the pole above and below the damaged zone.

Following application of bands 10, additional sections of fiber mat 11 are applied over the tension members and are resin-impregnated. After building up the pole in this manner with several additional layers of fibrous mat, a spun rayon 12 is wrapped very tightly around the glass fibers in a helical pattern to breathe out air pockets and to compress the previously applied mats, resin, tension members and bands into a continuous structure unitary with the pole. The resin quickly polymerizes and bonds the pole, the fibrous material, the tension members, and the bands into a continuous and single entity. The combination of mechanical attachment of the tension members to the pole and of the bonding of the resin to the wood, the fibrous material, and the tension members results in a continuous strong attachment of those materials to the upper and lower sections of the pole.

After the tape has been applied, a protective coating 13 is applied extending from above the repaired zone to screen out ultraviolet rays, protect the surface resins, and blend the sleeve into the color of the pole. By carrying out the foregoing procedure, the reduction in strength at the zone of weakness is overcome and the pole is ordinarily restored to at least full strength. Tests run on poles so repaired show that the weakest point of the pole following repair is ordinarily remote from the damaged zone and the repairs which have been made. Thus the restored area is stronger than other areas of the pole. The process is, however, relatively inexpensive when compared with the cost of replacing a pole and offers substantial advantages over that practice.

While we have illustrated and described a present preferred embodiment of our invention, it is understood that we do not limit ourselves thereto, and that our invention may be otherwise variously practiced within the scope of the following claims.

We claim:

1. The method of strengthening wooden poles having a zone of weakness which comprises applying metal band means to the pole above and below the zone of weakness, surrounding in between weakness with a fibrous resin impregnated material, and connecting tension means to the pole above the upper band means and below the lower band means and extending therebetween.

2. The method of strengthening wooden poles having a zone of weakness which comprises removing damaged material from the pole, applying tightly adhering metal band means to the pole above the zone of weakness and below the zone of weakness, applying resin impregnated fibrous material to the pole intermediate the band means, fitting tension means to the pole, said tension means being attached to the pole just above the upper band means and just below the lower band means, and thereafter applying additional band means around the tension means intermediate the upper band means and lower band means.

3. The method of strengthening wooden poles having a zone of weakness which comprises removing damaged material from the pole, applying a preservative to the sound wood adjacent the zone of weakness, applying metal band means to the pole above and below the zone of weakness, applying a plastic resin and fibrous material to the pole, which materials extend between the band means, applying tension means to the pole, which tension means are driven into the pole just above the upper band means and just below the lower band means and extending therebetween, thereafter applying further band means surrounding the tension means intermediate the upper band means and lower band means.

4. The method of strengthening wooden poles having a zone of weakness which comprises removing damaged material from the pole, applying metal band means above the zone of weakness and below the zone of weakness, surrounding the zone of weakness with a fibrous resin-impregnated material, applying tension means to the pole extending from above the upper band means to below the lower band means and overlying the upper band means and lower band means, and then applying additional band means around said tension means intermediate the upper band means and lower band means.

5. The method of strengthening wooden poles having a zone of weakness which comprises removing damaged material from the pole, applying metal band means above the weakened zone and below the weakened zone, surrounding the weakened zone with a fibrous resin-impregnated material, applying tension means to the pole extending from above the upper band means to below the lower band means, and then applying additional band means around said tension means just below the upper band means and just above the lower band means.
6. The method of strengthening wooden poles having a zone of weakness which comprises removing damaged material from the pole, applying a preservative to the sound wood adjacent to the zone of weakness, applying metal band means above the zone of weakness and below the zone of weakness, then applying a fibrous material and a resinous material to the pole intermediate the upper band means and lower band means, thereafter driving extending portions of tension means into the pole above the upper band means and below the lower band means, said tension means extending therebetweent and overlying said fibrous material and resinous material, and then applying further band means about said tension means intermediate said upper band means and lower band means.

7. The method of claim 6 in which at least some of the band means intermediate the upper band means and lower band means are slightly offset from the upper band means and lower band means.

8. The method of strengthening wooden poles having a zone of weakness which comprises removing damaged material from the pole, applying a sterilizing agent to sound wood adjacent to the zone of weakness, applying tightly adhering band means to the pole above the zone of weakness and to the pole below the zone of weakness, some of the exposed wood intermediate the band means not being covered by the sterilizing agent, applying a glass fibrous material and a resinous material to the pole intermediate the upper band means and lower band means, driving the points of wire form means into the pole with the points of said form means projecting into the pole just above the upper band means and just below the lower band means, then applying additional band means intermediate the upper band means and lower band means, thereafter applying additional glass fibrous material and resinous material to the pole intermediate the upper band means and lower band means, and finally applying a protective coating to the materials so applied to the pole.

9. A new article of manufacture comprising a wooden pole, a plurality of metal band means tightly adhered to said pole, resin-impregnated fibrous material extending between said band means, tension means attached to said pole adjacent an upper one of said band means and a lower one of said band means, and additional band means tightly surrounding said tension means.

10. A new article of manufacture comprising a wooden pole, a pair of spaced-apart metal band means clamped to said pole, resin-impregnated fibrous material adhered to the pole and extending between the upper band means and lower band means, tension means attached to said pole adjacent to and above the upper band means and adjacent to and below the lower band means, and extending therebetween, additional band means clamped about said tension means, and resin-impregnated fibrous material surrounding the tension means and all said band means.

11. A new article of manufacture comprising a wooden pole having a section above a zone of weakness and a section below a zone of weakness, a pair of spaced-apart metal band means clamped to said pole, one being clamped to each of said sections, resin impregnated fibrous material adhered to the pole and extending between the upper band means and lower band means, tension means attached to said pole adjacent to and above the upper band means, and adjacent to and below the lower band means, said tension means extending between the points of attachment to the pole and overlying said resin-impregnated fibrous material, additional band means clamped to said tension means, and additional resin impregnated fibrous material overlying said tension means and additional band means.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,390,951

James Henry Finger et al.

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, lines 31 and 32, "Eventually the diameter of the pole is reduced to the less severe as the distance below the surface increases." should read -- less severe as the distance below the surface increased. Eventually the diameter of the pole is reduced to the --; line 35, after "strength" insert a period; line 42, after "because" insert -- of --.

Signed and sealed this 16th day of December 1969.

(SEAL)

Attest:

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Commissioner of Patents