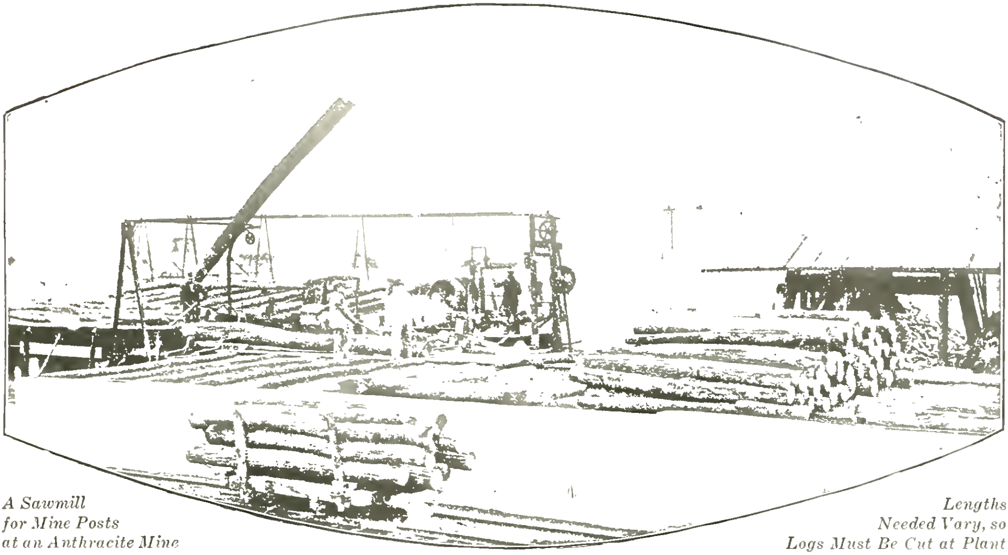

A Sawmill for Mine Posts at an Anthracite Mine

Lengths Needed Vary, so Logs Must Be Cut at Plant

Wood Preservative Which Makes Putrescible Matter Stable, Strengthens Timber, Making It Fire Resistant

Consists of Oxides of Copper and of Zinc, Ammonia and Carbolic Acid—Solution of Copper Oxide in Ammonia Dissolves Albumin, Cellulose and Pectines, Making New Bodies Which Cement Wood and Render Inconstant Substances Stable

By F. G. Zinsser*

Of the many preservatives that have been used for prolonging the life of timbers the most important are chloride of mercury, sulphate of copper, chloride of zinc, creosote and a combination of the last two.

The impregnation of dried wood with a cold solution of bichloride of mercury produces excellent results. The bichloride is extremely antiseptic and has the advantage of small bulk. It is sold in solid form, and the difficulties of transportation are therefore entirely eliminated. In spite of all this and the fact that a complete and permanent preservation can be obtained with 2 or 3 per cent of this salt, the cost is prohibitive, and the poisonous character of the mercury salts makes their use extremely dangerous.

Sulphate of copper is used in 1 or 2 per cent water solution. It is inexpensive, and for this reason as well as for its good qualities it has been used in many European countries. As it is not caustic it does not injure the wood and leaves it clean and odorless. Being an astringent, the wood into which it is injected becomes more tenacious. Because the oxide of copper, which protects the vegetable fiber, is volatilized only at a high temperature, this treatment makes the timber less combustible. Nitrogenous matter impregnated with sulphate of copper becomes rotproof, because a metallic substance hostile to parasites has combined with the albumens, which are then no longer likely to rot. Copper sulphate has kept ties and posts, when placed under conditions which retain this antiseptic in the wood, in a perfect state of preservation forty-four years after they were placed.

Unfortunately, sulphate of copper seriously affects iron. Nails and spikes coming in contact with it are corroded through the formation of sulphate of iron. For that reason vacuum and pressure injections can be made only in copper impregnating apparatus, and this is too expensive to be used economically.

However, sulphate of copper in the presence of rain water and earthy alkalies in the soil is dissolved. Posts impregnated with it and placed in the ground lose their copper entirely under the action of these solvents, and in five or six years become quite rotten, according to Leduc, Director of Belgian Telegraphs, in the *Revue Universelle des Mines*, 1897. When the copper has disappeared the pores of the wood are open to the attacks of a legion of microbes.

When wood is treated with zinc chloride in a water solution it is either immersed in open vessels or impregnated by a vacuum-pressure treatment. This preservative has great antiseptic qualities, and the compound formed with the albuminous substances of the wood strongly resists rotting. Unfortunately, like copper sulphate, it does *not* resist the action of solvents, and is decomposed in the presence of lime in the soil.

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As it is hygroscopic—absorbing water from the air—it can be used only in places that are permanently dry. Like wood treated with copper sulphate, when freed of the preservative the pores of the wood are left open and favor putrefaction, with resultant disintegration.

Pine ties impregnated with zinc chloride lost 80 to 85 per cent of the original salt three years after impregnation, and beech ties from 90 to 95 per cent. Zinc chloride is an acid salt, and when it combines with the albuminous substances in the wood it sets free hydrochloric acid, which, according to Hutin and Boutigny, damages the vegetable fiber. The acid also attacks iron, and this in railroad ties and in much other equipment is highly undesirable.

Creosote Long Known as Stable Preservative

the fatty and oily substances, such as paraffin, inert most desirable as a preservative. It shows great stability, and for that reason has had extensive use for this purpose. It is a thick fluid, which must be raised to a temperature of 178 deg. F. for diffusion through wood, and a large quantity of it must be used if the best results are to be obtained. In 1876 the Western Railroad Co. of France reduced the quantity used on its ties about one-third, but found that after three years rot began to appear, and that after five years the ties had to be removed. The loss of creosote from creosoted ties on the roads of the company just mentioned is shown in the table given below:

Date	Pounds	Date	Pounds
August, 1904	45 29	October, 1907	18 84
October, 1904	37 69	October, 1908	17 85
October, 1905	28.76	October, 1909	17.08
October, 1906	22 44		

After all, oil is an emollient which softens the vegetable fiber and lowers its physical resistance, and while the fatty and oily substances, such as paraffin, inert in themselves, will remain, the antiseptic elements—carbolic acid, aniline and the like—being soluble in water, are apt to be removed.

Carbolic Acid Soon Washes Out of Wood

Blocks of wood impregnated with carbolic acid, which would seem to promise long life because that acid is the most effective matter contained in the coal-tar oils, do not show the resistance expected of them. The coal-tar oils themselves, containing some carbolic acid, are found to be better preservatives, as the insoluble fatty matters tend to act as a waterproofing, and the rain is less able to remove them. When creosote is applied to paving, however, it has been found that it does *not* prevent the moistening of the wood sufficiently to prevent expansion and consequent heaving. Wood treated with creosote is sticky, heavy and difficult to handle, has an irritating odor, and it is asserted that the creosote increases inflammability.

From 15.6 to 18.7 lb. of creosote per cubic foot of timber is recommended abroad for satisfactory results. The cost is therefore high considering the additional expense of manipulation, and to this must also be added the freight where the creosote has to be carried long distances. This is important, as the creosote is used without dilution, and every pound used must be transported.

According to Henri Monseur, the inventor of the wood preservative Ac-zol, this substance retains all the important properties of the older preservatives and eliminates their objectionable features. As he frankly says, he is not offering anything new in the way of antiseptics, but makes use of the well-known qualities of carbolic acid, which is the active principle of creosote oil, and the efficient action of both zinc and copper. He compounded these in such a manner that though readily soluble during the treating process, they become permanently fixed in the wood after impregnation is complete and the wood dried. He makes use of the fact that an ammoniacal copper solution softens wood fiber, and that after the ammonia, which acts simply as a carrier, has evaporated, the combination of copper and wood fiber becomes hard again. That is how artificial silk is made.

This preservative, as the name implies, is made up of ammonia, copper, zinc and phenol, the latter being the chemical name for carbolic acid. Softened in the manner described above, the wood absorbs the solutions readily, and after the ammonia is evaporated, the salts of zinc and copper with carbolic acid, being neither corrosive nor conductors of electricity, are firmly and permanently imbedded in the wood. The antiseptic qualities of these salts are well known. None of the vegetable parasites, worms or wood borers can live in their presence.

Preservative Adds Strength to Wood Fibers

It should be added that the carbolic acid, being present in combination with these metals, does not impart any odor to the wood. The preservative actually increases the strength of the wood as the copper and zinc salts combine with the vegetable matter, such as albumin, tannin and pectines, and form a sort of binder, which hardens to a cement, closely uniting the wood fiber.

Ac-zolated wood placed in mines in 1910 and 1912 is still in position in 1921. After nine years of service it is in perfect preservation, and in all probability will last for a long time to come, whereas untreated timbers in the same position were totally unfit after six or seven months. This is the statement of G. Deltenre, managing director of the collieries of l'Arbre St. Michel at Mons lez Liége, one of the largest collieries in Belgium.

Wood consists of two parts, the sapwood and duramen. The sap, or imperfect new wood, contains channels surrounded by living cells composed of cellulose, pectine and albuminous substances. The decomposition of these is rapid as soon as the life of the plant ceases. The duramen is the center of the tree and is formed of completely lignified tissue in which living substances are replaced by incrustations of mineral bodies drawn from the soil, such as lime, magnesia, iron, silica, etc., and also contains tannins. This part of the tree is extremely resistant to decay. The Ac-zolating process does the work that nature has not had time to accomplish in the sapwood by changing its chemical composition.

The first engineers to use Ac-zol were Lambiotte and Grad, director general and chief engineer respectively of the Elizabeth and Courcelles-Nord collieries in Belgium. At the Elizabeth colliery, Auvelais, Belgium, several timbers were placed in the return airway on Sept. 20, 1910, some treated with Ac-zol and some untreated. On Jan. 10, 1911, two of these, one treated and the other untreated, were taken out. The latter was rotted to such an extent that it could no longer offer effectual resistance. Four rings of each of these two timbers were sent to the State Testing Station at Malines and were submitted to a crushing test. The average crushing strength of the untreated was less than half of the treated timber. Only the center of the untreated material, about 1.6 in., remained fibrous.

Regarding the timber placed Sept. 20, 1910, I have no further information, but J. O. Grad, now works director of the Courcelles-Nord colliery, in March, 1918, declared that Ac-zolated timber placed Oct. 15, 1910, in a return airshaft in the Allaye mine at a depth of 458 ft. was still in good condition and likely to serve for many more years.

On Feb. 6, 1918, according to Carlo Fremin, chief engineer of the D'Aiseau-Presle collieries, the timber placed in a return airway in the Roselies shaft workings in July, 1913, was still in place and likely to give several years of service, despite the fact that unimpregnated timbers placed in May, 1914, had been renewed each year since that date.

Dr. A. Berge, professor at the University of Brussels, reduced three kinds of treated wood to sawdust and treated the dust with water saturated with carbon dioxide and alkalies. The wood treated with 2 per cent of copper sulphate lost 77 per cent of its copper. The one treated with 2 per cent of copper sulphate and 3 per cent of ammonia lost 41 per cent of that metal and that treated by Ac-zol lost only 3½ per cent.

Experiments on Wood in an Activated Soil

He then took pieces of wood and placed them in wet ground charged with a solution of invert sugar and brewers' yeast. After forty-eight hours at 86 deg. F. the Ac-zolated wood lost 4½ per cent of its copper and wood impregnated with 2 per cent of sulphate of copper, 81 per cent. As Ac-zol does not contain either sulphates, chlorides or nitrates, it does not attack iron.

Wood was immersed in Ac-zol for twenty-four hours by Durieux, general overseer in the research service and experimental station for rivers and forests of the Belgian government. It was then desiccated and buried for nine months with manure, when it was again dried and weighed. The Ac-zolated wood lost 9.11 per cent, whereas natural wood lost 38.26 per cent and that treated with a 2 per cent solution of copper sulphate lost 22.61 per cent of its weight. These are averages of many experiments made on samples of alder, fir, birch, oak and pine.

At the Malines State Experimental Station in Belgium five sets of tests were made for the resistance to compression. The average results were for creosoted wood, 4,125 lb.; wood treated with sulphate of copper, 7,538 lb., and Ac-zolated wood, 8,164 lb. per square inch. Under tension the results were: Creosoted wood, 5,021 lb.; wood impregnated with copper sulphate, 5,547 lb.; Ac-zolated wood, 8,150 lb. per square inch. Four compression tests were made on behalf of the management of the Elizabeth colliery by the same authorities on treated and untreated timber. Natural wood showed a strength of 6,614 lb. and Ac-zolated wood, 12,829 lb. per square inch.

The salts of the heavy metals contained in Ac-zol render the wood fire resistant, and so long as these salts have not been volatilized by high temperatures, their presence diminishes the fire danger. Ac-zol is transported in a highly concentrated form. Six or eight parts of this solution with 94 or 92 parts of water is the proper concentration for treatment, which can be made either by immersion, a vacuum-pressure treatment or by application with a brush. Where small quantities of wood are to be impregnated and where means for vacuum and pressure treatment are lacking, a simple cold immersion is sufficient and insures a very satisfactory penetration where heavy oils would not penetrate, even when applied hot, except in a superficial manner. However, even with Ac-zol the vacuum and pressure method is always preferable. This system is much easier for the injection of Ac-zol and much more rapid than with creosote, the first being applied cold whereas coal-tar oils without the aid of heat are not sufficiently liquid to penetrate.

It may be added that the wood impregnated with Ac-zol can not only be tinted with any color but after being dried can be painted. Its increased strength

PILES OF WOOD TO BE USED IN THE MARVINE MINE OF THE HUDSON COAL CO. FOR POSTING ROOF

This picture is not only expressive of the large part timber plays in the development of an anthracite mine but also shows the long conveyors which are used at the Marvine breaker for transporting the coal from the headhouses for treatment. These lines carry the coal over the railroad and are 1,100 ft. long.

makes it especially valuable wherever the timber is subject to great weight. Where stocks of timber have to be carried, the wood is often found to have lost 40 per cent of its resistant power before it is put in the mine. When Ac-zolated, it can be kept in stock without deterioration and as the replacement of timber is less frequent, stocks can be diminished, saving appreciably in invested capital and the area devoted to its stocking. Furthermore, timber can be purchased when it is cheapest, be brought to the mine when it is best transported, and still be in condition for replacement when needed.

Who's Who In Coal Mining

H. G. Williams

THOUGH he is consulting manager for the Utah Fuel Co., H. G. Williams no longer spends all his time in Utah, yet any stranger interested in coal mining, coming into the state, would soon learn that he was the dean of the coal operators of Utah and one of the outstanding figures in the Rocky Mountain region.

Mr. Williams was born in 1856 at Merton, Wis., where he received a general education. Later he entered the University of Chicago. In his junior year at this institution he was forced to stop his studies on account of poor health.

Starting as a transit man for the Atchison, Topeka & Santa Fé R.R., he constantly rose to higher positions with a progress that was both rapid and sure. In 1880, one year after he was employed as a transit man by the Santa Fé, he was given charge of a division out of Atchison, Kan. After holding this position he resigned and became superintendent of the Capitol Iron Works at Topeka, Kan., for two years, when he was called back (in 1883) to the Santa Fé railway and made engineer and sales agent for the coal companies in Kansas belonging to that railroad.

In 1884 he was mining engineer for the Raton Coal & Coke Co. In 1886 he was raised to chief engineer, and his authority was extended to the San Pedro Coal & Coke Co. in New Mexico and the Trinidad Coal & Coke Co. in Colorado. In 1887 he added the engineering work of the Canyon City Coal Co. in Colorado to his other tasks, these companies all being controlled by the Atchison, Topeka & Santa Fé Ry.

In 1888 he was made chief engineer for all the coal properties of the railroad company, including, in addition to the above, the Cherokee & Pittsburgh Coal & Mining Co., and the Osage Carbon Co. of Kansas. In 1890, after the change in control of the Atchison, Topeka & Santa Fé Ry., Mr. Williams resigned and took the position of chief engineer with the Pueblo Smelting & Refining Co., Pueblo, Col. This position he resigned in 1891 to become assistant superintendent and engineer for the Pleasant Valley Coal Co. in Utah, which is now part of the Utah Fuel Co.

In 1892 he returned to the position of chief engineer with the Pueblo Smelting & Refining Co. and two years later rose to the position of assistant general manager. In 1896 he was again called to Utah by the Pleasant Valley Coal Co. to become its superintendent and chief engineer, with headquarters at Castle Gate. From that time until the present Mr. Williams has been identified with the same company, rising to the position of general superintendent in 1900, to general manager of both the Pleasant Valley Coal Co. and the Utah Fuel Co. in 1901. After holding the position for fourteen years, he resigned in 1915 and became consulting manager, which position he still holds. He was succeeded as general manager by A. H. Cowie.

Utah has produced a number of coal operators whose successful accomplishments have made them known to the coal industry all over the United States, and due to the fact that the Utah Fuel Co. (including the Pleasant Valley Co.) was for many years the outstanding coal producer of the state most of these men have worked for Mr. Williams or been associated with him. Mr. Williams is a man of forceful character, but possesses a kindly and sympathetic disposition and a keen sense of humor, which give him the great gift of holding his friends.

H. G. WILLIAMS
Consulting Manager, Utah Fuel Co.

Mr. Williams has always zealously guarded the safety of his men and either initiated or assisted in the adoption of the methods which are used in the coal mines of the state to protect the miners. This includes the sprinkling system, which is used in all the mines of the state and which provides a sprinkling line to every working place, also the electric shot-firing system from the outside of the mine, which is in use at the majority of the state's mines. Utah now has probably the most modern set of safety regulations of any coal-mining state in the Union, and when these were being discussed in 1920 Mr. Williams, although resting in California, made a careful study of them and submitted valuable suggestions which were embodied in the final draft.

ABOUT THE ONLY KIND of strike now popular in this country is the averted one.—*Chicago Daily News.*

IT IS REVEALED THAT there are some volunteers in the army of the unemployed.—*Pittsburgh Gazette Times.*