The Preservation of Railway Ties.

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The question of a future tie supply for railways has, for a decade or more, been a serious one in the United States, owing to the rapid depletion of the forests, and within the past five years the anxiety has spread to Canada.

Nearly five years ago the writer became, in the course of other business, acquainted with Geo. W. McMullen, of Picton, Ont., a man who had made the conservation of waste a life study and who had made wonderfully successful studies in other fields. The conversation turned on one occasion to the subject of the preservation of timber, and in the course of it some facts and theories of extraordinary interest were developed. Mr. McMullen had, in the course of other investigations, become possessed of a fairly complete laboratory and was in close touch with modern bacteriology and practical chemistry. As a result of the acquaintance, experiments of great interest have been made, involving an entirely new process of drying timber, and more especially with reference to railway ties, the supply of which has become, within the last few years, a most momentous question with the railways. More particularly has this become so in Canada, owing to the depletion of the forests and the great increase in railway mileage during the past half decade.

Average Life of Railway Ties.—Assuming the average life of ties, for instance, at six years, the Canadian Northern Ry. alone will need over 4,000,000 a year and the other two trunk roads something more than this, or say from 12,000,000 to 15,000,000 in all. Our northern forests cannot stand this drain for any length of time, much less can we hope by any reasonable efforts in reforestation to keep abreast of the demand. The timbers used are slow-growing ones, with the exception of jack pine, and even this takes 30 or 40 years to attain sufficient size.

There are two means by which we can stave off the impending famine, one by increasing the life of the timber tie, and the other by using some other material, such as steel or concrete. Such experiments as have been made in the latter expedient have not been altogether satisfactory from the point of view of economy, even where they were so physically.

The first expedient is the only one which has come into any considerable use on this continent and it has usually taken the form of injection of creosote into the pores of the wood. This acts as an antiseptic, preventing the bacterial growth which results in decay through what we are accustomed to call "rot." The creosoting process, while a great advance on the use of raw woods, is by no means a perfect cure; first. because it is expensive, nearly doubling the cost of the tie; second, the timber is somewhat weakened in the process, owing principally to the high temperatures to which the wood is subjected; third, to be at all effective the timber should be thoroughly seasoned or dried, and this is hardly practicable by existing means, except by the consumption of a large amount of time and space and the locking up of a considerable amount of capital for that time. The Germans stack and air-dry their ties for 18 months or more before treatment, and even then do not get a dry tie or perfect product, and in America it seems to be seldom that more than one-third to one-half of this time is allowed.

Dry Woods Almost Indestructible.—According to notable chemists, dry woods or cellulose are almost indestructible by any ordinary agency such as the tie is exposed to. The bacterial growth requires moisture and oxygen for its development. It would appear, therefore, that if we thoroughly dry a piece of timber, and keep it dry, it will last indefinitely. We know from actual experience that this is so. Everyone has used or seen old timber in the form of beams and joists taken from buildings two or three centuries old and perfectly sound. In these cases moisture has been excluded. Again, every one has seen, or at any rate read, of piles and foundation timbers many centuries old in a perfect state of preservation. In these cases oxygen has been excluded. We all know that exposed timber will generally last longer when coated with paint or tar or some waterproofing material. The exceptions are where the timber has been waterproofed before it was seasoned, with the effect of retaining the moisture already in the stick and preventing its evaporation. Timber, even when air-dried for a considerable length of time, still contains 15% or more of moisture, the percentage varying with the nature of the material and the size of the stick.

Seasoning Timber Increases Strength.—Another point not so well recognized or understood is that seasoning timber increases its strength by as much as 80 to 100% in some cases, over that of the green stick. It will be seen at once that, consistently with reasonable expense and loss of time, it is well worth while to dry not only ties, but timber of any kind used as a beam or strut, where strength is necessary. If we increase the strength by even 60%, we require only 62% of the amount of material, and, as this percentage is dry, while the other contains a very large amount of moisture, the saving in freight is very much more than the apparent 38%. In Eastern Canada, at any rate, transportation is a very large item in the cost of our timber and is compelling us, as a matter of expediency, to use steel and concrete where we should use timber if it were readily available.

It being granted that drying or seasoning is extremely desirable, the question is as to the means. In the case of ordinary lumber, air-drying supplemented by a few hours in a kiln is fairly satisfactory. In that of dimension timber it is not so. First, because the air-drying in the case of large sticks takes years to accomplish, because the temperatures used in the ordinary kiln are so high as to injure the strength of the timber; third, because, even when carried on with the greatest care and deliberation, the outside laminae dry first and shrink before the heart of the stick has any chance, and this shrinkage causes checks and cracks which, for many purposes, render the stick useless.

When the "wooden walls of England" were a reality, the seasoning of large sticks was carried on by immersion in sea water for three years, more or less, the saps and resins were dissolved and washed out, and the pores of the wood left open and filled only by water. The subsequent drying was then easily, quickly, and uniformly carried on throughout the stick, and the resultant deposits of salt acted as antiseptics, just as the creosote does in the modern process. This was perhaps the most perfect seasoning possible, or ever accomplished. The process was very likely suggested to the English shipbuilder by his observation of the condition of logs and driftwood which, after years of immersion, had been cast upon his shores by the Gulf Stream and local winds and currents. The Eskimo knows no other process than this and his woods are very perfect and lasting; but, in these days of rush and hurry, it cannot be expected that anyone will prepare his material three or four years in advance. Probably the excellent reputation which Canadian white pine had with the British Admiralty was largely due to its long immersion in the waters of the Ottawa and the St. Lawrence before it was finally loaded on shipboard.

Wash Out Sap and Other Liquids.—In the experiments made in the last two years, as above mentioned, an effort was made to use the same process that nature does, and dissolve, neutralize or wash out the sap and other liquids or semi-liquids which obstruct and close the pores, and to do this within a reasonable time, much faster than nature unassisted can accomplish the work. Hot water is more effective than cold water, and hot vapor of water is, in some cases, still more so. In the new process, which is simplicity itself in theory, although the best form of mechanical application took much time and thought to study out, warm vapor, or in other words, warm air, saturated with moisture, is circulated among the ties. This opens and cleans the pores of the wood just as a Turkish bath does in the case of a man. The liquid components of the saps and resins, filling the vesicles themselves, expand with the heat, and force their way out, to be diluted and carried away by the warm vapor. After some hours of this treatment, the amount of moisture is reduced by very slow degrees, until, at the end, it is practically dry and the timber is removed with not more than 5% of moisture left in it. The rapidity with which this is done depends upon the size of the sticks and the nature of the timber, just as it does in other methods, but no subject has yet been found which did not, in the end, yield to treatment. Care is taken not to let the temperature of the kiln get above 160° F. so that no injury may be done to the fibre of the wood.

Coating to Exclude Moisture.—Timber so treated is, I believe, indestructible, except by fire, so long as it is kept dry. Even without further treatment, it will undoubtedly long outlast unseasoned material. It is, in this shape, in pre-eminently good condition to receive creosote, but we believe that creosote is absolutely unnecessary and that the elements of decay being altogether removed from the inside, all that is necessary is to keep them from entering from the outside. Some waterproofing coating is desirable, and in the case of ties a cheap one is the only one which can be economically used. In the experiments so far conducted a heavy oil tar was found, which answered the purpose perfectly, and which is an almost worthless by-product of the refineries. The ties are merely dipped in a hot bath of this material for a few minutes and, on coming out, are sanded by a sand blast, to absorb any superfluous