

same as it does in mortars of hydraulic cement. I have been for a long time aware that it was a very easy matter to wash out the timber when fresh cut, and get the first chemical in by the Boucherie process; but I was not sure about getting the second in, as I was afraid that chemical reaction would take place too quick when one chemical met the other, and the capillary tubes would become choked. (Some years since, Mr. Ransome came to New York to introduce his artificial stone called "Apenite," and told me that he produced his results for stone in the same way that I proposed to preserve timber—namely, by the use of two chemicals with cementing properties when combined; he mixed the sand with one, moulded the blocks to shape, and then forced the second chemical in by pressure; the two combining, and forming an insoluble salt, cemented the grains of sand together, and formed a good durable stone. I have cut into a piece of Mr. Ransome's "apenine," to make it hold water like a cup, and then subjected it to the rains, freezings, and thawings of a whole winter, and could not disintegrate it.) Timber that has been washed free of its albumen and filled in with inorganic matter cannot decay; there is nothing in it to decay, it is made up of carbon, as inorganic salts. I allude to timber that has been brought to its utmost perfection of preservation; but this in everyday practice would be expensive and tedious, and, for most purposes where timber is used, not called for in railway practice and economy. Timber, subjected to such treatment as I propose, would outlast two or more sets of steel rails, and get worn out before it would rot out.

(2.) *As to Inflammability.*—I would answer, if we can wash out timber, if we can fill the vacant spaces with inorganic matter, and if the vacant spaces in timber are of greater cubic capacity than the fibre of the wood, is it not reasonable to suppose that it cannot be easily set fire to? If we can run a red-hot poker into a barrel of gunpowder that has been mixed with sand in equal parts, and not explode it, we ought to count with reasonable certainty on not readily firing a stick that has more than half of its ingredients inorganic in composition; nor could an engineman make much steam if furnished with such wood as fuel. An engineman that tried to kindle his fire with dried pine-sticks, that had been used for any time to stir whitewash, would soon find that he was on a fool's errand.

(3.) *As to Shrinkage.*—I would answer: Timber, when first cut, has its tubes filled with a liquid representing, with other volatile matter, more than one-half of the whole. When all, say a greater part, of the volatile matter is driven out by heat and atmospheric currents, or otherwise, the particles of fibre formed in tissue tubes have a tendency to consolidate, to cling closer together, to concentrate each on itself, then in groups, and lastly on a common centre. This contraction goes on for many years, and must astonish any one that has watched it in thin sections of fir or pine, under the microscope, and measured the shrinkage with micrometers. Each year it will contract, and, when subjected to an atmosphere surcharged with moisture, it will absorb water and expand, only to lose the water again at the next hygrometric change, and shrink to smaller dimensions than ever before. Now, if we can fill these tubes, or partly fill them, with an insoluble salt, we can in a measure arrest this shrinkage—to what extent no one has as yet ascertained, for no one has carried out fully the process I would propose, namely, to wash out the capillary tubes from one end, by forcing water through them, then, by same process, force two chemicals into the timber, one after the other, the latter to act as a re-agent, combine with the first, and form an insoluble salt. Boucherie has done the washing and sending in one chemical by a simple, inexpensive, and most philosophically correct method. Payne and Thilmany have both used two chemicals, and aimed at an impregnation resulting in an insoluble salt in the wood, but by a method which is mechanically and philosophically incorrect. The representatives of the Thilmany process claim to be able to send the second chemical into the centre of large timbers, and produce the result aimed at. If they can do this by pressure on all sides and ends of a stick, the tubes of which are already filled with a ponderable liquid, it looks reasonable to suppose that the second chemical can be forced in from one end if there is no resistance at the other.

(4.) *As to the ravages of the Teredo.*—I would answer: The early writers on the habits, character, and intentions of this terrible worm, appear to have all got in a fog as to why and what for he bored a hole in a stick, and not being content with one, he bored two, or a dozen, and made himself about as disagreeable and destructive as a worm could well be. Linnaeus, Cuvier, Blainville, Lamarck, and Sir Everard Home, all writing before the era of creosoting and chemical preservation of timber dawned on railway economy and harbour works, appear to agree that this abominable specimen of animal life bored for a habitation, and not for sustenance. They placed "this beast" among the Vermes Testacea, and then confounded him with a genus, *Tubicolæda*, which does bore into timber, shells, and stone expressly for a habitation. He bores a small hole even in the hardest stone, sits in it quietly, and spends the remainder of his days in fishing; while the other fellow goes, like a "tramp," after something to eat, wandering around in the dark, and doing all the damage he can. It was left to our day and times to show that this unmitigated scoundrel bores for sustenance; and, it may be, for the fun of the thing (as a live Yankee is said to sit on a fence and whittle a stick of pine-wood by the hour, just for the fun of the thing) and to try his auger, for it is keen and sharp, and he is a clever and quick worker. I have spent days in wonder, while dancing attendance on this specimen of animated nature, digging him out of timber and watching his work and habits, in the Bay of Panama, where I also saw some beautiful specimens of *Tubicolæda*; so I have had an acquaintance with both of them of over thirty years, and again had to pay his majesty the teredo marked attentions when Engineer of Harbour Defences of New York, during the civil war. At Colon, on the Atlantic side of the Isthmus of Panama, the teredo cut off piles of ten inches diameter in less than one year. I have cut these worms out of piles at Tobago that were eight inches long, and could bore a hole of nearly a half-inch in diameter. It has been found that the teredo will not bore into the palmetto of Carolina, or the green-heart of Guiana; it does not appear to suit their appetite, nor does timber that has been creosoted, so we can congratulate ourselves on there being something that will arrest his devastating war on our harbour works.

(5.) *As to Preserving Timber free from Poisonous Vapours.*—I would answer, that this can easily be done by using none of the expensive and poisonous chemicals such as chloride of mercury, sulphate of copper, chloride of zinc, &c., but, in their place, inexpensive chemicals, such as can be easily manufactured by any intelligent people and in any part of the world, as the elements I would use can be found anywhere—namely, silicate of soda (silex dissolved in caustic soda, under pressure) and chloride of calcium (the basic salt of lime). Silex, lime, and soda, the inorganic elements from which these chemicals