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The Art of Preserving Wood.

Wood is an article of prime necessity and stands foremost in its connection with every conceivable interest within the range of civilization. Millions of men and unlimited capital are daily employed in converting wood and lumber to the innumerable and necessary uses required for human comfort. So great is the demand for lumber in the progress of the arts and civilization, that our native forests, which

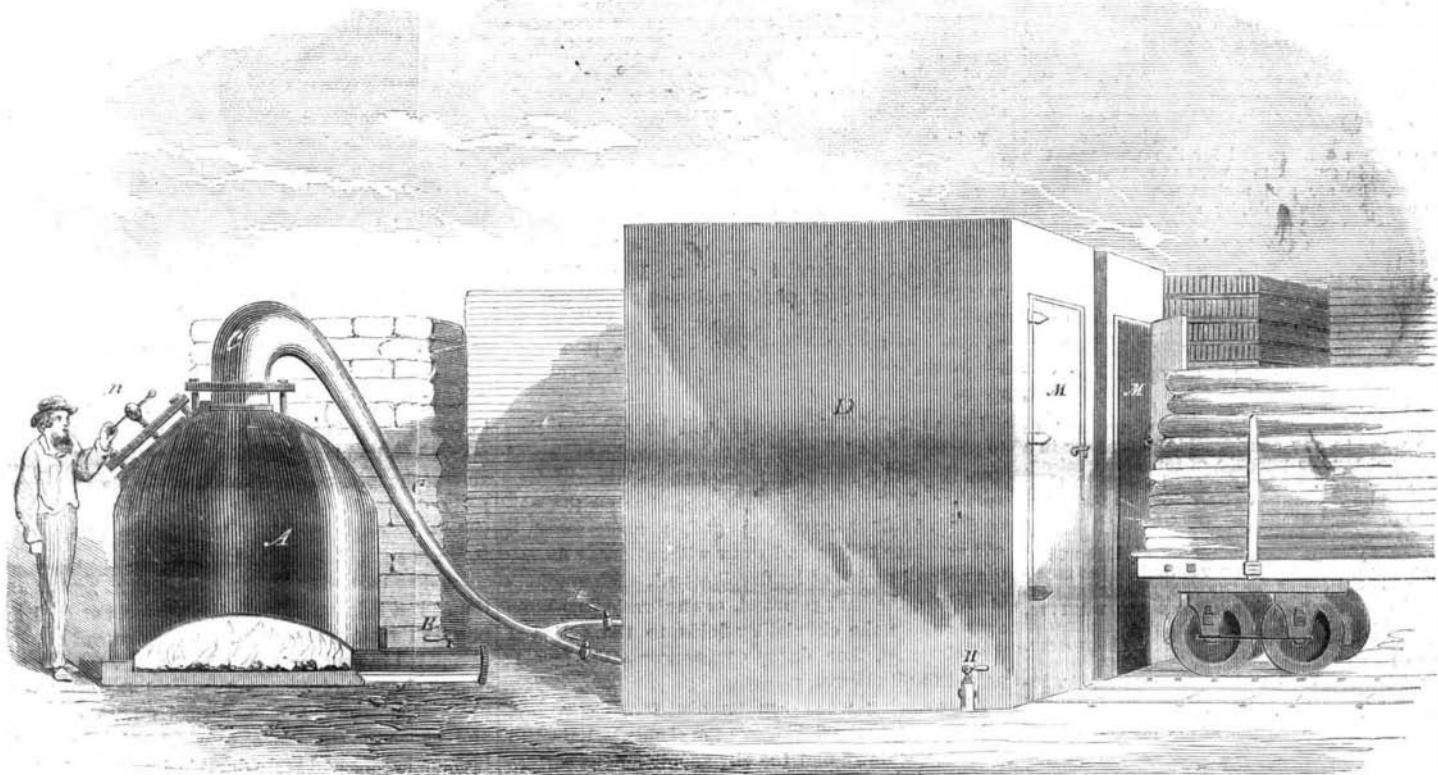
in the useful arts than the effectual preservation of wood from decay, and the saving of the vast annual expenditure required in removing the things which the elements have destroyed, and in supplying new materials and structures in their place.

Out of the great number of inventions and patents made and obtained for this purpose, one invention—that for which Bethell obtained Letters Patent in England, in 1838—has demonstrated the fact, that

lute solution of corrosive sublimate. This method, always too expensive to admit of general application, has been wholly abandoned in this country.

In 1837, one Margary obtained a patent in England for preserving timber by immersing it in a solution of acetate or sulphate of copper. After being thoroughly tested in England this process has gradually yielded to other processes.

In 1838, Sir William Burnett's process was patented,



ROBBINS'S APPARATUS FOR PRESERVING WOOD.

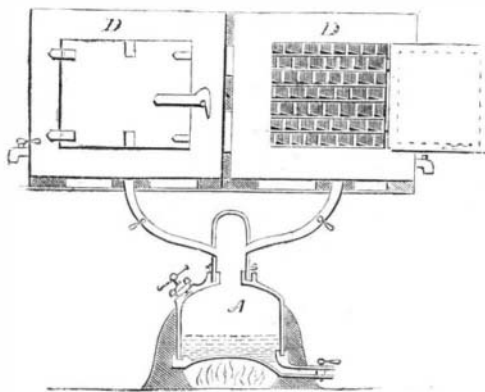
so recently covered nearly the whole of the Eastern and Middle States have been brought into requisition and removed, except small portions at great distances from market or situated in almost inaccessible localities. The increase of our population and the improvements in the arts, generally, have been so rapid, that even now it is a serious problem as to where we are to obtain our future supply of wood and lumber.

Notwithstanding wood is so intimately and extensively connected with all the various interests of human progress, and the vast and unlimited means devoted to its conversion from its condition in the forest to its ultimate uses, it cannot have escaped, even the most casual observer, that it is, nevertheless, an article subject to rapid and useless decay. It is a no less important fact, that wood occupies a place that cannot be supplied by all the other resources of nature aided by human invention.

It now becomes a matter for serious inquiry whether we cannot accelerate the growth of wood or preserve it from decay. Indeed, this has long been a subject of most earnest inquiry and deep concern in countries of an older civilization than our own; and within the last thirty years the inventive genius of man has been taxed to devise means by which so desirable a result could be obtained as the preservation of wood. In view of the immense expenditure of time and capital, devoted to fashioning and adapting wood to the various forms and uses required, it is obvious that no greater achievement can be made

by the use of oleaginous compounds, obtained from the distillation of coal tar, properly applied, wood can be preserved for an indefinite length of time.

The following-named inventions and patents, made



and granted in Europe, are referred to for the purpose of showing some of the means which have been resorted to—without substantial success—to obtain this desirable result; and also to afford such information to the public as will guard it against any expenditure of means with a view to the introduction of such processes in this country.

Kyan's process for preserving wood was the first to attract general attention. It was introduced in 1832, and subsequently patented in this country. The process consists in saturating the wood with a di-

and since that time Burnettizing wood has been practiced in Europe and America. In this process the wood is saturated with a concentrated solution of the chloride of zinc. While Kyan's discovery failed of being widely adopted, from the fact that the material employed was too expensive to admit of being generally used, Burnett's process, for a similar reason, has only been employed to a limited extent.

Payne's process was patented in England in 1841. He employed two solutions, successively, which naturally decomposed each other, forming an insoluble substance in the pores of the wood. The earthy or metallic solution is first introduced into the timber, under pressure; after which the solution is drawn off and the decomposing fluid forced in. Sulphate of iron and carbonate of soda are said to form the insoluble compound in the pores of the wood. This process has been tried in England and this country, and has met with some favor in France.

Dr. Boucherie, a distinguished French chemist, invented a process for preserving wood, and for which he procured a patent. It is claimed that this process accomplishes two objects:—First, it expels the sap; and, secondly, it fills the pores of the timber with a preservative solution. The fluid that is alleged to preserve the wood is so introduced by pressure that it "passes longitudinally along the fibers," thus expelling the sap and occupying its place. The claims of this process are being urged in this country under the false pretense that it is a new discovery.

Bethell—by his process patented in England in 1838—rendered wood more imperishable by the use of a cheaper material; but his machinery was unnecessarily complicated, and his method of conducting the process quite imperfect and too expensive to admit of general application. We extract the following partial description of Bethell's process from a small treatise on the art of preserving wood, published in this country in 1859:—

It consists in impregnating the timber with an oily matter obtained from a rough distillation from coal tar. This oily matter contains a variety of substances, having different chemical properties; one of the essential ingredients for this purpose is said to be creosote which forms, as estimated, about thirty per cent of the product of distillation used for this purpose. The other ingredients have a no less important effect. The oily matter is injected into the timber by pressure in closed vessels, from which the air is first partially exhausted.

The subjoined letter from Dr. Dwinelle, who personally witnessed what he describes, is sufficiently explicit, in respect to Bethell's machinery and process.

LOUIS S. ROBBINS—Dear Sir: I cheerfully comply with your request to give you such information as I obtained in Europe, several years ago, in regard to the use of coal tar and its products as a means of preserving wood.

In 1852, while investigating different matters of public interest in London, I was invited by Mr. Burt to visit his extensive works on the Surrey side of the Thames, where he had, for several years, been treating—for the English and India markets—large quantities of wood with products of coal tar, according to a process patented by Mr. Bethell in 1838.

His process consisted in placing the wood or lumber in a large iron cylinder, constructed expressly for the purpose, and made very strong. When these cylinders were sufficiently charged with wood—it being carried into them on cars constructed for the purpose—the ends were closed in such a manner as to render them perfectly tight, the air and moisture were then exhausted, as nearly as possible, by air pumps attached to the apparatus for that purpose. Then other pumps were employed to force the liquid product, that had been obtained by distillation of coal tar, into the cylinders, which was continued until a pressure of 150 lbs. to the inch was reached. After a certain time had elapsed, the wood was taken out of the cylinders and placed in a suitable position for drying, when it was ready for use.

The machinery employed for these operations was both complicated and expensive, and so imperfect, in respect to its capacity to produce the result desired, that a large amount of time was required to saturate the wood to any considerable extent, or in a degree sufficient for the purpose of its preservation. This method, however, was considered the best then known, and had been proved to be a success for many years, by the practical use of the wood thus treated.

Bethell's process seemed to be very objectionable, not only because it required much time and labor, but also for the reason that it was only suited to the treatment of lumber to be used for the most ordinary purposes, such as railroad sleepers, piles for wharves, bridges, etc., etc.

I have carefully examined your patented process. It appears to be simple, rapid and inexpensive, and much more perfect in its results than Bethell's, inasmuch as the hot oleaginous vapors arising from the distillation of the coal tar must, under the circumstances, permeate every portion of the wood or lumber to any extent required.

Your process is open to none of the objections urged against Bethell's plan, since, by its use, wood may be rapidly and properly treated for all the various uses to which wood is applied in the mechanic arts. Moreover, the fact that you use the same material leaves no doubt as to the success of your patent, it having long since been practically established in Europe, that the products obtained from the distillation of coal tar, if properly applied to wood, will preserve it for a great length of time from decay, and also from destruction by marine and other insects. Truly yours,

WM. H. DWINELLE, M. D.,
No. 119 Tenth Street, New York.

The great value of Bethell's discovery has been so clearly demonstrated, by the uniform results of its application, that scientific men in Europe, and especially the most distinguished engineers in England, have come to entertain but one opinion of its merits. It can hardly be necessary to multiply authorities in this connection, since the following emphatic testimony—extracted from Dr. Andrew Ure's "Dictionary of the Arts," must satisfy the most skeptical reader. Treating of the results of Bethell's process he says:—

The effect produced is that of perfectly coagulating the albumen in the sap, thus preventing its putrefaction. For the wood that will be much exposed to the weather, and alternately wet and dry, the mere coagulation of the sap is not sufficient; for although the albumen contained in the sap of the wood is the most liable and the first to putrify, yet the ligneous fiber itself, after it has been deprived of all sap, will, when exposed in a warm damp situation, rot and crumble into dust. To preserve wood, therefore, that will be much exposed to the weather it is not only necessary that the sap should be coagulated, but that the fibers should be protected from moisture, which is effectually done by this process.

The atmospheric action on wood thus prepared, renders it tougher, and infinitely stronger. A post made of beech, or even of Scotch fir, is rendered more

durable, and as strong as one made of the best oak, the bituminous mixture with which all its pores are filled acting as a cement to bind the fibers together in a close tough mass; and the more porous the wood is, the more durable and tough it becomes, as it imbibes a greater quantity of the bituminous oil, which is proved by its increased weight. The materials which are injected preserve iron and other metals from corrosion; and an iron bolt driven into wood so saturated, remains perfectly sound and free from rust. It also resists the attack of insects; and it has been proved by Mr. Pritchard, at Shoreham Harbor, that the *teredo navalis*, or naval worm, will not touch it.

Wood thus prepared for sleepers, piles, posts, fencing, etc., is not at all affected by alternate exposure to wet and dry; it requires no painting, and after it has been exposed to the air for some days, it loses every unpleasant smell.

This process has been adopted by the following eminent engineers, viz.: Mr. Robert Stephenson, Mr. Brunel, Mr. Bidder, Mr. Brathwaite, Mr. Buck, Mr. Harris, Mr. Wickstead, Mr. Pritchard, and others; and has been used with the greatest success on the Great Western Railway, the Bristol and Exeter Railway, the Manchester and Birmingham Railway, the North Eastern, the South Eastern, the Stockton and Darlington, and at Shoreham Harbor; and lately, in consequence of the excellent appearance of the prepared sleepers, after three years' exposure to the weather, an order has been issued by Mr. Robert Stephenson that the sleepers hereafter to be used on the London and Birmingham Railway are to be prepared with it before being put down.

For railway sleepers it is highly useful, as the commonest Scotch fir sleeper, when thus prepared, will last for centuries. Those which have been in use three years and upward, look much better now than when first laid down, having become harder, more consolidated and perfectly water-proof; which qualities, combined with that of perfectly resisting the worm, render this process eminently useful for piles, and all other woodwork placed under water.

It is stated by the best authorities, and confirmed by ordinary experience and observation, that the decay of wood is due to the action of oxygen and moisture; and we find that in proportion as it is excluded from these destructive agents it retains its durable and substantial qualities. It would seem that the direct effect of these elements is to remove the antiseptic principles of the wood, and afterward to permeate its substance with moisture, thus softening its fibrous portions and producing mold or decay.

From this brief statement it will be obvious that to preserve wood it must, in some way, be protected from the action and influence of these decomposing agents. In its growing state, wood has all the elements of self-preservation; and, if undisturbed, it will continue to live and grow without decay during the natural period of its development. When a limb is broken, the bark removed, or an abrasion made, so as to expose the circulating fluids to the action of the elements, then decay commences—this fact is patent to all observers.

All growing wood has an oleaginous covering, which protects the fluids from the elements, but when wood is cut down and the oily supply for the surface can no longer be obtained from the soil, artificial means must then be employed that will fully protect the wood from the influence of oxygen and moisture. Oleaginous compounds, such as are obtained from the distillation of coal tar and similar substances, are adapted to this purpose; and they can be applied to wood in such a manner as to preserve it for an indefinite period. This is what is accomplished by Mr. Robbins's patented process hereinafter described. The oily products obtained from the distillation of bituminous substances are not decomposed and destroyed by the action of oxygen and moisture at ordinary temperatures. Hence, when they are properly applied to wood they must protect and preserve it.

It appears to have been the leading idea with all the European inventors, if we except Bethell, to deprive wood of some of its important constituents and essential properties, or to otherwise change them by chemical action. In this, they not only disregarded the common experience of all ages, but they were at war with Nature. The common mistake among them consisted in attempting to produce a condition of wood that is wholly unlike its living state, instead of restoring to it what had been lost by time and exposure to the elements. Moreover, while the materials used actually destroyed the native integrity of the wood, they were of far too costly a nature to admit of general application. For these reasons the several processes of Kyan, Margary, Burnett, Payne and Boucherie, will ultimately be regarded as failures, practically and in every essential sense.

Very different will be the public verdict respecting

the claims of Bethell's discovery. How far he really comprehended, or even perceived the principles which the subject involves, we may not be able to determine; nor is this important in estimating the value of what he accomplished. It is manifest that his course of experiment was in the right direction. He sought to preserve, by artificial means, the vitality of Nature—to prevent the loss of those constituents and properties which are essential to wood in its normal and undecaying state. To him belongs the credit of originality, and of furnishing the potent suggestion which has enabled Mr. Robbins to complete a discovery second to no achievement in the useful arts, in the universality of its application, and in the consequent magnitude of its practical results.

Hitherto we have discovered nothing that will so effectually resist moisture as oil. It is not only a demonstrated fact in science, but it has become a proverb everywhere, that oil and water have no affinity—that they will not unite. While water finds its way through the closest animal tissues and into the hardest wood, and, by mechanical pressure, may even be forced through the solid metals, this antagonism between oil and water is universal and irresistible. This suggests the immense value of oil in preparation of all durable fabrics and manufactures of wood that are required to be impervious to moisture. In all civilized countries, and back through the entire historic period of the world, men have acted on this suggestion; in the preparation of the skins of animals, for shoes and for other purposes; in the manufacture of various outside garments; in painting their dwellings, ships, fences, furniture, and all the other superstructures of wood. These are rendered durable by the proper application of oil, and in proportion as the oil so applied is of a nature suited to endure the action and influence of oxygen and moisture.

The vegetable and animal oils differ essentially in their constituents from the oleaginous compounds derived from bituminous substances. The difference in their inherent capacity to resist moisture is equally marked and no less deserving of notice. The exposure of the former to the action of the elements gradually diminishes this power of resistance. Heat brings the organic oils to the surface of whatever they are applied to, and some of them are soon dissipated so that they no longer afford a sure protection. But it is not so with the products of coal tar, or with the bituminous oils. These, instead of being dissipated in part, or otherwise impaired by the ordinary changes of temperature and the varying degrees of moisture, become resinous from exposure; and hence the substances to which they are applied become harder and more durable by time. It is the unqualified testimony of Dr. Ure that railroad sleepers, that had been in use for more than three years, "looked much better than when first laid down."

At the time we write corrosive sublimate is worth one hundred and thirty-five dollars per one hundred pounds, while chloride of zinc is still more expensive. The preparation of railroad ties, by the use of such materials, would cost some four or five dollars each, while the cost of a far more effectual treatment, by the heavier products arising from the distillation of coal tar, would scarcely exceed ten cents. In the treatment of railroad ties and the timber for bridges and wharves, acids and alkalis are especially objectionable because they corrode the iron bolts and spikes that are necessarily employed, and thus impair and ultimately destroy the wood with which they are in contact. If copper nails and sheets be employed, as in covering the hulls of vessels, the corrosion must be more rapid when such substances have been employed in the preparation of wood. On the contrary, oil prevents this corrosion of the metals, and in this respect it contributes essentially to the inherent durability of any structure that may be made of such composite materials.

SPECIFICATIONS OF THE ROBBINS PATENT.

To All Whom it may Concern:—Be it known, that I, Louis S. Robbins, of the City, County and State of New York, have invented a new and improved process for preserving wood from mold or decay; and I do hereby declare that the following is a full, clear and exact description thereof, which will enable those skilled in the art to make and use