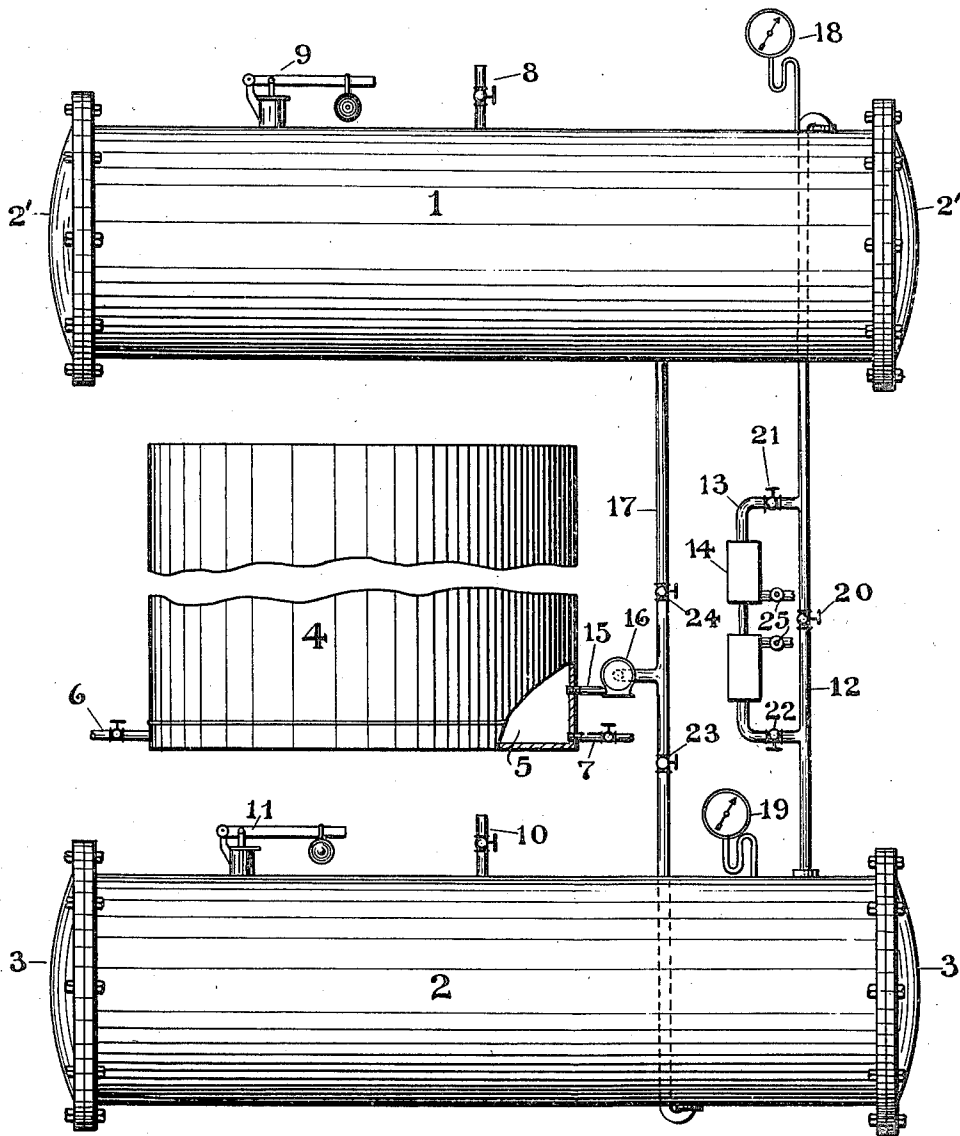


C. ELLIS.
PROCESS OF PRESERVING WOOD.
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Patented June 4, 1912.



WITNESSES:
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PROCESS OF PRESERVING WOOD.

1,028,201.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CARLETON ELLIS, a citizen of the United States, and a resident of Montclair, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Processes of Preserving Wood, of which the following is a specification.

This invention relates to a process of treating wood with preservatives and relates in particular to a method of injecting preservative material, such as sulfur-containing oils, creosote and the like in a manner which preferably provides the wood with merely a fiber coating of the preservative solution.

It has been the custom heretofore to treat wood with creosote by what is known as the empty cell process which merely wets the fibers of the wood without introducing a saturating amount of the creosote oil. This reduces the cost of treatment without greatly reducing the preservative action.

Petroleum oils, and more particularly asphalt oils have been tried to some extent as wood preservatives. Among these are the so-called "timber asphalt," Bakersfield asphalt and Mexican ebano oil. Oils of this character are used in a saturating amount for preserving wood, as for example railroad ties. The saturation of the tie calls for a large amount of oil and although the oil may be obtained near its source at a low cost per gallon in comparison to creosote yet the cost of saturating or full cell treatment of timber approximates that of creosote as applied in the empty cell process.

In the present invention oils of the creosote type may be used or mixtures of creosote oil and petroleum and asphalt oils, but the operation of the present process is more particularly intended for the treatment of wood with asphalt oils of rather heavy consistency containing sulfur or high-powered preservatives such as copper and arsenic compounds, dinitro benzol and the like.

As I have set forth in U. S. Patents Nos. 871,392 and 991,434 and in my copending applications Serial Nos. 396,104, 474,565, and 633,076 an oil-soluble compound of arsenic or copper such as copper oleate, resinate and the like, may be introduced into petroleum oils to furnish a high-powered fungicide and bactericide, so that the oil may be used advantageously for wood preservation. Copper compounds of this character are useful

for preserving certain classes of woods while other oil-soluble compounds such as those of arsenic, lead, mercury, zinc and the like are useful on other types of wood. The asphalt oils are very effective water-proofing materials and in this respect at least are superior to the creosote. As a rule they have a greater consistency than the creosote oils and hence are somewhat more difficult to introduce into the wood. Conversely it is also somewhat difficult to remove from the wood any excess of the oil which may have been injected. These petroleum oils or residues have no pronounced antiseptic action and hence are not highly efficient preservatives. For example, they usually are not able to cope with *Merulius lachrymans* or dry rot, the mycelium of which secrete a considerable amount of liquid substance, acting as a ferment and dissolving the fiber walls of some of the weaker cellulose structures and swelling and greatly weakening the harder varieties of cellulose tissues.

In addition to the high-powered preservative agents mentioned, certain other compounds of an organic character, particularly the nitro compounds of the aromatic series may be used. Among these are dinitrobenzol, dinitrochlorbenzol, dinitrophenol, dinitro ortho cresol and their homologues. Of these dinitrophenol is specially effective, its presence to the amount of .025% in nutrient gelatin preventing the growth of mold. Four (4) ounces of nitro compound to a gallon of asphalt oil affords a very good preservative. One (1) ounce of dinitrophenol and 1¼ ounces of copper oleate to a gallon of petroleum oil afford an excellent tie preservative. In the case of preservatives to be used for treating piling to prevent the attack of *Teredo* and *Limnoria* special pains must be taken to have the oil properly proportioned as regards the character and amount of the high-powered preservative. Dinitro ortho cresol in combination with oil-soluble arsenic compounds and copper oleate forms a useful basis for the treatment of piling. For wood which is not to be exposed to extreme service conditions and especially for railroad ties which are to be treated in such a manner that their preservative life substantially coincides with their mechanical life sulfur compounds are useful. It has been proposed heretofore to make use of polysulfid of calcium for treating wood.

The polysulfid is partially converted into carbonate of lime and partly into thiosulfate and other oxysalts on exposure to the air. Some of these compounds have an alkaline reaction and with the oxygen of the air convert cellulose into the friable oxycellulose. This causes tendering of the wood and loss of spike holding power.

Sulfur forms a very good antiseptic material under some circumstances. The proposal made hitherto to impregnate wood with sulfur alone, in a molten state, has certain disadvantages, one of which is the high temperature required to put the sulfur into a condition so fluid that it will penetrate readily. Another objection is the rather brittle condition of the wood after the sulfur has solidified within its interstices. If however sulfur is dissolved by heating in an oil such as petroleum in which it is not very soluble at ordinary temperatures and the hot saturated solution introduced into wood, a portion of the sulfur will separate on cooling, forming a fine precipitate on and around the fibers of the wood. In this state the sulfur is a good fungicide and greatly retards the development of wet and dry rot. To illustrate, a petroleum oil of about 32° gravity will dissolve at 100° C. some 10% or so of sulfur. On cooling a 10% solution to about 60° C. the sulfur separates to a very considerable extent forming a finely divided precipitate. If therefore wood, previously heated to a temperature of about 100° is immersed in an oil bath containing about 10% of dissolved sulfur, pressure applied and the wood finally cooled a product is obtained carrying the fungotoxic sulfur quite uniformly distributed throughout the interior of the wood. At 120°, the melting point of sulfur, ordinary petroleum oil takes up considerably more than 10% of sulfur. With asphalt oils and other unsaturated oils, union of sulfur and oil takes place, more or less, at 120° C. and the oil becomes vulcanized, usually accompanied by thickening. A vulcanized asphalt oil, containing uncombined sulfur, may readily be thinned with creosote; twenty five or thirty per cent. of the latter sometimes being required. When creosote and petroleum oil are mixed it has been supposed that the bactericidal qualities of the creosote were greatly diminished or entirely suppressed by the palliative effect of the petroleum oil. This is not however strictly true. Petroleum has relatively slight antiseptic action and dilution of the creosote by it perhaps reduces the preservative action to an extent slightly greater than the degree of dilution would warrant. On the other hand creosote as compared to some of the petroleum oils and particularly the partially vulcanized asphaltic oils is a poor waterproofing agent. An oil which

thoroughly waterproofs is a great desideratum in wood preservation, hence the combination of creosote and partially vulcanized asphaltic oil fortified with an excess of uncombined sulfur offers a preservative having a number of valuable qualities. By adjusting the ratio of creosote and asphalt oil for each particular wood the requisite penetration and waterproofing qualities are secured. The antiseptic features of creosote are supplemented by the fungo-toxic action of the precipitated interstitial sulfur, the amount of which is under regulable control, and the precipitation of sulfur in the pores of the wood tends to augment the resistance of the wood to the penetration of moisture. The asphalt oil obtained from the Bakersfield region is remarkably effective as a waterproofing agent but the supply of this useful oil is limited. The vulcanization of ordinary petroleum residues and semi-asphaltic oils affords a substitute for the Bakersfield oil at a very moderate cost. Such a vulcanized oil can be properly fortified with a high-powered antiseptic to form a satisfactory preservative. By using an excess of sulfur over that required for vulcanization at any specific temperature, the excess of the sulfur serves as an antiseptic and affords an oil which is very serviceable in many localities. Creosote may be used in the form of a miscible oil. If rosin is saponified with potash and introduced into creosote the mixture may be diluted with water to a very considerable degree and still persist as a clear homogeneous solution. On the further addition of water however the creosote is precipitated and forms a milky emulsion. Such mixtures as these may carry petroleum or asphalt oils and may be introduced into wood at such a dilution that the further addition of water causes precipitation of the creosote. A copperized miscible oil may be made in accordance with Letters Patent on miscible oil No. 993,827. Thus when the tie or other cellulose structure treated in this way is exposed to rain or earth moisture the creosote or other oily body precipitates and deposits on the wood fiber. Care should be taken in the case of green or unseasoned wood, as a moisture sensitive solution of this character would cause precipitation of the creosote or other oil, during the impregnating process. Seasoned wood is far more adaptable to this treatment than green moisture-containing wood. Of course it is not desirable to have a strongly-alkaline soap present in large amount, because of liability of oxidation of the cellulose to oxycellulose. Rosin soap is somewhat inclined to alkalinity because of hydrolysis and is best used in conjunction with a small proportion of oleic acid, using a slight excess of the resinous acids and oleic acid so that the potash is well neutralized.

The impregnation of wood with emulsions is generally speaking difficult and unsatisfactory. Emulsions of zinc chlorid and creosote or petroleum oil for example, do not enter the wood very easily and one component is apt to penetrate more easily than the other. Damp wood will absorb the zinc chlorid solution from an emulsion leaving the particles of oil of the emulsion on the surface of the timber. Anhydrous zinc chlorid or fluorid may be dissolved under certain conditions in asphalt oils to some extent to secure a moderately good antiseptic material. Timber treated with miscible oil containing water-soluble soap may be immersed in a solution of calcium chlorid, magnesium sulfate, barium chlorid, copper sulfate and the like so as to form a metallic water-insoluble soap in the superficial pores of the timber, thereby improving its resistance to the entry of moisture. The precipitation of the soap renders the oil vehicle of the miscible oil no longer soluble in or emulsifiable with water thus causing said oil vehicle to become fixed. Creosote solutions which are soluble in water may also be made by use of sulfonated oils. The manner in which compositions of this sort may be prepared has been set forth in Patent 879,375. Simply mixing a slightly alkaline concentrated sulfonated oil with creosote yields a useful product.

The copper and other compounds of naphthenic acids are useful with a certain limited number of oils for treatment of wood. Copper naphthenate is a very effective preservative. If present to the extent of 1% it prevents the development of the lower organisms. 1% or 2% of copper naphthenate in solution in gasoline is absorbed by dry wood readily, although so low a proportion of nonvolatile material does not waterproof the wood. If however copper naphthenate is dissolved in fairly heavy Texas or Oklahoma asphalt oil, a water-proofing and preservative composition is secured.

In carrying out the process of the present invention the compositions described in the foregoing may be used. In certain modifications of the process involving low impregnating temperatures, the sulfur and oil solution mentioned above is not readily used.

For impregnation, I preferably employ wood which has been air or kiln dried. The treatment of green wood to remove the moisture by means of hot creosote oil for example, is undesirable because of the tendency to thereby weaken the fiber. Creosote combines to a certain extent with wood fiber, especially if heated to a high temperature. Its action is probably partly that of condensation with some of the aldehydic bodies present in the wood tissue and partly dissolution of lignin. Petroleum oils may be used at high temperatures without this

same disadvantage but low temperatures, say 130 to 150° F., are to be preferred to 212° F. The present process embraces the treatment of wood with a preservative oil to cause partial impregnation, the wood used for these purposes being preferably previously dried so that moisture is not expelled to the detriment of the operation; and in subjecting the partially impregnated wood to a very high gaseous pressure to properly distribute the oil I prefer a gas substantially free from or of reduced oxygen content to be used. The subjection of heated wood whose surfaces are coated with oil to ordinary air until high pressure carries with it the tendency of spontaneous ignition, which is avoided by the preferred procedure herein set forth.

In carrying out the process I preferably use two impregnating cylinders and pass the gas from one cylinder to the other, to and fro, alternating the operations so the gas may be used over and over again and in such a manner that it does not have to be compressed from atmospheric pressure up to the maximum pressure required each time a charge is applied.

By referring to the drawings it will be seen in what manner the process is carried out. The drawings are diagrammatic and for the sake of simplicity divers obvious accessories are not included, as will be obvious to those familiar with the wood treating art.

The drawing shows two treating tanks and an oil reservoir in side elevation. A portion near the bottom of said reservoir is shown in section.

In the drawings 1 and 2, are treating tanks and as shown are cylindrical shells having the headers 2', 2' and 3, 3 respectively, by means of which the wood to be treated is introduced.

4 is a tank containing the oil supply. This tank has a steam jacket or steam jacketed bottom shown at 5, with inlet and outlet for steam, 6 and 7 respectively.

8 and 10 are blowoffs and 9 and 11 are safety valves.

A pipe 12, connects the tanks 1 and 2. It leads from the top of tank 1 to the top of tank 2. This is provided with the bypass 13, in which is situated the air compressor or pump 14. This pump is provided with the gas or air intakes 25. A pipe 15 leads from the tank 4 to a pump 16. This communicates with the pipe 17 which connects with the bottom of tanks 1 and 2. Suitable valves are arranged in these pipe lines to control the flow of oil or gas. Pressure gages are shown at 18 and 19.

In the operation of the process wood is charged into the tank 1, and is treated with warm oil under a pressure of 75 or 80 lbs., more or less, depending on the fluidity of the oil and the character of the wood.

After exposing the wood for an hour or two to the action of the oil partial impregnation is secured. Meanwhile tank 2, is charged with wood and then the oil is allowed to pass from the tank 1, to the tank 2, additional hot oil being supplied from the supply tank 4. The removal of the excess oil from the tank 1, may be accomplished by forcing air or gas into this tank 1, by means of pump 14, so that the oil is forced out through the outlet pipe 17, to the tank 2. The oil in tank 2 is placed under similar pressure and in the meantime the partially impregnated wood in tank 1, is exposed to a gaseous pressure considerably greater than that which it received when immersed in the bath of heated oil. To accomplish this the pump 14, is operated to raise the gaseous pressure in the tank 1, to about 125 lbs. This pressure is maintained in tank 1, while the wood in tank 2 is being impregnated with oil. Then the oil is removed from the tank 2 and the gas pressure in tank 1 is relieved through the pipe 12, into the tank 2, so that the gas pressure in both tanks is equal. If the tanks are approximately the same size the air pressure will then be between 50 and 70 lbs. in each tank. The pump 14, is then put in operation in a reverse way, connections being made for these purposes which are not shown in the drawings, but will be obvious to those skilled in the art. The pressure in the tank 1, is reduced by pumping down to practically atmospheric level. The gas pumped from pump 1, is forced into pump 2 making the pressure in tank 2 approximately 125 lbs. Any loss by leakage may be compensated by the introduction of a fresh gas supply. The air pressure in tank 2 is thus brought up to 125 lbs. without starting from atmospheric pressure so that the cost of the use of compressed gas in this way is materially reduced as compared with operation from an atmospheric-pressure datum-plane. In some of the methods heretofore practised air at atmospheric pressure is

compressed to the necessary degree and after treatment of one charge of timber this air is allowed to escape and be wasted:—the operation being repeated with each new charge of timber. Thus the pressure datum-plane is that of atmospheric air. In the present process the datum-plane may be established at any suitable or predetermined pressure within the limits imposed by the other operations; hence whether pressure or vacuum be employed the same body of gas may be repeatedly used in the treatment of successive charges of timber without necessarily restoring said gas to atmospheric pressure.

On the release of the gaseous pressure in either tank the gas under pressure in the spaces between the fibers of the wood rushes out and in so doing carries with it a considerable portion of the surplus oil employed so that only a fiber-coating amount of the oil is left in the wood. The operation is reversed in the manner indicated; the gas being alternately forced into one tank and then in the other with each successive charge.

What I claim is.

1. The process of treating wood comprising subjecting wood to a preservative oil under pressure and then to the action of a fixed gas under higher pressure, said gas carrying less oxygen than normal air.

2. The process of treating wood comprising subjecting wood to the action of a preservative oil under pressure and then to the action of a gas under higher pressure and in using the same body of gas repeatedly in the treatment of successive charges of timber, without restoring said gas to atmospheric pressure.

Signed at Chesham in the county of Cheshire and State of New Hampshire this 12th day of July A. D. 1911.

CARLETON ELLIS.

Witnesses:

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