

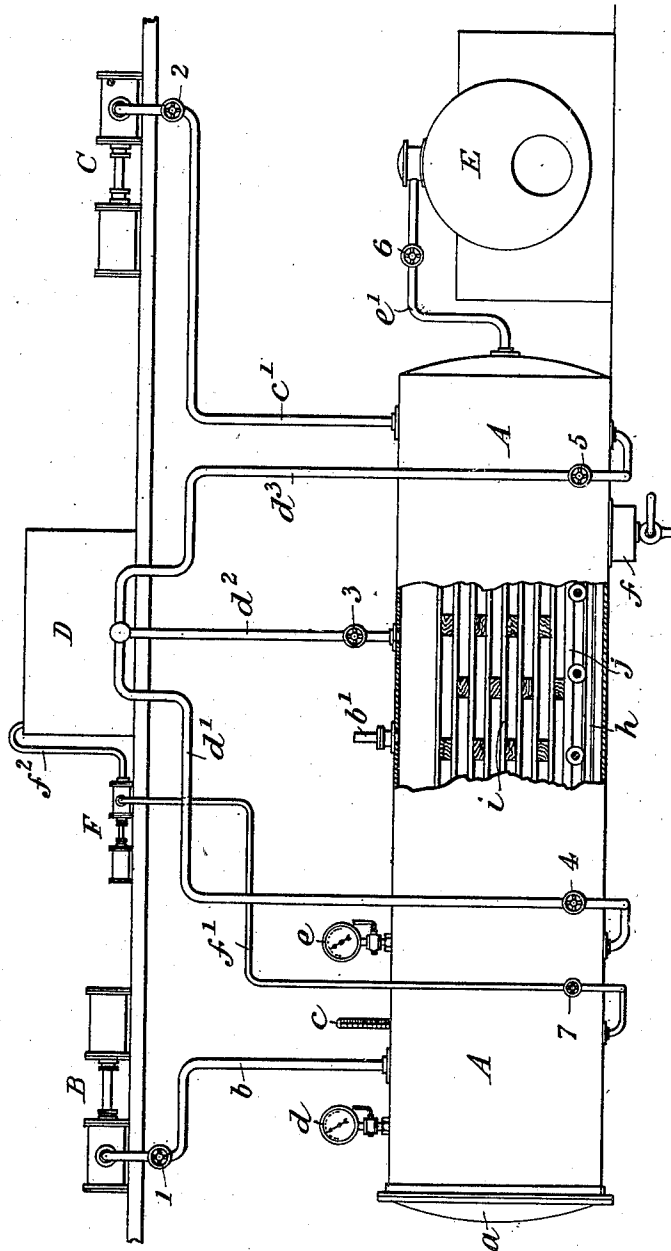
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H. V. SIMPSON.  
PROCESS OF FIREPROOFING WOOD.

(Application filed Dec. 27, 1899.)

(No Model.)



WITNESSES:

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# UNITED STATES PATENT OFFICE.

HENRY VALENTINE SIMPSON, OF LONDON, ENGLAND.

## PROCESS OF FIREPROOFING WOOD.

SPECIFICATION forming part of Letters Patent No. 668,227, dated February 19, 1901.

Application filed December 27, 1899. Serial No. 741,725. (No specimens.)

*To all whom it may concern:*

Be it known that I, HENRY VALENTINE SIMPSON, a subject of the Queen of Great Britain, residing in London, England, have  
5 invented certain new and useful Improvements in Processes of Fireproofing Wood, of which the following is a specification.

My invention relates to a method of treating wood for the purpose of making it non-inflammable or otherwise preserving it and of introducing coloring-matter into it, if desired. According to the method hitherto generally followed for these purposes the lumber to be treated is inclosed in an air-tight  
15 receptacle and then heated by direct contact with steam or by means of internal steam-coils or hot jackets for a considerable time. When the wood has been sufficiently heated, a portion of the constituents are withdrawn therefrom and the pores are exhausted of air by a vacuum-pump. Then the chemical solution is admitted and immediately fills the empty pores. The impregnation may be assisted by pressure. This process has under  
25 certain conditions given good results; but it has been found to possess the following disadvantages—that is to say, the direct action of heat on wood in the ordinary condition of the latter (either as dry heat or in the form of steam) is liable to affect its structural strength, to darken its color, and to otherwise alter its characteristics. Moreover, the heating adds considerably both to the length of time and to the cost of the treatment. Now  
35 my invention relates to the treatment of wood with solutions of the kind hereinafter stated or with other suitable solutions in such manner that better impregnation can be obtained than when live steam or hot air is used in contact with the wood in its ordinary condition, as hitherto, whereby the possibility of injuring or discoloring the wood is avoided and considerable economy of fuel and time is effected. Also when using the solutions hereinafter  
45 referred to I am able to introduce into the wood insoluble matter, so as to seal the fireproofing salts in the pores of the wood.

I employ a horizontal cylindrical receptacle with an opening at one or both ends capable of  
50 being hermetically sealed by means of doors. The cylinder and doors must be capable of withstanding from two hundred and fifty to

three hundred pounds hydraulic pressure per square inch. In connection with the cylinder I employ an air-pump for creating an exhaust, 55 a pressure-pump for obtaining the necessary pressure, and the usual connections with tanks holding the impregnating solution.

The accompanying drawing illustrates diagrammatically an apparatus suitable for carrying out my invention. 60

In the drawing, A is a horizontal cylindrical receiver provided at one end with an opening adapted to be sealed hermetically by means of a door *a*. The cylinder and door 65 must be capable of withstanding from two hundred and fifty to three hundred pounds hydraulic pressure per square inch. The receiver A is provided with a safety-valve *b'*, thermometer *c*, vacuum-gage *d*, pressure-gage *e*, and blow-off cock *f*. Within the receiver A are longitudinal rails *h*, upon which the timber *i* to be treated can be run in on cars *j*. 70

B is a vacuum-pump for exhausting the receiver through the pipe *b*, which pipe is fitted with a cock 1 to open and close communication with the receiver. 75

C is a pressure-pump communicating with the receiver through a pipe *c'*, adapted to be 80 opened or closed by a cock 2. This pump serves to put pressure on the contents of the receiver when required.

D is a tank for containing the impregnating solution. One tank only is shown; but 85 it will be understood that several may be employed. Pipes *d'* *d''* *d'''*, adapted to be closed by cocks 3, 4, and 5, serve to conduct the impregnating solution from the tank D to the receiver. 90

E is a boiler for supplying steam to the receiver A when required through the pipe *e'*, which is adapted to be closed by a cock 6.

F is a pump for drawing the solution from the receiver when so desired and returning 95 it to the tank D by the pipes *f'* *f''*.

7 is a cock in the pipe *f'*, adapted to open or close communication with the pump F.

The wood to be treated (which can be of the ordinary trade sizes and descriptions) if 100 very wet may be first dried to some extent and is placed on the cars *j*, which run on the rails *h* into the cylinder A. The door *a* is then closed and the solution admitted into

the cylinder through the pipes  $d'$   $d^2$   $d^3$  until the latter is full. Pressure is then applied by the pump C for the necessary time—say ten hours—which depends on the character and dimensions of the wood. The solution

is then returned to the tank D by the pump F. In the case of soft wood of slight thickness, such as pine one inch to two inches, matchboarding, electric-wire casing, and veneering, the above-specified time will be found sufficient to effect saturation, and the wood can then be withdrawn, and as no steam or other heat has been used the wood will not be affected in respect of its color or otherwise. Such woods as one-inch pine I find can be saturated with three hundred pounds pressure in three to six hours. In the case of hard woods I prefer a pressure exceeding three hundred pounds, in which case the receiver must be correspondingly strong.

In the case of the harder kinds of wood or greater thicknesses of soft wood only a partial impregnation will have been effected by the above operation, and I therefore continue the treatment as follows, viz: When the wood is partially impregnated, as above described, the cylinder A may or may not be exhausted by means of the vacuum-pump B. Sufficient live steam is then led into the cylinder from the boiler E to cause ebullition of the solution already in the wood. When the vacuum-pump is employed, this ebullition takes place at a low temperature, and the wood is therefore not subjected to an injurious temperature. The effect of this ebullition of the solution in the wood is to render the wood amenable for further impregnation. When this ebullition has continued for, say, three or four hours, the steam is cut off (the vacuum being maintained) and the solution is again admitted to the wood under pressure of the pump C, when the wood will be found to take up a considerably-increased quantity of the solution. In the case of very thick or very hard woods this further treatment may be advantageously repeated.

In certain cases I may heat the wood, as above described, without creating a vacuum. The ebullition will then take place at the ordinary temperature of boiling water without ill effects, for when the wood has been previously partially impregnated even this great heat does not appear to affect it. A characteristic feature of this method is the application of heat to the wood only after it has been partially impregnated with the solution without heat. There are two well-known methods or processes of impregnation. One of these is known as the "double-solution" method and consists in impregnating the wood by successive solutions which cause a reaction on meeting, thereby fireproofing the wood and precipitating in the wood insoluble matter which cannot be washed out. The disadvantage of this process is the length of time required, the extensive apparatus, and the considerable precipitation formed on the outside of the

wood, causing waste and an unsightly appearance and also injury to any tools that may be used in working the wood thereafter. The other, or the single-solution method, consists in using fireproof ingredients which are soluble in water, the wood being impregnated with the solution and the water being driven off by evaporation, leaving the salts in the wood. The disadvantage of the single-solution method is that the ingredients employed, being necessarily soluble in water, are liable to be washed out on exposure to the weather, or if the wood is subjected to washing or scrubbing the wood is also liable to absorb moisture, so that it will corrode metals and will be in other respects inconvenient. Now the ingredients of the solution I employ and their proportions are such that I can introduce, as already stated, a desirable proportion of insoluble matter into the wood in a single solution, thus affording practically all the advantages of both the double and single solution methods without any of the disadvantages appertaining thereto. In order to obtain this desirable result, I make use of the property possessed by the combination of certain salts which, although soluble in water at a certain strength, will, on the strength of the solution being increased by the evaporation of the water or other volatile matter, crystallize out as insoluble precipitates. As an example, I may mention the combination of phosphate of ammonia, sulfate of ammonia, and sulfate of zinc in certain proportions—say six, six, and two—in solution with water at a certain strength of solution—say sixteen per cent. The wood is impregnated, as above referred to, with this solution, then the water of the solution is driven off from the wood by evaporation either in the open air or in kilns, and so the solution in the wood gets stronger, causing eventually a considerable quantity of an insoluble precipitate of probably phosphate of zinc or some compound salt to form throughout the saturated part of the wood, and so sealing the ammonia salts in the pores of the wood. If the solution is used cold and no heat used in the drying off the water of the solution, the sulfate of ammonia may be omitted. Another example is a solution of phosphate of ammonia, sulfate of ammonia, and sulfate of magnesia in the proportions of six, six, and one. In this case the result may be assisted by the formation of phosphate of magnesium, which would take place if any ammonia be set free in the dry rooms or kilns. Still another example is a combination of sulfate of ammonia, sulfate of zinc or of magnesia, and boracic acid in the proportion of ten, six, and four, the boracic acid forming borate of zinc or of magnesia, which is crystallized in the wood on the strength of the solution being increased by evaporation. In order to prevent this last-mentioned solution becoming too acid, I may add a small proportion of potash or other suitable alkali thereto or combine borax therewith. I find the pro-

portion of insoluble matter thus formed is, in the above-specified proportions, sufficient to effect my purpose of rendering wood water-resisting or non-absorbent, non-inflammable, and non-corrosive. The proportion may under circumstances depending on the nature of the wood and the method of impregnation be somewhat varied.

When coloring-matter is to be introduced into the wood, it may be added to the solution used for rendering the wood non-inflammable, or if the wood is to be colored only and not rendered non-inflammable a colored solution of any known constituents may be used instead of the non-inflammable solution.

I claim as my invention the following-defined novel features, substantially as herein-before specified, namely:

1. A method of treating wood to render it non-inflammable by impregnation with a single solution, characterized by impregnating wood with a solution of ammonium salt and metallic salt, said salts being soluble at a certain strength, but which, when the strength of the solution is increased react and deposit an insoluble precipitate in the pores of the wood which precipitate seals the non-inflammable ingredients therein.

2. A method of treating wood to render it non-inflammable by impregnation with a single solution, characterized by impregnating the wood with a single solution of sulfate of ammonia, phosphate of ammonia, and a metallic salt, said salts being soluble at a certain strength of solution but reacting when the strength of the solution is increased, to produce an insoluble precipitate, then removing sufficient of the solvent to cause the deposit of said insoluble precipitate in the pores of the wood, whereby said insoluble precipitate seals the non-inflammable salts in the pores of the wood.

3. A method of treating wood to render it non-inflammable by impregnation with a single solution, characterized by impregnating the wood with a single solution of sulfate of ammonia, phosphate of ammonia and sulfate of zinc, and then removing sufficient of the solvent to cause the deposit of an insoluble precipitate in the pores of the wood to seal the non-inflammable salts therein.

4. A method of treating wood to render it non-inflammable by impregnation with a single solution, characterized by first impregnating the wood, before the application of

heat, with a solution of ingredients, which ingredients are soluble at a certain strength, but which, when the strength of the solution is increased, react and deposit an insoluble precipitate, then subjecting the wood to the action of live steam so as to increase the absorptive powers of the wood for the solution, then again applying the same solution to the wood to impregnate it to the required depth, and finally removing sufficient of the moisture to cause the deposit of said precipitate to seal the non-inflammable salts in the pores of the wood.

5. A method of treating wood to render it non-inflammable, by impregnation with a single solution, characterized by first impregnating the wood, before the application of heat, with a single solution of sulfate of ammonia, phosphate of ammonia and sulfate of zinc, then subjecting the wood to the action of live steam so as to increase the absorptive power of the wood for the solution, then again applying the same solution to the wood to impregnate it to the required depth, and finally removing sufficient of the moisture to cause the deposit of the insoluble precipitate to seal the non-inflammable salts in the pores of the wood.

6. The method of treating wood for rendering it non-inflammable and for other purposes, which consists in depositing in the wood substances which are non-inflammable and insoluble in water, then subjecting the wood to the action of live steam, and then further depositing in the wood substances which are non-inflammable and insoluble in water.

7. The method of treating wood for rendering it non-inflammable by impregnation with a single solution, which consists in impregnating it with a solution composed of a mixture of salts which are soluble in water at a certain strength of solution but which produce an insoluble precipitate when the strength of the solution is increased by evaporation, and subsequently treating the wood to evaporate such impregnated solution and thereby effect such precipitation in the pores of the wood.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HENRY VALENTINE SIMPSON.

Witnesses:

ARTHUR C. FRASER,  
FRED WHITE.