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METHOD OF PRESERVING THE WOODEN STRUCTURE OF COOLING TOWERS BY IMPREGNATING

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1 Claim. (Cl. 117—57)

This invention relates to cooling towers and more particularly to a method of preserving the water saturated wooden structure therein.

The section of heat exchanging equipment referred to as the cooling tower generally has a splash deck made of wood. In these towers water is allowed to fall downwardly within a louvered or ventilated column, therefore, the wood soon becomes saturated with water and subject to rapid deterioration. This condition of the wood, as well as the very inaccessible position of the tower has thwarted any attempts to preserve the wood therein after the tower has been placed in use, short of complete dismantling and treatment thereafter. It is highly desirable, however, to impregnate this wood with relatively insoluble materials that are toxic to insects and wood destroying organisms in order to preserve the wood. Many materials are known and have been used to treat wood in that they are toxic to these organisms and insects, but they have been applied to the dry wood before fabrication.

In order to preserve wood that is used in cooling towers it is necessary to first obtain a complete impregnation of the wood with the toxic materials and also to use a material that will not be easily leached out. Past methods of impregnating wood have included (1) application of a solution under pressure, possibly preceded or followed by a vacuum; (2) diffusion in green wood using natural sap as the carrier; (3) soaking in a solution of the preservative; (4) a hot dip followed by a cold dip to draw the solution into the cell cavities of the wood; and (5) by the application of a paste to dry wood and allowing it to penetrate with time. None of these methods, however, lend themselves to the treating of water-saturated wood in a cooling tower which has been in use for some time.

Having regard to these problems, the primary object of this invention is to provide a method of treating the wooden structure of a cooling tower after the tower has been placed in use and the wood has become saturated with water, and further, to provide a method of treating the wood in cooling towers with a wood preservative that is permanent and will no leach out.

One of the important aims of the instant invention is the provision of a method of impregnating the water-saturated wood of cooling towers by diffusing therein a wood preservative, the diffusion taking place by virtue of a difference in the solution pressure of the preservative and the water within the wood. A still further aim is the method of preserving the wooden structure of cooling towers by impregnating the wood with a wood preservative having a two component system, the first component reacting with the second component subsequent to impregnation to form a water insoluble preservative therein which is resistant to leaching.

This invention has for a yet further aim the method of treating the wooden structure of a cooling tower by applying to the moist surface of the wood a water soluble dry preservative for a time sufficient to cause impregnation of the wood with the preservative and, further, to a method of directing a fine spray of water onto the sur-

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face of the wood until the preservative has completely diffused into the wood.

Also an object of the present invention is the provision of an economically feasible method of treating water-saturated wood in a cooling tower after the tower has been fabricated and assembled in a place by the method set forth above. More specific objects of the invention will appear during the course of the following specification.

The process of the present invention is carried out by applying to the moist surface of the wood in a cooling tower that has been in use and thus is saturated with water, either a slurry prepared by mixing with a quantity of water an amount of water soluble preservative in excess of its solubility or a water soluble dry wood preservative, and allowing it to remain there for a time sufficient to cause complete impregnation of the wood. This preservative may be made up of a two-component system, the first component reacting subsequently with the second component to form a water insoluble preservative within the wood, that is resistant to leaching. Another method employed is to apply to the surface of the moist wood a slurry of a water-insoluble preservative, the slurry being prepared by mixing with a quantity of solvent for the preservative an amount of the preservative in excess of its solubility.

The complete impregnation of the water-saturated wood, when a slurry of the wood preservative is applied thereto, is accomplished due to the variation in solution pressure between the preservative and the water within the wood. The dissolving of a solid in a liquid involves several factors. In ideal solutions the molecules break away from the crystal and fill the volume of the solvent until the solution is saturated. The factors that affect the solubility of a solid in a liquid are concentration, temperature and pressure. The method of this invention takes advantage of the concentration factor, as it would be completely impractical to vary the temperature or pressure of a solution to be used to impregnate a cooling tower subsequent to use. In a homogeneous solution the system is in equilibrium and a sample from any portion will be identical with any other portion, but, when a heterogeneous solution is present a sample from one portion will not be identical with the other. However, if the portions of the heterogeneous solution are miscible with each other, then diffusion of one portion into the other takes place due to the solution pressure of the portions having the higher concentration, eventually an equilibrium being established in which the solution will become substantially homogeneous throughout. The rate at which this diffusion takes place will vary with the concentration increment between the various portions. Therefore, in the present invention when a solution of a wood preservative having a higher solution pressure than the water within the wood is applied to the surface of that wood, diffusion takes place as the equilibrium is established and the wood becomes impregnated with the preservative. Thus, when a slurry of the preservative is employed, its solution pressure remains constant while the diffusion is taking place due to the continued dissolving of the solid material into the water as the solutions approach the equilibrium.

The impregnation can be carried out by the use of various suitable materials, including insoluble preservatives such as compounds of copper and arsenic dissolved in a weak solution of ammonia, this material being diffused into the wood and the ammonia later evaporating and leaving the insoluble precipitate in the wood. Also soluble materials such as dichromates which are converted to a less soluble material by oxidation can be used, and a third type depends on a reaction between two components of the wood preservative within the wood to form a less soluble material.

An example of the first type above is the following:

Example 1

	Percent
Cupric hydroxide -----	58
Arsenic trioxide -----	39
Ammonia -----	3
Acetic acid -----	Trace

The materials become relatively insoluble when the ammonia evaporates, and a water insoluble precipitate remains in the wood.

An example of the second type above is copper dichromate which will oxidize within the wood to form a less soluble material that is toxic to wood destroying organisms.

Examples of the third type above are the following:

Example 1

First component -----	Copper sulphate.
Second component -----	Sodium chromate.

Example 2

First component -----	{ Copper sulphate.
	{ Sodium arsenate.
Second component -----	Sodium chromate.

Example 3

First component -----	{ Copper sulphate.
	{ Sodium arsenate.
Second component -----	{ Sodium chromate.
	{ Sodium fluoride.

Example 4

First component -----	{ Zinc sulphate.
	{ Sodium arsenate.
Second component -----	Sodium chromate.

Example 5

First component -----	Copper sulphate.
Second component -----	Sodium phosphate.

Example 6

First component -----	Copper sulphate.
Second component -----	{ Sodium borate.
	{ Boric acid.

Example 7

First component -----	Sodium pentachlorophenate.
Second component -----	Copper sulphate.

In all cases soluble materials are used which react when coming in contact with one another to produce relatively insoluble precipitates that are toxic to the wood destroying organisms, or insoluble materials dissolved in a suitable solvent, the solvent subsequently volatilizing. When reacting substances are used, the various chemicals are proportioned to produce on reaction the desired end product although it is sometimes desirable to use an excess of some material to assure complete reaction of the others. Since these materials react when they come into contact with one another it is necessary to impregnate the wood with first one and then with the other, but it makes no difference in which order the two components are diffused into the wood, the same reaction resulting irrespective of the order of application. Experiments have shown that the penetration within the wood in a 24-hour period is equal to or greater than that obtained by pressure methods. Usually 24 hours is sufficient time to allow penetration. Also the surface of the treated wood should be preferably washed with clear water before the second solution is applied to prevent precipitation on the surface. Detergents may or may not be used with the preservative to obtain spreading. Also thixotropic jells that become fluid upon agitation may be added.

The method of the present invention is preferably carried out by applying to the surface of the wood, a slurry

of the component or components of the wood preservative in water or a solvent for the water insoluble preservatives. Although a less concentrated solution would give the same results, the rate of diffusion would be much slower and thus increase the cost of the operation. Also the dry material may be applied to the moist surface of the wood, and a fine spray of water maintained on the surface of the wood to keep the material damp. The preservative dissolves in the water to the extent of its solubility in the small amount of water present on the surface of the wood, and the resulting concentration of this solution causes rapid diffusion of the preservative into the wood.

A principal feature of this process is the fact that inexpensive, readily obtainable products on the open market may be employed to treat the wood, a method now being presented in which any material soluble in water or in any other suitable solvent can be used to impregnate the water-saturated wood without the necessity of tearing down and dismantling the cooling tower in order to treat the wood therein. Although the method of the present invention is directed toward treatment of water-saturated structure in a cooling tower, it could also be applied to any wood which has become completely saturated with water. If feasible, the wood, if not already saturated with water, may be saturated and the present process carried out.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

In a method of preserving the wooden structure of cooling towers by impregnation with a wood preservative subsequent to fabrication thereof, the improved steps of flooding the outermost surfaces of the wooden structure while in a fabricated condition with water for a time sufficient to completely saturate the entire structure; applying in successive order, sufficient quantities only of each of a pair of slurries to subject all of the outermost surfaces of the structure substantially simultaneously to a respective slurry, one of the slurries containing an excess of a metallic sulfate preservative chosen from the group consisting of zinc sulfate and copper sulfate and the other slurry containing an excess of a metallic salt preservative chosen from the group consisting of chromate, arsenate, fluoride, phosphate, borate and pentachlorophenate, each of said slurries being maintained in contacting relationship to the structure for a time sufficient to substantially impregnate the structure with each preservative, the excess of preservative in each slurry maintaining the solution pressure of each of the slurries at the maximum point throughout diffusion of each of the preservatives into said structure; applying water successively to the outermost surfaces of the structure subsequent to application of each of the slurries and in sufficient quantities only to maintain the structure completely saturated and the outer surfaces thereof moist without excessive runoff of water containing a respective preservative; and collecting the liquid runoff containing said preservatives and reapplying the same to the structure during the period that a slurry containing the corresponding preservative is maintained in contacting relationship with the structure.

References Cited in the file of this patent

UNITED STATES PATENTS

46,518	Wurtz -----	Feb. 21, 1865
668,227	Simpson -----	Feb. 19, 1901
709,799	Ruping -----	Sept. 23, 1902
802,680	Chisolm -----	Oct. 24, 1905
1,291,696	Bloom -----	Jan. 14, 1919
1,398,065	Carpenter -----	Nov. 22, 1921
2,012,975	Schmittutz -----	Sept. 3, 1935
2,108,017	Lithgow -----	Feb. 8, 1938

FOREIGN PATENTS

141,189	Australia -----	May 10, 1951
596,317	Great Britain -----	Jan. 1, 1948