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PROCESS OF COLORING WOOD

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This invention relates to improvements in wood coloring processes and has for its primary object to provide an impregnation process expediting the coloring of wood under conditions resulting in the satisfactory coloring of the treated wood.

The present invention is in the nature of an improvement on the wood treating process of my prior U. S. Patent No. 2,042,826, June 2, 1936, and for carrying out the present improved process it is preferred to employ a cylindrical receptacle equipped in general like that disclosed in my above mentioned prior patent, with the principal difference that the internal heating coils of the prior receptacle are omitted and, instead, heating coils are applied externally to the shell of the receptacle. By omitting the internal heating coils, the receptacle capacity is very substantially increased.

According to the present improved process, the shell of the cylindrical receptacle is preferably preheated by the external heating coils to approximately 325° F., said external coils being preferably employed to continue heating the shell throughout the complete treatment of the wood, thereby to eliminate condensation of the vapors injected into the receptacle as hereinafter described.

The wood to be treated is piled upon a truck in suitably spaced layers, said truck preferably running on tracks providing for conveniently loading the receptacle. The door or doors of the loaded receptacle are closed and a strong circulation of the atmosphere within the receptacle is forcibly induced, preferably by means of internal fans as described in my prior Patent No. 2,042,826.

A partial vacuum of approximately 24" is then drawn by any suitable means such as an air-pump, ejector or syphon evacuator, thereby opening the outer pores of the wood and effecting, by reduction of external pressure, a lowering of the vaporization point of moisture in the wood. While it is preferred, in order to expedite the process, to start the operation of the fans before the vacuum step, it is obvious that this order of procedure is not absolutely essential.

After attaining the partial vacuum referred to, a predetermined quantity of ammonia gas is introduced into the receptacle, said ammonia gas being preferably in the form of vaporized aqua ammonia supplied by an evaporator external to the receptacle. The quantity of the vaporized aqua ammonia introduced into the receptacle is a predetermined fractional portion of a basic quantity comprising approximately 100 lbs. of aqua ammonia for each 1000 board feet of wood

within the receptacle. A turbulent circulation of the ammonia gas within the receptacle is promptly induced by the fans, thereby insuring constantly subjecting all of the wood to said gas.

Coincident with, or immediately before or after, the introduction of the ammonia gas, live steam in the form of dry saturated steam is introduced into the receptacle, the temperature of the steam before introduction preferably being approximately 325° F. However, superheated steam may be employed and particularly when treating wood such as veneers. The steam is, of course, also brought into a condition of high turbulence by the fans, and enough steam is introduced to develop a predetermined pressure which is held for approximately one hour, the temperature, of course, rising to correspond with the pressure developed.

The pressure developed in this first treatment is dependent upon the number of successive treatments to which the wood is to be subjected, said pressure being higher in a first treatment when the least number of successive treatments is contemplated, and the pressures attained during each succeeding treatment being progressively greater. The number of the successive treatments to which the wood is subjected is of course based upon the character and size of the wood being treated.

The described first treatment of the wood results (1) in the emptying of the outer pores of the wood by the vacuum step, and (2) the subsection of the wood to the combined action of ammonia gas and steam. The ammonia gas produces a coloring effect upon the wood, while the injected steam serves to heat the wood, thereby vaporizing the water content thereof. The vapors thus generated seek to escape through the outer pores of the wood by the development of internal pressure. While the induced circulation of the atmosphere within the receptacle aids the escape of vapors generated in the wood, a condition of substantial balance of pressures internally and externally of the wood is ultimately reached. This condition retards the permeation of the ammonia gas throughout the wood and, if permitted to continue, will consequently prolong the coloring operation.

According to the present invention, the condition of balance referred to is destroyed after a treatment period of predetermined length. It has been ascertained by experiment that the coloring process is most efficiently expedited by holding for substantially one hour the pressure initially developed by the injection of steam and by then

interrupting the ammonia gas and steam step by again drawing a partial vacuum of substantially 24". The second vacuum step results in opening the pores of said wood to a greater depth than in the first vacuum step. Live steam and the same fractional proportion of ammonia gas are again injected into the receptacle, but this time a somewhat higher pressure is permitted to develop, with a corresponding increase in temperature. The developed pressure is again held for approximately one hour and the treatment may be further repeated to meet requirements, each time using an equal fractional portion of the predetermined basic quantity of ammonia gas and increasing the developed pressure a predetermined extent. It has been found in practice that four successive treatments of this character, i. e., a complete coloring operation of four hours, is all that is necessary to satisfactorily color lumber 16 feet in length, throughout the length and thickness thereof, while shorter lengths are likewise satisfactorily colored in a total of two and three hours.

That the present improved process expedites production is evidenced by the fact that in commercial practice the same coloring effects which heretofore required ten hours are now produced in four hours in lumber of the same kind and size. It is evident that this gain in time is due primarily to the interruption of the combined ammonia gas and heating step by drawing a partial vacuum at the intervals requisite to destroy the balanced condition of the external and internal pressures of the wood, each vacuum step opening the pores to a greater depth, so that by imposing an increased pressure after each vacuum step, the ammonia gas which is introduced at the same time is caused to rapidly and completely permeate the wood simultaneously with the steps taken to prepare the wood for the gas. In this connection, it may be stated that I believe I am the first to combine preparation of the wood by repetitions of heat and vacuum steps with the subjection of the wood to any extraneous coloring medium such as ammonia gas.

It has been determined by experiment that for lumber requiring only one vacuum step interruption, the steam pressure developed in the receptacle during the initial treatment of approximately one hour is preferably about 40 lbs. gauge and that for the succeeding treatment of about one hour the steam pressure should be increased to about 60 lbs. gauge. For lumber requiring three successive one hour treatments with two intervening vacuum-step interruptions, the steam pressure developed in the receptacle during the initial treatment need be only about 35 lbs. gauge, the pressure for the second treatment being raised to about 50 lbs. gauge, and for the third treatment to about 65 lbs. gauge.

For lumber requiring four successive one hour treatments with the intervening vacuum-step interruptions, the initial treatment pressure may be about 30 lbs. gauge, the pressures for each of the following three treatments being successively increased by about 10 lbs.

At the completion of the coloring operation, the receptacle is first "blown down," whereupon the doors of the receptacle may be opened and the colored wood removed from the receptacle.

Having thus set forth the nature of the invention, what I claim herein is:

1. The process of coloring wood, consisting in subjecting the wood in a closed receptacle to ammonia gas and to the direct action of live steam

developing a predetermined pressure in the receptacle, and repeatedly interrupting said ammonia gas and steam step by creating a partial vacuum in the receptacle at approximately a time when pressures internally and externally of the wood approach a balance, the predetermined pressures varying increasingly with successive repetitions of the ammonia gas and steam step.

2. The process of coloring wood, consisting in subjecting the wood in a closed receptacle to successive treatments each comprising, the drawing of a partial vacuum in the receptacle between treatments at approximately a time when pressures internally and externally of the wood approach a balance, the introduction into the receptacle of ammonia gas and sufficient live steam to develop a predetermined pressure in the receptacle, and holding the developed pressure until interruption of the treatment by said drawing of a partial vacuum, the predetermined pressures of the successive treatments varying increasingly.

3. The process of coloring wood in a receptacle, consisting in preheating the shell of the receptacle by means external thereto, loading the receptacle with the wood to be treated, inducing and maintaining a forced circulation of the atmosphere within said receptacle, drawing a partial vacuum, introducing into the receptacle a predetermined quantity of ammonia gas and sufficient live steam to develop a predetermined pressure, interrupting the ammonia gas and steam step at approximately a time when pressures internally and externally of the wood approach a balance, said interruption being effected by drawing a partial vacuum in the receptacle, introducing into the receptacle another predetermined quantity of ammonia gas and sufficient live steam to develop a predetermined pressure greater than said first named pressure, and maintaining the increased pressure for a predetermined period.

4. The process of coloring wood, consisting in subjecting the wood in a closed receptacle to successive treatments each comprising, (1) the preheating of the receptacle shell to approximately 325° F. by means external to said receptacle, (2) inducing and maintaining a forced circulation of the atmosphere within the receptacle throughout the complete treatment, (3) the drawing of a partial vacuum, (4) the introduction into the receptacle of vaporized aqua ammonia representing a fractional portion of a basic quantity substantially equal to 100 lbs. aqua ammonia per 1000 board feet of wood within the receptacle, said fractional portion being substantially equal to the fractional portions of said basic quantity introduced into said receptacle in the succeeding treatments of the process, (5) the introduction into said receptacle of sufficient dry saturated steam to develop a pressure of from approximately 30 lbs. to 40 lbs. gauge, predetermined by the number of the subsequent treatments, (6) holding the developed pressure approximately one hour, and (7) repeating steps (3) to (6), inclusive, two or more times with the developed pressure increased in each repetition.

5. In the process of coloring wood by subjecting the wood in a closed receptacle to ammonia gas under temperature conditions resulting in vaporization of the water content of the wood, the improvement consisting in accelerating completion of the coloring process by drawing a partial vacuum in the receptacle at approximately a time when pressures internally and externally of the wood approach a balance, and then further

coloring the wood by again subjecting it to ammonia gas under said temperature conditions.

5 6. In the process of coloring wood by subjecting the wood in a closed receptacle to ammonia gas and to the direct action of live steam resulting in vaporization of the water content of the wood, the improvement consisting in accelerating the completion of the coloring process by drawing a partial vacuum in the receptacle at approximately a time when pressures internally and externally of the wood approach a balance, and then further coloring the wood by again subjecting it to ammonia gas and the direct action of live steam.

10 7. In the process of coloring wood by subject-

ing the wood in a closed receptacle to a predetermined quantity of ammonia gas under temperature conditions resulting in vaporization of the water content of the wood, the improvement consisting in accelerating completion of the coloring process by subjecting the wood to successive treatments, each comprising introducing in said receptacle a fractional portion of said predetermined quantity of ammonia gas under said temperature conditions, and the drawing 10 of a partial vacuum in the receptacle between treatments at approximately a time when pressures internally and externally of the wood approach a balance.

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