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(Senior 1926
Thesis)

The Preservation of Fence Posts

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Introduction.



Nothing is more characteristic of the typical American industry than the practice of utilizing the most desirable raw materials first and the less desirable only when depletion of the original supply becomes a reality. Such has been the general trend in the fence post industry. Heavy inroads were made upon the virgin stands of the more durable species, and now with their growing scarcity we are facing the problem of utilizing economically the less durable woods. The application of a preservative treatment seems to be the most feasible solution. The Wood Preserving News of August, 1924, estimates that the equivalent of 103,125,000 board feet of timber could be saved from decay annually by the treatment of fence posts alone. This is important, not only in its bearing upon the conservation of our forest resources, but also because it can be made a large factor in reducing the annual expense for upkeep in those industries that use fence posts.

The preservative treatment of wood is almost universally practiced in European countries, but until recently it has been very greatly neglected in America. It is well known that the Greeks and Romans realized the antiseptic properties of essential oils for the preservation of wood. The Britons used to preserve the wood in their warships against decay, and the Dutch early learned the advantages of preserving their dyke timbers. Although

these people made early use of wood preservatives, very little was accomplished in determining the cause of decay until the early part of the 19th. century.

Cause of Decay.

Scientists were of the opinion that decay was the result of fermentation of the sap and the chemical action of the soil. Even as late as 1833, it was believed that decay in wood was due to a spontaneous combustion, and that the peculiar plants (fungi) found in connection with it were the product of this decomposition rather than the cause.

To appreciate the value of any preservative treatment, it is necessary to know exactly what causes decay, and how a preservative treatment tends to prevent it. The above theories have been discarded as it is now definitely known that decay is the result of chemical action on the wood caused by certain low forms of plant life called fungi. Wood destroying fungi produce very fine thread-like filaments which penetrate the wood in all directions. They are able to send these filaments through the wood fibers, breaking down the cell walls and utilizing portions of this decomposed material for food. This action very markedly weakens the wood, making it crumbly, stringy, or spongy,--in other words producing rot or decay. The presence of decay in its advanced stage may be detected by fruiting bodies or sporophores on the surface of the wood. Fungi are propagated by means of spores which float in the air, and find lodgment in some exposed spot where conditions are favorable to growth. Decay is also

transmitted by contact of a sound with a defective piece. Fungi require for their growth definite amounts of air, moisture, warmth, and food. If any one of these essentials can be taken from them they will die. A proper preservative treatment should accomplish this result.

It is interesting to note that the first real attempts in timber preservation were made not on account of the scarcity of timber but because of the high cost of replacing it. Without a preservative treatment, the cost of posts and replacement charges may mount up to a large figure. Railroad and Telegraph companies are at this time treating practically all wood used under conditions favorable to the growth of fungi. The soundness of this policy is well illustrated by the results of a storm occurring in Illinois and Missouri on December 19, 1924. A moderate rain accompanied by freezing temperature made a path of sleet over 100 miles wide through these two states. Many telephone wires with one inch of ice and icicles five to nine inches long weighed at least three quarters of a pound per lineal foot, and engineers have estimated that the horizontal strain, because of the ice, amounted to one and a quarter tons per span of 130 feet, with thirty wires, or approximately fifty-one tons per mile.

In these two states, telegraph and telephone companies lost some 54,000 untreated poles, while throughout the entire storm area less than 100 creosoted poles broke. The pressure-creosoted pine poles, many of which had been in service eight or nine years, did not break, although hundreds of untreated poles in the same lines were not strong enough to withstand the load.

Relative Durability of Species.

Below is a table showing the estimated average life of posts as determined by the U. S. Forest Products Laboratory.

<u>Species</u>	<u>Untreated</u>	<u>Treated</u>
Osage Orange	Over 15 years	#
Locust	"	#
Mulberry	"	#
Yew	"	#
Western Juniper	"	#
Catalpa	12-15	#
Redwood	"	#
P. O. Cedar	"	#
Cypress	"	#
Nor. White Cedar	10-15	20 and up
Chestnut	"	"
W. Red Cedar	"	"
White Oak	6-8	"
Longleaf Pine	"	"
Douglas Fir	"	"
Red Oak	2-5	"
Ash	"	"
Tamarack	"	"
W. Yellow Pine	"	"
Lodgepole	"	"
Loblolly	"	"
Red Gum	"	"

Preparation for Treatment

If a post is to be set without being treated, it makes practically no difference as to length of life whether it be seasoned or unseasoned. Under like conditions, a seasoned post set by an unseasoned post will soon come to the same moisture content, and decay may be expected to attack one about as soon as the other. However, to secure the best results from a preservative treatment, posts should be peeled and thoroughly seasoned. The durability of a post does not depend on the season of the year in which it is cut. There is some advantage

in winter cutting, in that if left to season naturally, deep checking is less apt to occur. It is necessary that all bark be removed, since most preservatives will not readily penetrate bark, and all portions of the post covered by bark at the time of treating would be practically free from preservation.

As a rule, sapwood takes preservatives more readily than does heartwood, sycamore and hemlock being the only exceptions. This is an apparent advantage, as the post supply of the future may be expected to come from species having a fast growth rate in early life and, consequently, a large amount of sapwood. Assuming this to be the case, our problem will deal chiefly with the preservation of round posts.

Wood with open pores, such as red oak, slippery elm, tupelo gum and birch, are easily penetrated, but wood in which the pores are closed or partly closed by tyloses or gums, as in the heartwood of white oak, chestnut, red gum and sugar maple, is penetrated with great difficulty. No distinction as to penetration can be made between ring porous and diffuse porous woods, or even between hardwood and conifers as a class. The density of a species of wood does not govern its penetration by liquids, although in creosoted conifers the dense summerwood nearly always shows better penetration than the adjacent springwood, except near the ends where the springwood is also easily penetrated. To be effective, the preservative must penetrate the wood, and the best treatment is the one that gives the

greatest penetration with the least absorption of oil.

Preservatives Used.

The practical introduction of the so-called creosoting process began in 1838, as up to that period such treatments as were applied to wooden materials were done by makeshift methods.

Sometime in the early 30's, a director of the Paris Mint took out a patent covering an apparatus for injecting chemicals into timber by means of vacuum and pressure in a closed, air-tight iron cylinder, and this idea was adopted and later improved, by others.

To the pioneers during the early 50's must be given credit for the intensive, intelligent work and the building of the foundation upon which the present industry is based.

Considerable care should be exercised when purchasing preservatives to guard against inferior grades or substitutes. Many Proprietary preservatives are to be found on the market today, but the cost is usually high and the actual value hard to determine. Wood tar creosote and water gas tar creosote have been used to some extent but are not to be recommended. Some idea as to the extensive use of coal tar creosote may be gained from the fact, that there were 76 million gallons sold in this country in 1921.

To be effective in the treatment of fence posts, a preservative should possess certain characteristics. The most essential of these are; availability, relative cheapness, toxicity to fungi, ability of penetration, non-corrosive to metal, and

ability to withstand leaching.

The preservatives most commonly used today are coal tar creosote, zinc chloride, sodium fluoride, and mercuric chloride. Of these, the first two have the widest application, but since zinc chloride is subject to leaching, coal tar creosote has been found to be the most suitable for fence post treatment, and only methods of its application will be dealt with in this paper. Experiments have been made in attempts to use paraffin, but its preserving qualities are not sufficient to warrant extensive use.

Charring has been found of little value in protecting the base of posts from decay. This is shown by service tests made by the United States Forest Products Laboratory on fences of charred and untreated posts of various species. Charred posts proved in these tests to be even less durable than untreated ones.

Theoretically, an area of charred wood around a post should prevent decay because charcoal does not decay or encourage the growth of fungi. But the charred area around the post is not usually a solid covering, but is checked through in many places. If posts are seasoned before they are charred the charring does not reach to the bottom of season checks, which are always present. If green, unchecked posts are charred, checks will open through the charred area as the post seasons. Charring deep enough to resist decay would undoubtedly weaken a post of ordinary size.

Attempts to preserve posts by applying a coat of concrete have failed chiefly because the concrete cracks and drops off. Setting in a concrete base may serve as protection against some of the physical forces of nature, but is apt to provide an ideal place for the collection of water, and so cannot be recommended.

The theory of boring holes near the base of the post and filling with corrosive sublimate has not proved successful. It is found that the preservative is not equally distributed throughout the base of the post, and holes very materially weaken the post.

Methods of Application

The most effective commercial treatment of posts is accomplished by the use of pressure. Impregnation under pressure is the most satisfactory means of injecting preservatives into wood, and while the various pressure processes differ in details, the general principle is the same in all cases. By the use of pressure, the penetration of the preservative is subject to control, so that the amount of the preservative and the penetration may be varied to suit the different requirements, and thus result in an economical use of preservatives.

If pressure treatment is not feasible in any case, then other methods may be used. For creosote these consist of dipping, brush treating, or spraying. If the timber is well seasoned and the non-pressure treatments carefully made, the additional life

secured well warrants the expense.

A pressure treating plant consists principally of one or more treating cylinders six or seven feet in diameter, about 125 feet long and capable of withstanding a working pressure of 125 to 200 pounds per square inch. Inside the cylinder is a track for the tram cars which carry the wood to be treated. Various methods may be used for the movement of these cars. The treating cylinder is provided with heating coils to heat the preservative, which penetrates the wood more readily when hot.

The pressure processes for the treatment of wood are grouped into two classes. First, the full-cell process, the object of which is to fill the intercellular spaces of the wood as completely as possible with the preservative. Second, the empty-cell process, the object of which is to secure as thorough and deep a penetration as possible with the use of a minimum quantity of preservative.

In the full-cell process the seasoned posts are placed in the retort, a vacuum drawn, and, without breaking the vacuum, the cylinder is completely filled with the preservative fluid. The vacuum not only accelerates the entrance of the preservative into the retort but also makes it possible to force the preservative into the posts more quickly and with less pressure than is the case when the preservative must displace or compress the air in the wood. After the retort is filled, additional

preservative is forced into the cylinder by means of pressure pumps, the pressure being gradually raised to, and maintained at, 125 to 175 pounds per square inch at a temperature of about 180 to 200 degrees Fahrenheit until the required amount of creosote has been forced into the wood. The pressure is then released and the preservative drawn from the cylinder. With this process about ten to sixteen pounds of creosote oil per cubic foot of wood treated is considered standard practice. The expense of the method may prohibit its use for farm purposes, but it has practical application for special purposes.

In the empty-cell process, a vacuum is not drawn preliminary to admitting the oil, but, on the contrary, air is pumped into the cylinder, and thus into the wood, under considerable pressure. Then, while the air pressure is maintained, creosote oil is pumped into the bottom of the cylinder. As the oil enters, the air is gradually released from the cylinder, but without allowing the pressure to drop. In this way the cylinder is filled with oil, but a considerable quantity of air is entrapped in the wood.

More oil is now pumped in and the pressure increased. This compresses the air within the wood and forces oil in on top of it. When sufficient oil has been injected, the pressure is released and the oil drained from the cylinder. A final vacuum is now drawn. This great reduction in pressure allows the air entrapped in the wood to expand and force some of the

oil out of the wood. By this process the wood retains about five to nine pounds of oil per cubic foot.

For the treatment of posts in limited quantities, where costs of the apparatus for pressure treatment are prohibitive, the open tank or dipping process is recommended. The theory of the open-tank process is that the heat expands and expels a portion of the air and moisture in the cellular and inter-cellular spaces and, as the preservative cools, there is a contraction and condensation of air and water that remains. By this action the preservative is drawn into the wood. In seasoned timber, air, and in green timber, water, is the chief element to be removed before the wood can be impregnated; and since air can be expelled much more easily than water, seasoned timber is the more successfully treated.

Standard equipment for this practice consists of a tank of such size that the posts may be placed in it and covered with preservative. This tank is provided with coils for heating. An additional tank, in which to place the posts for cooling is necessary. A fifty-gallon steel drum will be adequate for this purpose.

In the open-tank process, the posts are placed in the tank of liquid and completely submerged. The liquid is then heated to about 175 degrees Fahrenheit and this temperature held until the posts are thoroughly heated. They are then removed to the smaller tank which contains cool liquid and allowed to

cool. If no second tank is available, the heat may be removed and the posts allowed to cool in the original tank.

The simplest method of applying creosote is by the brush treatment. The equipment required consists merely of a large kettle for heating the oil, a small pail, and a paint brush. For best results the preservative should be heated to about 200 degrees Fahrenheit before application. It is then simply painted on with the brush. Usually two coats are given the post, being sure that the first coat is dry before the second is put on. This method has the advantage of being cheap and simple, and of using a small amount of oil. It is best adapted to durable species.

Since decay is more active where the post is in contact with the ground, often only a butt treatment is applied. This method of treatment is similar to the open tank process, except that the posts are placed in the tank in a vertical position and not completely submerged.

Recently the idea was conceived of puncturing the ground line area to increase depth of penetration and provide extra protection. As a result came the invention of the Pentrex machine. With this machine the poles are punctured at the ground-line area by forty-two iron bars, four and one-half feet long, three inches wide, and three quarters of an inch thick. Each bar is equipped at the bottom end with a detachable point holder, so the depth and spacing of the puncture can be accurately gauged. Each bar works independently of all the

others, in order to take care of the irregularities of the pole. These bars are raised by cams and dropped by gravity. The post is transported under the bars by live rolls and raised into position by hoists.

The specifications for the Pentrex treatment are as follows: (a) The portion of a post's surface within a distance of one foot above and two feet below the ground line shall be punctured. (b) The incision shall not exceed one-half inch in depth or one-eighth inch in width. The distance between the edges of adjacent incisions measured along the surface shall not be less than three-eighths inch in a plane perpendicular to the axis of the post, and not less than five-eighths inch in any other plane. (c) The depth of penetration in the punctured section of any post shall not be less than three-eighths inch.

The cost of a preservative treatment depends on the price at which the creosote is obtained, cost of the apparatus, number of posts treated, the labor and fuel charge, and the per day capacity. An average figure may be placed at between ten and twenty cents per post, the actual cost depending on the above mentioned factors.

The direct saving resulting from any treatment depends largely on local conditions. The chief points to be considered are the comparative cost and the average life of treated and untreated posts. It is estimated that an open-tank treatment will give posts a twenty year life. This is about three times the average life of untreated posts in use today. The decrease

in replacement charges, together with less cost for raw materials, should in any event justify the use of a preservative in some manner.

Conclusion

In conclusion, it would seem that with the general trend toward closer utilization, the greater scarcity and higher price of raw materials, and the direct money saving by a preservative treatment, there will be a tendency in the future to apply a preservative by some of the above described methods to all wood used under conditions favorable to decay.

The practice of wood preservation has increased by leaps and bounds in the last two decades. Large users of post and pole materials have been convinced that the application of some preservative is justifiable from an economic standpoint and many of them are treating a large per cent of all posts set. If economical for large companies, preservative treatment of posts should also find favor among the farmers of the nation. Taken collectively, the farmers probably use more posts than any of the larger industries.

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