March 25, 1941. A. D. BOARDMAN 2,235,822

PROCESS FOR IMPREGNATING WOOD

Filed Dec. 28, 1937

Fig. 1

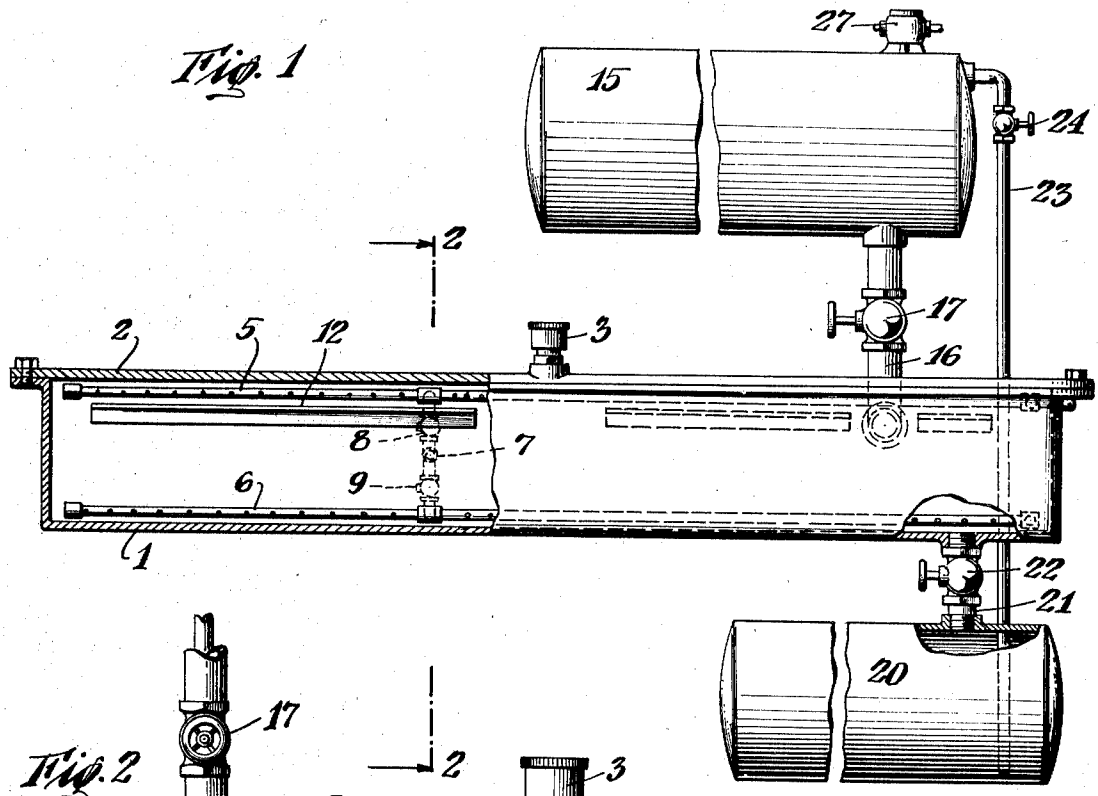
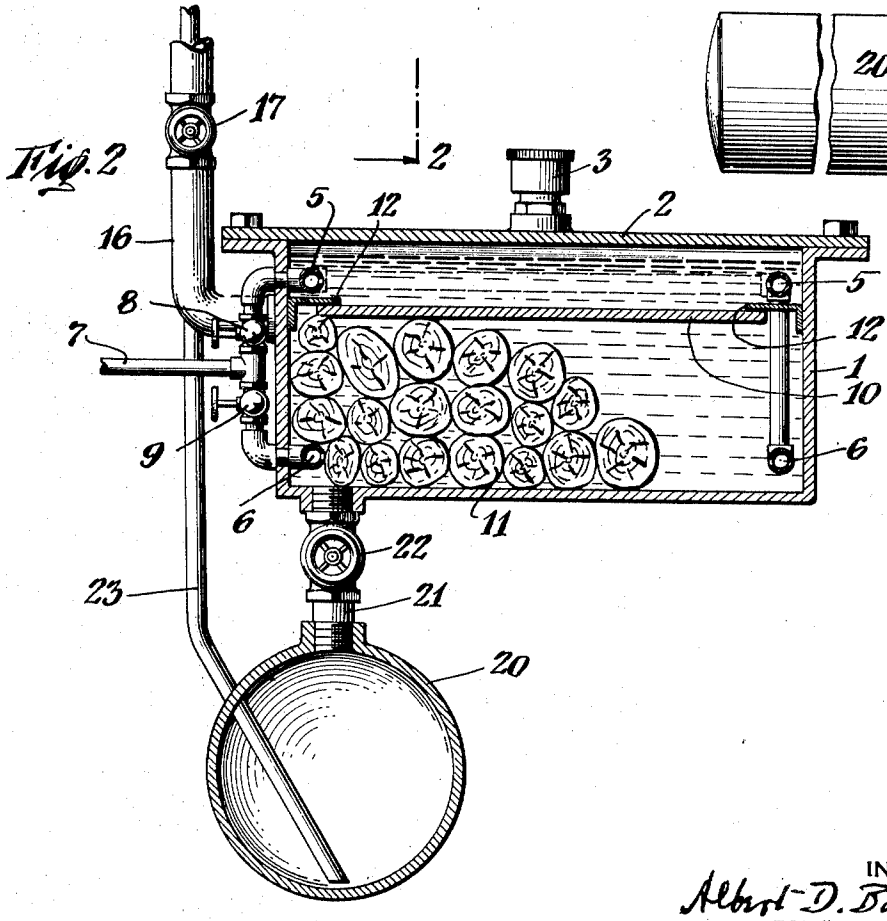


Fig. 2



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PROCESS FOR IMPREGNATING WOOD

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1 Claim. (Cl. 21—22)

This invention relates to the impregnating of wood, and the object of the invention is to provide an improved process for impregnating wood with liquid preservative agents, and more especially with acid copper-chromate solutions, such as those set forth in U. S. patents to Gunn 1,684,222 and 2,041,655. Such solutions are used to preserve wood from rot and attack by insects.

Impregnation of wood with preservative agents has hitherto usually been carried out with the aid of variations in pressure. For example, the wood has been placed in a closed chamber, which was then evacuated to draw as much air as possible out of the pores of the wood. Next, the impregnating liquid was admitted to the chamber and, after the wood was covered thereby, the pressure in the chamber was raised to above atmospheric, so that the liquid was sucked into the pores and forced under pressure deeper into the wood, compressing the residual air in the pores in the process. This method is expensive, not only as regards initial cost of plant and upkeep, but also with regard to operating cost.

Another method was to place the wood in a tank, submerge it in the impregnating liquid and then heat the whole to upwards of 212° F. to drive the air out of the wood both by expanding it thermally and also by replacing it by the steam formed as the result of the conversion of the moisture content of the wood into water vapor. The liquid and wood were then allowed to cool before drawing off the excess liquid to permit the liquid to be sucked into the pores by the contraction of the residual air in the pores and the condensation of the water vapor therein. This method is not only wasteful of heat, in that large volumes of liquid are repeatedly heated and cooled, but also is inapplicable to the impregnation of wood by acid copper-chromate solutions as the essential ingredients of such solutions precipitate out when they are heated to 170° F. or above.

These disadvantages of prior processes are avoided by the present invention, according to which the wood, especially wood containing moisture, is heated with steam to cause the air in the pores of the wood to expand and to bring about vaporization of the major part at least of the water vapor in the pores of the wood. The hot wood is then quickly submerged with a cold or luke-warm acid copper-chromate solution. After giving the cool solution time to penetrate the pores, the excess is run off and the wood permitted to dry.

I have found that by heating wood with steam to around 210° F. and then quickly immersing it in the treating solution at around 80° F., an absorption of around 30 to 35 pounds of the solution per cubic foot of wood is obtained. In some cases the absorption runs as high as 40 pounds.

Woods are composed of cellulosic solid matter having a specific gravity of around 1.56, substantially irrespective of the species of wood, and of pores filled with air or other gases, sap or other aqueous solutions. An average sample of pine has, when kiln dry, a specific gravity of about 0.6. Hence the volume of air or other gases, sap, etc., in such wood is around 0.62 cu. ft. per cu. ft. of wood. Consequently, with the absorptions above referred to, between 65 and 85 percent of the voids are filled with the impregnating solution.

Air in being heated from 70° to 210° F. expands about 25% of its volume so that merely heating the air in the pores of the wood to this extent would drive out only about 20% of the air. Hence the solution sucked into the pores as the residual air cooled would only fill 20% of the voids in the wood. The difference between 20% and 65 to 85% appears to be due to the fact that the air in the wood is largely expelled by the steam generated in the pores. If the pores were 100% filled with steam, then, after immersion in cold impregnating solution, the pores should be practically 100% filled with solution. At 180° F. the vapor pressure of water is half atmospheric pressure, so that, at that temperature, the water vapor formed in the pores of the wood cannot do more than drive out half of the air. At the boiling point of water, 212° F., the water-vapor could, theoretically at least, completely drive out the air. Preferably, therefore, to secure satisfactory filling of the pores with the impregnating solution, the wood should be heated by steam to a temperature not much below the boiling point.

Too high a temperature, especially for continued periods, is apt to injure the wood. Thus, for certain woods, at least, heating to 270° F. for 4 to 6 hours is apt to be injurious. Preferably, therefore, the temperature is not substantially less than 180° or greater than 270° F.

The steam treatment appears to have another effect besides vaporizing the moisture in the wood, viz: opening up of the pores first to permit gases to escape and second to allow liquid to enter.

An apparatus suitable for carrying out the process is shown, by way of example, in the accompanying drawing, wherein:

Fig. 1 is a side elevation of the apparatus; and Fig. 2 is a section on the line 2—2 of Fig. 1.

The chamber in which the wood is first steam heated and then impregnated is a long open tank 1, provided with a lid 2 arranged so that if it is desired to maintain therein an atmosphere of saturated steam under pressure, the lid can be clamped down on the top of the tank. Saturated steam at 5 lbs. gauge pressure has a temperature of 227° F., so that the wood treated thereby may be raised to a temperature of 212° F. or above. Ordinarily, however, good results are obtained without using steam under pressure, in which case the lid is not clamped down. A pressure relief valve 3 permits the escape of air when steam under super-atmospheric pressure is used, and the lid is, therefore, clamped down.

Inside the tank are a pair of steam pipes 5 near the top and another pair 6 near the bottom, fed from a common steam line 7. Valves 8 and 9 control the supply of steam to each pair of pipes independently. Each pipe has a series of holes therealong for the discharge of steam.

While the wood is being heated steam is admitted to both pairs of pipes. When the heating step has been completed, steam is shut off from the lower pair so that the impregnating liquid will not be heated thereby as it fills the tank. When the lid 2 is not clamped down, so that air is free to enter or leave the tank to a considerable extent, it is advisable to keep steam on the upper pair of pipes until the tank is filled with the treating liquid to keep the wood at as near 200 to 220 F. as possible until it is covered by the liquid. Cooling of the wood prior to the time it is covered by the liquid lowers the absorption by permitting the wood to suck in air instead of liquid.

As the wood being treated will normally float in the impregnating solution, means should be provided for holding the wood down below the liquid surface after the tank has been filled. As shown, such means comprise two or more cross bars 10 laid transversely across the wooden poles 11, or the like, to be treated, with the ends of the bars extending under inwardly extending flanges 12 on the tank walls.

An impregnating solution tank 15 is provided having a capacity in excess of that necessary to fill the tank 2 when the latter is charged with wood. This tank is at one side of and above the top of the tank 1 so that it can discharge into the latter by gravity through a pipe 16 provided with a valve 17. The bore of the pipe 16 and valve 17 is large so that the transfer of liquid is very rapid.

While after impregnation the residual liquid in the tank 2 may be forced or sucked back directly into the tank 15, I prefer to provide a sump tank 20 below the level of the tank 1 and connected to the latter by a pipe 21 and valve 22, both of large bore. Such a sump tank enables the tank 1 to be drained quickly, avoiding the necessity of a large capacity pump. From the bottom of sump tank 20, a pipe 23 provided with a valve 24 extends up to the tank 15. An air-pump 27 serves to lower the pressure in tank 15 sufficiently to suck the liquid from tank 20 up into tank 15. By using an air-pump, the liquid is kept out of contact with the pump parts. Make-up liquid is added to tank 15 as required, to compensate for that absorbed by the treated wood.

What is claimed is:

The process of preserving wood by causing a chemical reaction in the pores thereof to form therein an insoluble metallic compound from a solution of soluble metallic salts precipitable by heat, which process consists in providing a quantity of said solution substantially in excess of that necessary to treat a given quantity of wood, said solution being maintained at a temperature substantially below the point at which the reaction will occur, separately heating the wood with steam in a suitable chamber to a temperature substantially higher than the precipitation point of said solution for a period sufficient to fill said pores with steam, and promptly after the aforesaid steaming operation submerging said wood by introducing the solution into the chamber in bulk and rapidly raising the level of the solution about the wood, causing the solution to enter the pores of the wood and precipitate therein without prematurely cooling the wood or precipitating more than a negligible amount of solution on the surface of the wood or elsewhere in the chamber.

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