are made, can be found in quantity everywhere, can be easily and cheaply procured, and any people can be easily and quickly instructed as to their reduction and manufacture into salts.

To get these chemicals into timber I would adopt the Boucherie process, which I will now describe:

The Boucherie Patent.

Boucherie, an eminent French chemist who had long studied the nature and properties of timber, its structure and component parts, its growth and development, the results of a liquid called sap, formed of elements from the earth, gathered by the roots, and carried up in the capillary tubes to the laboratory of the leaves, where Nature directed certain changes and additions to be made, and then sent it down again to carry out the functions of building up and extending the woody structure, by depositing atoms in the fibre, and feeding all parts so they may grow, thrive, and be useful to man. Boucherie was led to experiment: he found that it was an easy matter to force any liquid through the whole length of a piece of timber that had been newly cut, and had in it its sap in a liquid state. He discovered also that the capillary tubes through which the sap is carried, and which form the strength and value of the timber, were continuous, and without lateral connections; for he could fasten a hollow ring, a cross, or a letter on to the end of a stick of timber, and then, by turning on a pressure with a coloured liquid, he could produce in the same color the same ring, cross, or letter at the other end of the timber. Long before his time, it was known that the elements of decay were in the sap, that the elements of strength and value were in the fibre of the tubes, and that they were carbon. By a simple train of reasoning, he came to the conclusion that he could, by pressure, run water through these tubes and wash out the organic matter, then fill the tubes with inorganic matter in solution, and in that way preserve the timber from decay He adopted the sulphate of copper as the chemical to use, devised a simple and cheap apparatus, took out a patent, and started it into useful operation. If he ever attempted to force in a second chemical, and make an insoluble salt in the wood, I never heard of it. His apparatus consisted of a wooden reservoir to hold his liquid chemical—this he erected some 25 to 30 feet above the ground, in the forest, or near where the timber was cut; some caps to go on the ends of the timber; some flexible tubes to connect the reservoir with the caps; some pumps to pump the liquid in the elevated reservoir, and the apparatus was complete. As far as I know, Boucherie never attempted to wash out the logs before running in the chemical, nor did he attempt to make an insoluble salt inside the timber; but what he did do was a great step in advance in the preservation of timber, leaving us to improve on what he did and perfect the system. I enclose a sketch, showing the manner in which the process was carried out. It shows Figure 1, a small reservoir, elevated on a frame made of poles held in position by lashings, and how a bed of forty sleepers can be treated all at one time. Treating a double-sleeper log is more fully shown in Figures 3 and 4. A log of double the length of a sleeper is cut transversely nearly in two, at the middle; a grumet or packing is inserted around the edge of the inner bark; a hole is bored in one piece to reach the saw-cut, a tube from the reservoir inserted, and the liquid under pressure turned on, to find its way out at the other ends by pushing the sap out first. Boucherie first experimented on live trees, while standing, by cutting off the tops; then hollowed out the upper ends, and filled them with a coloured chemical in solution, which descended in the timber, so he could see the colour and detect the salts in the lower parts of the trees.

With the knowledge of Boucherie's process, and the results he obtained, before us to reflect on, experiment on, and try to improve on, I would suggest the following process for all railway timber:—To cut logs to suitable lengths, to lay them while fresh cut in beds of twenty or forty, or such number as may be found the most convenient, to fasten on one end of each a suitable cap, made adjustable to logs of different diameters, and then, with a portable pumping engine, first wash out the timber by forcing warm water through it under a pressure of 50 lb. per square inch, or more, taking care to not heat the water sufficient to coagulate the albumen. By this operation the sap will be driven out, and, with it, much of the deleterious matter. Then force in the silicate of soda, coloured, so it can be seen when the water has been pushed out; then, with another pump and pipes, force in under full pressure the chloride of calcium, the two forming, when combined, a silicate of lime. If this second chemical can be got through before the reaction takes place—resulting in the water of the chemicals being hydrated and a dry insoluble salt formed—we may count with certainty on having timber that will last for ages, that cannot be burnt in any ordinary fire, that will not shrink much, that will most probably resist the ravages of the teredo and white ant, and that will not throw out noxious vapours, for you will have timber that is partially stone. If the second chemical cannot be got through, on account of the quick reaction and the choking of the tubes at one end, choke, say stop up, the other ends in the same way, confine the first chemical in the timber, and in time it will combine with the woody fibre and become a species of semi-petrifaction.

Timber that has been washed out by hot water, and then filled in with a hot solution of chloride of soda (common salt), and sun dried, or desiccated by currents of hot air, will be preserved and in a condition to last many years. At Syracuse, in the State of New York, there are hundreds of acres covered with vats devoted to salt making by solar evaporation; these vats are of wood, and are erected on sticks driven in the ground and standing about four feet high; the salt water from leaks trickles down and saturates these supporting sticks; no one of them is ever found decayed. By pumping ordinary sea water into a barrel hoisted into the top of a tree, say 25 or 30 feet above the ground on which sleepers lay, a hydraulic head can be obtained, which if applied through a flexible tube to the end of a newly cut piece of timber will wash it out thoroughly, if run long enough, and leave it in a condition when dried to last many years; this is certainly a cheap process, and within the reach of most people.

With a coloured liquid in a reservoir elevated 25 feet above the ground, where lay a stick of poplar 10 feet long by 10 inches diameter, the two connected by a tube, I have seen the sap begin to run out in three minutes, and in five minutes more the coloured liquid came through. I see no good reason why, after timber has been washed of its bad elements, it should not be filled with hot creosote oil by the Boucherie process, without resorting to the huge and costly apparatus used in the Bethell, Hayford, Thilmany, and other patented processes. The Boucherie apparatus, besides being more philsophic in its conception and operation, has the advantage of being much less costly; also in being easily