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WOOD PRESERVATION.

One of the greediest mouths which the forests of the United States are required to fill is that of the railway demand for ties, bridge timber, etc. According to "Poor's Railway Manual," there were in the United States at the close of 1883, 121,592 miles of railways. The average number of ties needed per mile of track is 2,820, and the duration of a tie averages about six years; hence the annual consumption of ties by all the railways of the country amounts to the stupendous total of 57,148,240. This number of ties represents, at the lowest estimate, 144,203,933 cubic feet of timber, enough to make 1,714,447,700 feet of lumber. At 20 cents a tie, the value of the ties laid yearly foots up $11,429,648. The amount of white pine cut in the Northwest in 1883 was not four and a half times larger than the above figures, a comparison that readily shows how much timber this one branch of the railway industry demands.

It must be borne in mind that we have only given statistics here of the number of ties required for the existing railways, but this large total is being continually increased by the construction of new lines of road, and we have omitted any estimate of the quantity of timber in other forms required for railways, wharves, bridge timbers, etc. etc.

In view of the enormous draft on the forests of the country, it is evident that the time is approaching when scarcity will cause an advance in price. The not remote prospect of such an advance, as well as the present economy of a proper conservative treatment, has induced several railways in the United States to conduct experiments looking towards some feasible means of timber preservation, and the American Institute of Civil Engineers has been for some time past collecting information regarding the various processes for this purpose, with the object of embodying such information in a report to be given to the public. The question of timber preservation is one of national importance, and as it is the aim of this journal to keep its readers informed in regard to everything connected with the lumber interest, we do not think we need to apologize for devoting considerable space to an account of the causes of the short life of timber used by railways, together with a description of some of the methods for its preservation.

There are two principal causes of the destruction of timber in use by railways, namely, decay, and mechanical wear. When wood is exposed to the atmosphere its decay may be considered a species of fermentation set up by the combined action of heat and moisture in the watery and albuminous constituents of the wood, which gradually convert it into *humus*, or rotten wood, this process being at the same time expedited by the presence of numerous boring insects, which take up their abode in the cells of the decaying wood and feed upon its juices.

The object of any national treatment for preserving wood is the coagulation of the albumen by substances capable of effecting this; of these the most effectual, as well as the most practical on account of its low cost, is creosote, which exercises a powerful action in the coagulation of the albumen and is also so destructive *to all kinds of insect life as to completely* exclude them from any wood which has been treated with it; the presence of a sufficient quantity of creosote in any liquid at once and completely arresting the fermentation for an unlimited time, and destroying all germs of animal and vegetable life.

Of the substances containing creosote the two most important, and in fact the only one available for this purpose, are coal tar and wood tar. When coal tar is distilled in iron vessels there is produced in addition to other substances, as naphtha, etc., about 30 per cent. of the so-called creosote, or dead oil, which has since 1850 been used in continually increasing quantities for this purpose. The quantity of coal used for gas making in Europe is about 10,000,000 tons annually, producing about 5 per cent. of tar, yielding about 155,000 tons of dead oil, the whole of which is available for treating timber. There is also a very large quantity of coal tar produced as a bi-product of the gas manufacture, in the United States, but excepting in a few cases nothing has been done towards utilizing the dead oil contained in it.

The second substance, wood tar, referred to above, is the tar produced by the destructive distillation of wood for the manufacture of charcoal. Considerable quantities of this substance are produced, but as yet it has been only considered as a waste substance or available for fuel.

As wood tar contains a large percentage of true creosote, which is entirely absent in the case of coal tar, it is a better preservative of timber than any of the constituents of coal tar, and recent experiments have demonstrated that it may be used by itself for this purpose if forced into the cells of the timber while heated and in a fluid state. Many other substances have been proposed for treating timber, but on account of their cost and the comparatively small quantities produced are not available to any important extent for this purpose.

The method of treatment which is generally considered to be the most thorough, practical and rational, is that which involves first the subjection of the timber in close vessels to the action of high pressure steam for a sufficient length of time to enable the steam to penetrate all the cells of the wood and to vaporize the liquids contained therein, these being afterward removed by a vacuum pump. After this preparatory treatment the preserving substance is forced into the cells of the wood under powerful pressure, the quantity of this substance being regulated according to the use for which the timber is destined. If simply to be used for bridges or elevated structures the quantity of the preserving substances required is less than for ties, and if for use under water or exposed to the attacks of the teredo the largest amount which can be forced *into the wood becomes necessary.*

The apparatus needed for treating timber by this method is simple and comparatively inexpensive. It consists of a cylinder of boiler plate, the size of which depends upon the dimensions of the timber to be treated. This cylinder is made strong enough to resist a pressure of 300 pounds per square inch, and has a track extending for its whole length along the bottom, the ends of the cylinder being closed by strong iron doors, provided with suitable means of rendering them air and water tight. Iron cars, having wheels of small diameter fitting the track on the bottom of cylinder, are provided to carry the timber on ties while under treatment. A steam boiler with vacuum and force pumps, also reservoirs fitted with steam coils for containing and heating the preservative substance are also provided. The operation may be briefly described as follows. After the cars loaded with the timber for treatment are run into the cylinder and the doors closed, steam at about 100 pounds pressure is injected into the cylinder and the supply continued for a length of time depending upon the nature of the wood and its dryness. The steam is then shut off and the vacuum pumps started and kept at work as long as any liquids or vapors are obtained. The vacuum pumps are then stopped and the hot preserving liquid allowed to flow from the reservoir into the cylinder until it is filled. After this the force pumps are started and their action maintained until the pressure in the interior of the cylinder rises to about 200 pounds per square inch, the pressure being maintained at this point until a sufficient quantity of creosote oil or other preservative liquid is forced into the cells of the wood. The force pumps are then shut off and the creosote oil or other liquid contained in the cylinder discharged into a suitable cistern, after which the doors at the ends of the cylinder are opened and the car carrying the timber or ties run out.

When wood has been creosoted in the manner described, paying proper attention to the complete removal of water and juices previous to the injection of the creosote, the density of the wood will be found to have considerably increased, and that its tenacity for holding spikes, etc., as well as its ability to resist mechanical wear has also increased to a very notable extent. One of the southern railway constructors stated some time since in a report on this subject that in his opinion (we quote from memory), a soft wood tie properly creosoted is much more valuable, both as regards resistence to decay and to mechanical wear, than the best white oak tie; in fact he considered creosoted soft wood ties worth $1 each for railway use.

One of the principal causes of the rapid destruction of ties from mechanical wear is imperfect road beds, but we think that as ties *become less abundant and more valuable more* attention will be paid to devices for protecting them from the direct action of the rails, and, as the life of a creosoted tie when exposed to decay alone, is practically unlimited, the advantages of creosoting will under those circumstances become still more apparent.

The principal item in the cost of preserving is the quantity and cost of the preserving substances. In the case of ties, three gallons of dead oil or of wood tar will be required, while for bridge timbers a smaller quantity will suffice.

The cost of treatment, aside from the cost of the preserving agent, will not in the case of ties vary much from five cents per tie. The cost of dead oil ranges from seven to ten cents per gallon.

Ties for creosoting should be carefully selected, as it is manifestly poor economy to creosote a tie in which decay has already commenced.

The necessity of a most thorough preliminary treatment of the ties for the removal of fermentable substance cannot be too strongly insisted upon, as the value of the subsequent preserving process depends almost wholly upon its proper performance, and its neglect has been the cause of frequent failures in wood-preserving operations. It is not long ago that complaints were made in some European journal that creosoted beech wood ties became rotten in the middle of the tie while the outside for an inch or two in depth remained perfectly sound. The reason for this condition of the tie seems clearly traceable to neglect of a proper preliminary treatment of the tie; the water and juices had been removed from the surface of tie, but not from the interior. Consequently the creosote oil was unable to penetrate that portion of the tie on account of the cells being already filled with water.

We do not wish to be understood in this article as advocating the immediate adoption in all cases of wood-preserving processes, for this will depend largely upon the cost of the ties. In many localities their cost is still so low as to preclude any treatment of this kind, but there are many others in which their cost has already increased beyond the point where creosoting may be profitably employed, the area of such localities is continually increasing, and it needs no prophetic vision to forsee that in the near future the adoption of some preservative process for wood will become universal.—*Northwestern Lumberman.*