METHOD OF REINFORCING DETERIORATED SECTIONS OF TIMBER AND MEANS OF CARRYING OUT THE SAME

Fig. 3.

Fig. 4.

INVENTORS
24. Duval Cravens, Robert E. McGuire,
28. Robert E. Birtz & Keith D. Wherry

BY
Christel & Bean
ATTORNEYS
Fig. 5.

Fig. 6.

INVENTORS
Duval Cravens, Robert F. McGuire, Robert E. Birtz & Keith D. Wherry

BY Christel & Bean
ATTORNEYS
ABSTRACT OF THE DISCLOSURE

Any exposed deteriorated material is removed from the deteriorated area, leaving a recess which is then filled in with a perforating board and plastering longitudinally and piling in good condition, primarily for reasons of safety, make frequent inspection of such timbers and it is the general practice to replace the same, or to reinforce them by "stubbing" if the extent of decay covers as much as about 5% of the area.

The present invention is directed to the repairing and reinforcing of timbers such, for example, as telephone and power poles, piling and the like.

Wood poles and piling set in the earth, after a period of time, begin to deteriorate from decay primarily in an area or areas at or near the ground line.

Utility companies and others concerned with the maintenance of a desire to avoid the weakening of an area which is overstressed due to decay. The present invention has for a principal object, the ability to provide a method, and means of carrying out the same, of repairing poles, piling and other timber in which an area has become decayed whereby the strength of the timber will be restored to substantially its original condition or increased beyond the original strength of the timber.

Another object of the invention is to provide a method of reinforcement and repair, and means of carrying out the same, which is considerably less expensive than the procedure of completely replacing the timber or, in the case of poles such as telephone and power poles and the like, of reinforcing the same by the practice of stubbing.

A further object of this invention is to provide a means of repairing and reinforcing poles and piling over an area from which the decayed material has been removed, which will not only restore substantially all of the original strength but will which will not be especially noticeable to a layman and therefore will not be unsightly.

The invention will be best understood from a consideration of the following detailed description thereof taken in connection with the accompanying drawings, forming a part of the specification, wherein like reference numerals denote like parts throughout and wherein:

FIG. 1 is a view in side elevation of a portion of a pole repaired in accordance with our invention, showing the reinforcement member secured thereto; FIG. 2 is a vertical section of a timber such as a pole or piling showing a transverse recess formed therein by removal of decayed material, coated with protective resin and filled with a quick setting cement, preparatory to the application of a reinforcing covering plate, all in accordance with the method of this invention; FIG. 3 is a transverse sectional view taken about on line 3—3 of FIG. 1; FIG. 4 is a transverse sectional view taken about on line 4—4 of FIG. 1; FIG. 5 is a transverse sectional view similar to the views of FIGS. 3 and 4 but showing an alternate arrangement; and FIG. 6 is a perspective view of the reinforcing member. The present invention is applicable to the treatment of timbers of any size or cross sectional configuration.

In setting forth the invention the description will be directed to the application of the method to a pole such as that shown in the drawings and generally designated 12. The invention comprises the use, among other materials, of a reinforcing member in the form of a relatively rigid plate of substantial length such as illustrated and generally designated 12. This plate is preferably formed of metal, such as rolled steel and is of a length greater than that of the pole and is of a width greater than that area of the pole to be reinforced and is of a suitable radius to suit the pole to desired strength.

Where the timber being treated is a pole of circular cross section, as here illustrated, the plate 12 will be correspondingly transversely curved or of transverse arcuate form to conform to the curvature of the pole. If the timber is of some other cross sectional contour as square, for example, then it will be understood that the plate 12 will be of similar shape or form to fit the square configuration of the timber.

The plate 12 is preferably formed in or has three distinct areas which are here designated 14, 16 and 18, which areas may of varying lengths as may be found desirable. The areas 14 and 18 are at the end portions of the plate and are provided with a multiplicity of holes or apertures 20 for the passage of fastening devices which may be in the form of nails, screws or the like.

The middle section or portion 16 is imperforate as shown in FIG. 1.

The inner side 22 of the plate has formed therewith a longitudinally extending spine or rib 24 which extends at full length of the plate and which is preferably at the longitudinal center thereof whereby the entire plate unit has a cross sectional configuration in the form of the letter T, the spine or rib 24 forming the leg of the T.

In carrying out the method of the present invention, the procedure preferably followed is as follows:

A careful inspection is made of the area suspected of being decayed, by sounding, wire brushing and drilling, to exactly locate all areas of deterioration. All of the exposed decayed wood is carefully removed from the body of the timber. As shown in FIG. 2, this procedure may involve the formation of a recess such as that designated 26, which might extend across the width of the timber.

The timber then is bored, in the section to be repaired, according to a predetermined pattern designed to locate all internal, non-exposed areas of decay in the section. A suitable preservative, preferably of the salt type such as Osmosalts, a water soluble powder comprising sodium dichromate, sodium fluoride and disodium arsenate as the principal active ingredients sold by Osmose Wood Preserving Co. of America, Inc., 980 Ellicott St., Buffalo, N.Y., then is applied to each bored hole under high pressure, to force the preservative into the internal areas of decay. In addition, a preservative, also pref-
erably of the salts type, is injected into the timber in the area surrounding the recess 26 and to be covered by the truss or plate 12. This is done to preserve the wood without interfering with the desired bond between the timber and the plate.

Following the removal of the decayed material, a groove or slot 28 is cut longitudinally into the timber by a suitable mechanism such as an electric circular saw. Such slot is preferably approximately one quarter inch in width and extends across the central portion of the recess 26 and into the solid wood for at least a minimum length of one foot above and below the recess. This groove is of sufficient width and depth to accommodate the full width and depth of the spine or rib 24.

After the timber has been thus prepared a high strength bonding agent such as an epoxy resin is applied usually over the surface of the recess 26 and also over the surface of the wood around the recess to cover that portion of the timber which will be covered by the plate 12, as indicated at 30.

This bonding agent is also liberally applied to the groove 28 as well as to the recess and to the area of the timber which is to be covered by and to have contact with the plate.

Prior to the setting up of the bonding agent, the recess 26 formed by the removal of the deteriorated wood is filled with a suitable fast setting cement, or other suitable filler 32 which is shaped over the outer surface thereof to bring it into conformity with the shape of the original timber.

A plate of steel or other suitable material is placed in grooves 28 prior to filling of the recess, to provide a continuous groove upon removal of the plate, and to keep the filler material from also filling the groove portions cut into sound wood. The bonding agent 30 is liberally applied to this groove, and over the surface of filler 32. It also can be applied to the inner, timber engaging surfaces of plate 12. Subsequently, and prior to the setting up of the bonding agent 30 the flange 24 of the permanent steel plate is inserted into the groove and forced in so as to bring the inner surface of the plate into the proper opposing relationship with the body of the timber.

As previously stated, the flange extends the full length of the plate and the plate is of such length as to extend with the flange the entire length of the groove 28 beyond the end of the recess or, in other words, above and below the recess, assuming that the pole or other timber is being repaired while standing in a vertical position.

After the plate has been fixed in position against the timber with the spine inserted in the groove, strong nails are driven into the wood of the timber through the holes 20 in the end portions 14 and 18 of the plate, such nails being designated 34.

A number of bands such as steel strips 36 are then placed around the timber and across the plate as shown in FIG. 1 and drawn tightly together at their ends and secured by suitable securing elements 38 of known type as shown in FIGS. 3 and 4.

Where strong adherence is not required, the recess may be filled only with a cement or other filler of high compression characteristics, the bonding agent between the filler and the timber being omitted. A coating of preservative such as Osmoplastic, comprising sodium fluoride as the major toxic component in a cresote carrier, made by said Osmos Wood Preserving Co. of America, Inc., can instead be applied to the recessed wall. In using a cement it is desirable that this be of a fast setting type so as to eliminate the use of forms and any delay caused by curing time.

The nails 34 or similar fasteners may also be given a coating of the epoxy before being driven into the wood. In this case the wood would first be provided with holes aligned with the holes in the plate so that the epoxy coated nails could be readily forced into the wood.

While the drawings illustrate, and the description refers to, plain headed nails for securing the plate in position, other fastening means such as wood screws may also be employed. In some cases, nails, screws and such fastening devices, and the holes therefore, might be unnecessary and therefore eliminated.

It is also contemplated that the steel plate and other metallic elements employed would be previously treated in a suitable manner to protect the same against corrosion.

After the strengthening truss or plate has been secured in place by means of the tightly drawn steel bands 36, the whole repair job may be covered with a suitable material such as paint or coal tar so as to render the repair substantially unnoticeable. The exposed surface of the timber in the repaired area and for a short distance thereto below is covered with a suitable preservative coating over which a moisture barrier can be applied.

Preferably, the rib 24 of the truss plate 12 is embedded entirely in sound wood, so far as it is possible to do so, thereby making available a maximum area for best bonding. Also, two reinforcing bands 36 on either side of the truss plate 12 on either side of the recess 26, and thus newly applied, are arranged in opposing relation. This is shown in FIG. 5, where the removal of exposed decayed wood left recesses 26' and 26" each substantially smaller in width than recess 26 of FIGS. 1–4.

The timber is inspected and prepared in the manner previously described. Grooves 28 are cut into the sound wood on opposite sides of the timber, between recesses 26' and 26", to receive the truss plate ribs 24. Resin 30 and filler 32 are applied, as before, although the filler can be omitted where, as here, the truss plate is not applied over the recess. The truss plates are nailed and banded in place. In this instance, the bands 36' have outturned ends 38' apertured to receive bolts 40 which extend between the ends 38 of opposing bands 36' for drawing them together about the timber. The band ends 38 can be reinforced by corner gusset plates 42, and boxed for esthetic value. Such band ends also might be attached directly to plate 12, as by welding, mechanical interlocking devices, or other means.

The method and means of FIG. 5 otherwise are the same as the method and means utilized in FIGS. 1–4. Of course, bands 36 can be used in place of bands 36' in FIGS. 1–4, and the embodiment of FIGS. 1–4 can be provided with a second, opposing plate 12, as in FIG. 5.

From the foregoing description it will be apparent that there is here disclosed a method and means of repairing and strengthening timbers of the type referred to where areas thereof have deteriorated, which method is esthetically unobjectionable as compared to other procedures such as stubbing, and relatively inexpensive as compared to replacing a whole timber. Also repairs made in accordance with the present invention can restore the timber to its original strength, or to an even greater strength in the repaired area, and the repair is of such a nature as to prevent abrupt and complete failure even under the application of extreme loads to the timber because of the employment of the several different elements of high but separate strength characteristics. The invention accordingly has a high safety advantage over other methods employed for repairing and strengthening timbers. Under strength tests of repairs made in accordance with the present invention, it has been found that the timber usually breaks before the repair. Where this does not occur, upon the application of extreme pressure, to bring about a deliberate failure of the repair such failure does not occur abruptly and completely or, in other words, the repair does not give way all at once. Accordingly, a repaired pole in use when subjected to excessive strains would not snap off and fall quickly, but such failure would proceed at a relatively slow pace and accordingly ample warning would be given by sound or sight, to
permit a person to remove himself from the area of danger.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiments are therefore intended to be illustrative and not restrictive. The scope of the invention is to be defined by the appended claims rather than by the description preceding them, and all changes that fall within the metes and bounds of the claims or their functional as well as conjointly and cooperative equivalents, are therefore intended to be embraced by those claims.

We claim:

1. The method of reinforcing a timber having a deteriorated area therein which comprises removing the deteriorated material, thereby forming a recess in and transversely of the body of the timber, forming channels in the timber by removing some of the non-deteriorated wood of the timber along lines extending longitudinally of the timber from each side of the recess, then filling the recess with a cementitious material, then covering the cementitious material filled recess and the channels with a substantially rigid truss plate of a shape conforming to the shape of the timber and having inwardly extending rib portions formed to enter the channels, and then firmly securing the truss plate to the timber.

2. The method according to claim 1, with the step of applying a coating of synthetic resin bonding material over the timber area exposed by the removal of the deteriorated material before applying the filler material.

3. The method according to claim 1, with the step of shaping the cementitious filler material to the contour of the timber prior to the application to the timber of said rigid truss plate.

4. The method according to claim 1, with the step of shaping the cementitious filler material to the contour of the timber prior to the application of the rigid truss plate to the timber, and forming a channel in the shaped filler material to comprise a continuation of the channels in the non-deteriorated wood and receive the inwardly extending rib portions of the truss plate.

5. The method according to claim 4, with the step of applying an epoxy resin bonding agent between the surface of the timber around the filled recess and the interior surface of the truss plate whereby to obtain a complete surface-to-surface bond between the truss plate and the material of the timber.

6. The method according to claim 1, wherein epoxy resin is the said channeling material.

7. The method of reinforcing and repairing a timber having a deteriorated area which comprises removing any exposed deteriorated material, forming a channel extending generally lengthwise of the timber in the deteriorated area, at least a portion of the channel being in sound wood, applying to the timber a truss plate generally conforming to the surface of the timber and having a rib entering the channel, and securing the truss plate to the timber.

8. The method according to claim 7, wherein the securing of the truss plate to the timber is effected in part by the extension of securing elements through the plate and into the timber at opposite sides of the recess.

9. The method according to claim 7, together with the steps of boring the timber in the section thereof containing the deteriorated area to locate internal non-exposed areas of the timber, forcing a preservative under pressure through the borings and into the internal areas of decay, and injecting a preservative into the timber beneath the exterior surface thereof in the area surrounding the recess formed by removal of the exposed deteriorated material all prior to the application of the truss body to the timber.

10. The method according to claim 9, wherein the preservative is of the salts type.

11. The method according to claim 9, together with the further step of applying a coating of preservative material over the surface of the timber in the repaired area and for a short distance therebelow.

12. The method according to claim 7, together with the step of applying synthetic resin bonding material between the timber and the truss body.

13. The method according to claim 7, wherein the recess formed by removal of deteriorated material is filled with a filler material.

14. The method of reinforcing a timber having a deteriorated area therein which comprises removing the deteriorated material, thereby forming a recess in the body of the timber, forming a channel in the timber by removing some of the non-deteriorated wood of the timber along a line extending longitudinally of the timber on one side of the recess, filling the recess with a filler material, then applying to the timber a rigid truss plate of a shape conforming to the surface of the timber and having an inwardly extending portion formed to enter the channel, and then firmly securing the truss plate to the timber.

15. The method of reinforcing and repairing a timber having a deteriorated area therein which comprises removing the exposed deteriorated material, thereby forming a recess in the timber, forming a pair of channels extending lengthwise of the timber on opposite sides thereof and in the deteriorated area thereof, at least a portion of each of said channels being in sound wood of the timber, applying to the opposite sides of the timber a pair of substantially rigid truss plates generally conforming to the surface of the timber and each having an inwardly extending rib entering the respective channel, and securing the truss plates to the timber.

16. The method of claim 15, wherein said channels are substantially entirely in sound wood on opposite sides of said recess.

17. A repaired timber having an area from which deteriorated material has been removed comprising, in combination with such timber, a truss of generally T-shaped cross-sectional configuration having an elongated plate portion and an inwardly extending spine, said plate portion abutting said timber and generally conforming to the surface thereof, said spine fitting a channel extending lengthwise of said timber in said area at least the opposite ends portions of said spine being in sound wood, and means securing said truss to said timber.

18. The invention according to claim 17, wherein the said means for securing the plate to the timber comprise elongated fastening elements, the plate having portions adjacent the opposite ends thereof formed with apertures through which said fastening elements adapted to extend into the timber being reinforced, and securing bands adapted to encircle the plate and the timber to which the plate is applied.

19. The invention according to claim 17, wherein the means for securing the plate to the timber comprise a banding strap for encircling the timber and the plate.

20. The invention according to claim 17, wherein the means for securing the plate to the timber comprise a pair of bands adapted to be arranged in opposed relation around the timber and the plate, and draw bolt means for interconnecting the opposing ends of the bands for drawing the bands together.

21. The invention according to claim 20, wherein said bands have out-turned ends, and reinforcing corner gusset means secured to said bands at said ends.

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JOHN E. MURTAGH, Primary Examiner.