

*The Philosophy.*

All timber is composed of fibre, and albumen or sap. The fibre, separated from the sap and volatile parts, is nearly pure carbon, consisting of small continuous tubes or capillaries, constructed parallel, and laid up more or less compactly according to the hardness or density of the species from which it is taken. This can be seen by taking thin sections from woods of different density, and subjecting them to view under a microscope. The tubes vary in diameter as the wood becomes more or less dense. The sap or albumen consists of acidulous, resinous, glutinous, saccharine, and other matters in liquid form, and is carried through these tubes by capillary action. Besides the above, timber has among its constituent elements oxygen, hydrogen, and nitrogen. The elements of decay are in the juices of the wood, such as are named above, and are at the time the timber is cut always in solution. They are the food on which timber lives, grows, and thrives, and are assisted in all their functions by the oxygen that is chemically combined with them, as it is with nearly everything in nature, assisting vitality in life and decay in death. This principle belongs to all organic matter, and in nearly everything of inorganic matter, in use by man, until it returns to the normal condition from which it sprung. Pure carbon is indestructible by the effect of time. The strength and value of timber used for constructive purposes belongs to the fibre, the carbonaceous part—and none to the juices, which contain all the elements of decay, and the carbon or fibre none. This being the case, the chief point to be gained is to get rid of the juices and retain the fibre intact. How is this to be done? Surely not by letting the sun or artificial heat take from it the oxygen and hydrogen, the watery parts, that held these elements of decay in solution, and leaving them in a dry state, to resume their functions connected with decay as soon as they can absorb, from rain or moisture in the air, the elements that had been driven out by heat; also, it is not reasonable to suppose that we can get rid of this deleterious matter by subjecting timber to pressure on all sides and ends at one time, as is done by most of the modern processes and patented inventions—the apparatus for which is all costly, cumbersome, and expensive in its manipulation, besides being slow and uncertain in its application, on account of the difficulty of getting any liquid containing an antiseptic to reach the centre of a piece of timber of any size. When the density of the wood is considered, and the pressure is equal on all sides and ends, the liquid used as a preservative cannot go in until there is a vacant place provided for it to go into. So nearly all of the patent processes depend on—or, more properly, are based on—treating seasoned or partially seasoned timber, or timber that has been artificially desiccated by a costly and slow process, which vaporizes the water, and leaves all the deleterious matter caked on to and sticking fast and hard to the walls of the capillary tubes of fibre, and leaving some minute spaces into which chemicals in liquid form can be made to penetrate by great force; and then the greatest, and in fact the only, hope that can be entertained is, that the chemicals can and will dissolve the deleterious elements, combine with or coagulate them, and act as an antiseptic.

All the processes, except the French process of Boucherie, are designed to act as above described, and most all of them leave the capillary tubes filled or partially filled with soluble matter, to be dissolved and dried again by every hygrometric and climatic change. If the tubes in which the strength lies are of carbon, if carbon is indestructible, if the tubes are continuous and without lateral connections from one end of a stick of timber to the other, and are channels in which a liquid is made to run by an act of nature—is it not best to first wash out these tubes, and clear them of all, or nearly all, of the albumen, sap, or juice that contains the seeds of decay? We will see if this can be done, when we come to speak of the very clever process of the eminent chemist, Dr. Boucherie. Maxime Poulet, a French chemist, in a work on timber preservation published in 1879, refers to over 170 different kinds of apparatus and processes in connection with timber preservation that have been invented, and described in scientific journals, since 1700. Let us look at some of the patented processes of the last fifty years, and see what inducements they offer for adoption.

*Bethell's Patent.*

The Bethell process, by the use of creosote, was the first brought to public notice after the commencement of the railway era, and was for many years, considering cost and results, the best of all the patented processes; and is to-day—with Hayford's improvements, which I will refer to—the best of all, depending on immersion and pressure in a huge cylinder, as a preservative for timber for railway purposes against decay, and against the ravages of the teredo and other animals in salt water; but it will not answer for preserving timber for ships and houses, on account of its increasing the flammability of the timber, and also giving it a pungent and acrid smell. The creosote oil used is merely coal-tar, deprived of its ammonia and retaining its carbolic acid. This oil has certainly antiseptic qualities, and can preserve timber from decay for many years, as it combines with the albumen, and destroys or neutralizes the effects of the seeds of fungi; it also has great penetrating power, and is insoluble in water.

Mr James Abernethy, our present President of the Institution of Civil Engineers of England, creosoted the timber he used in the works of the harbour of refuge at Blyth, some thirty years ago, and I am in the belief that the teredo has not touched it to this time. The timber in Leith Pier, creosoted in 1850, was not injured by the teredo in 1862. I have seen this day a creosoted sleeper, from the track of the Great Western Railway of England, that had been in service for twenty years and was perfectly sound.

The objections to this process are that it requires a costly apparatus, a huge metal cylinder, a railway track to run through it, railway cars, boilers, engine, pumps, pipes, houses, &c., and must necessarily be local. Great difficulty has been experienced by the old process in getting the creosote oil to penetrate to the centre of a railway sleeper, and is only accomplished at the expense of much time and great force; this difficulty increases as the timber to be treated is more and more dense.

The operation is first to create a vacuum, by exhausting as much as possible the air from the capillary passages in the timber, this takes from four to five hours; then the creosote is turned on, and a pressure of 150 pounds per square inch applied for six and sometimes for ten hours; so that, with the loading and unloading the car, closing in the cylinder, exhausting and pumping, more than a whole day