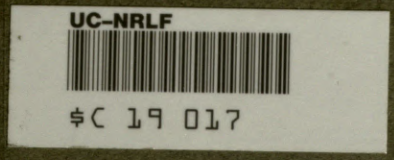
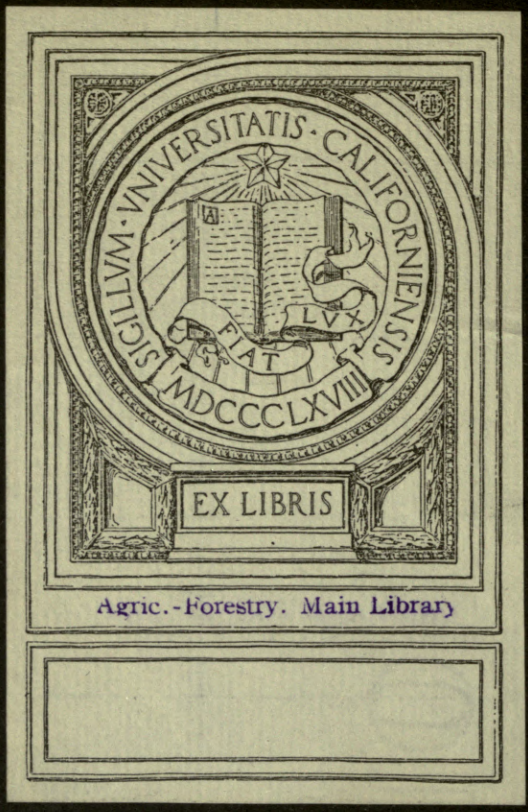


WOOD PRESERVATION

Specifications for Treatment with:
(1) Creosote Oil (Full-cell)
(2) " " (Empty-cell, and final vacuum)
(3) " " (Empty-cell, initial pressure and final vacuum)
(4) Zinc Chloride
(5) Zinc Chloride and Creosote
(6) Creosote (for ties and structural timbers)

Why the Creosoted Tie. P. R. W.



SPECIFICATION

FOR

THE PRESERVATIVE TREATMENT OF WOOD WITH CREOSOTE OIL

(Full-cell Process)

Adopted by the American Railway Engineering Association and consistent with best practice

Except when ordered otherwise by the railroad's representative, the material to be treated shall be air-seasoned until in his judgment any moisture in it will not prevent injection of the specified amount of preservative; shall be restricted in any charge to woods into which approximately equal quantities of preserving fluid can be injected; and shall consist of pieces approximately equal in size and sapwood content, on which all framing, boring, or adzing shall have been done, so separated as to insure contact of steam and preservative with all surfaces.

The preservative used shall be the one most suitable and available of the following standards of the American Railway Engineering Association (similar to specifications of the American Wood Preservers' Association and others):

Creosote Oil, Grade 1
Creosote Oil, Grade 2
Creosote-Coal-Tar Solution
Creosote Oil, Grade 3

The material shall retain the amount of creosote oil necessary to permeate all of the sapwood and as much of the heartwood as practicable. The quantities specified may vary from 10 pounds per cubic foot for material from needleleaved trees from which most of the sapwood has been removed to 24 pounds per cubic foot for piling which has wide sapwood. The quantity of creosote oil retained shall be calculated, on the basis of 100° F., from readings of working-tank gauges or scales or from weights of at least one-tenth of the material on a suitable track scale before and after treatment, checked as may be desired by the railroad's representative.

After the material is placed in the cylinder, a vacuum of at least 22 inches shall be maintained until the wood is as dry and as free of air as practicable. The creosote oil shall then be introduced, without breaking the vacuum until the cylinder is filled. The pressure shall be gradually raised and maintained at a minimum of 125 pounds per square inch until the required quantity of preservative is injected into the material or until the railroad's representative is satisfied that the largest volumetric injection that is practicable has been obtained. The temperature of the preservative during the pressure period shall be not less than 170° F.,

Over

nor more than 200° F., and shall average at least 180° F. After pressure is completed and the cylinder emptied of preservative, a vacuum shall be maintained until the material can be removed from the cylinder free of dripping preservative.

At least once each day the railroad's representative shall determine penetration by sampling ties at middle and rail sections; from other material samples shall be taken as desired. Any holes that may be bored shall be filled with tight-fitting creosoted plugs.

The treating plant shall be equipped with the thermometers and gauges necessary to indicate and record accurately the conditions at all stages during the treatment, and all equipment shall be maintained in condition satisfactory to the railroad. The owner of the treating plant shall also provide and keep in condition for use at all times the apparatus and chemicals necessary for making the analyses and tests required in this specification.

When permission is given to prepare material for treatment by steaming instead of seasoning by air, it shall not be subjected to pressures or temperatures for periods sufficient to injure the wood.

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SPECIFICATION

FOR

THE PRESERVATIVE TREATMENT OF WOOD WITH CREOSOTE OIL

Empty-cell Process with Final Vacuum

(See U. S. Patents 707,799 and 831,450)

Adopted by the American Railway Engineering Association and consistent with best practice

Except when ordered otherwise by the railroad's representative, the material to be treated shall be air-seasoned until in his judgment any moisture in it will not prevent injection of an adequate amount of preservative; shall be confined in any charge to woods into which approximately equal quantities of preserving fluid can be injected; and shall consist of pieces approximately equal in size and sapwood content, on which all framing, boring, or adzing shall have been done, so separated as to insure contact of steam and preservative with all surfaces.

The preservative used shall be the one most suitable and available of the following standards of the American Railway Engineering Association (similar to specifications of the American Wood Preservers' Association and others):

Creosote Oil, Grade 1
Creosote Oil, Grade 2
Creosote-Coal-Tar Solution
Creosote Oil, Grade 3

The material shall retain an average of at least 6 pounds of creosote oil per cubic foot for cross-ties and 10 pounds per cubic foot of other material, and no charge shall retain less than 90 per cent nor more than 110 per cent of the quantity per cubic foot that may be specified. The quantity of preservative retained shall be calculated, on the basis of 100 degrees F., from readings of working-tank gauges or scales or from weights of at least one-tenth of the material on a suitable track scale before and after treatment, checked as may be desired by the railroad's representative.

After the material is placed in the cylinder, the preservative shall be introduced, at not over 200 degrees F., until the cylinder is filled.

The pressure shall be raised and maintained until there is obtained the largest practicable volumetric injection that can be reduced to the required retention by a quick high vacuum. The pressure and temperature within the cylinder shall be so controlled as to give the maximum penetration by the quantity of preservative injected. After the pressure is completed the cylinder shall be speedily emptied of preservative and a vacuum of at least 22 inches promptly created and maintained until the quantity of preservative injected is reduced to the required retention.

Over

At least once each day the railroad's representative shall determine penetration by sampling ties at middle and rail sections; from other material samples shall be taken as desired. Any holes that may be bored shall be filled with tight-fitting creosoted plugs.

The treating plant shall be equipped with the thermometers and gauges necessary to accurately indicate and record conditions at all stages during the treatment, and all equipment shall be maintained in condition satisfactory to the railroad. The owner of the treating plant shall also provide and keep in condition for use at all times the apparatus and chemicals necessary for making the analyses and tests required in this specification.

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SPECIFICATION

FOR

THE PRESERVATIVE TREATMENT OF WOOD WITH CREOSOTE OIL

(Empty-cell Process with Initial Air Pressure and Final Vacuum)

Adopted by the American Railway Engineering Association and consistent with best practice

Except when ordered otherwise by the railroad's representative, the material to be treated shall be air-seasoned until in his judgment any moisture in it will not prevent injection of an adequate amount of preservative; shall be restricted in any charge to woods into which approximately equal quantities of preserving fluid can be injected; and shall consist of pieces approximately equal in size and sapwood content, on which all framing, boring, or adzing shall have been done, so separated as to insure contact of air and preservative with all surfaces.

The preservative used shall be the one most suitable and available of the following standards of the American Railway Engineering Association (similar to specifications of the American Wood Preservers' Association and others):

Creosote Oil, Grade 1
Creosote Oil, Grade 2
Creosote-Coal-Tar Solution
Creosote Oil, Grade 3

The material shall retain an average of at least 5 pounds of creosote oil per cubic foot, which shall permeate all of the sapwood and as much of the heartwood as practicable, and no charge shall retain less than 90 per cent nor more than 110 per cent of the quantity per cubic foot that may be specified. The amount of preservative retained shall be calculated, on the basis of 100 degrees F., from readings of working-tank gauges or scales or from weights of at least one-tenth of the material on a suitable track scale before and after treatment, checked as may be desired by the railroad's representative.

After the material is placed in the cylinder it shall be subjected to air pressure of sufficient intensity and duration to provide under a vacuum the ejection of preservative necessary to insure the required retention. For example: With red oak pressures of 40 to 60 pounds for 30 minutes, while with pine having a large percentage of sapwood pressures of 70 to 90 pounds for 30 minutes will be required. The preservative shall then be introduced, the air pressure being maintained constant until the cylinder is filled. The pressure shall be gradually raised to at least 150 pounds per square inch, and maintained until all of the sapwood and as much of the heartwood as practicable are saturated, or until the railroad's representative is satisfied that the largest volumetric injection that is practicable has

Over

been obtained. The temperature of the preservative during the pressure period shall be not less than 170 deg. F., nor more than 200 deg. F., and shall average at least 180 deg. F. After the pressure is completed the cylinder shall be speedily emptied of preservative and a vacuum of at least 22 inches be promptly created, and maintained until the material can be removed from the cylinder free of dripping preservative.

At least once each day the railroad's representative shall determine penetration by sampling ties at middle and rail sections; from other material samples shall be taken as desired. Any holes that may be bored shall be filled with tight-fitting creosoted plugs.

The treating plant shall be equipped with the thermometers and gauges necessary to indicate and record accurately the conditions at all stages during the treatment, and all equipment shall be maintained in condition satisfactory to the railroad. The owner of the treating plant shall also provide and keep in condition for use at all times the apparatus and chemicals necessary for making the analyses and tests required in this specification.

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SPECIFICATION

FOR

THE PRESERVATIVE TREATMENT OF WOOD WITH ZINC CHLORIDE

Adopted by the American Railway Engineering Association and consistent with best practice

Except when ordered otherwise by the railroad's representative, the material to be treated shall be air-seasoned until in his judgment any moisture in it will not prevent injection of the specified amount of preservative; shall be restricted in any charge to woods into which approximately equal quantities of preserving fluid can be injected; and shall consist of pieces approximately equal in size and sapwood content, on which all framing, boring, or adzing shall have been done, so separated as to insure contact of steam and preservative with all surfaces.

The zinc chloride used shall be acid-free and shall not contain more than 0.1 per cent iron. Dry zinc chloride shall contain at least 94 per cent soluble zinc chloride, and in any solution purchased the percentage of zinc chloride specified shall be the amount of soluble zinc chloride required.

The material shall retain an average of 0.5 pound of dry zinc chloride per cubic foot, which shall permeate all of the sapwood and as much of the heartwood as practicable, and no charge shall retain less than 90 per cent nor more than 110 per cent of this quantity.

The treating solution shall be no stronger than necessary to obtain the required retention of preservative with the largest volumetric absorption that is practicable, and shall be thoroughly mixed before use. Its strength shall not exceed 5 per cent and shall be determined by analysis. Chemical titration, using a silver-nitrate solution with potassium-chromate indicator, will usually be satisfactory. For example: With red oak the strength shall not exceed 4 per cent, and the volume injected shall be not less than 20 per cent, while with pine having a large percentage of sapwood it shall not exceed 2 per cent, and the volume injected shall be not less than 40 per cent. The amount of solution retained shall be calculated from readings of working-tank gauges or scales or from weights of at least one-tenth of the material on a suitable track scale before and after treatment, checked as may be desired by the railroad's representative.

Air-seasoned material shall be steamed in the cylinder for not less than one hour nor more than two hours, at a pressure of not more than 20 pounds per square inch, the cylinder being provided with vents to relieve it of stagnant air and insure proper circulation of the steam and being drained to prevent condensate from accumulating in sufficient quantity to reach the material. After steaming is completed, a vacuum of at least 22 inches shall be maintained until the wood is as dry and as free from air as practicable. Before the preservative is introduced, the cylinder shall be drained of condensate, and if the vacuum is broken, a second one as high as the first shall be created. The preserva-

Over

tive shall be introduced, without breaking the vacuum, until the cylinder is filled. The pressure shall be gradually raised and maintained at a minimum of 125 pounds per square inch until the required quantity of preservative is injected into the material, or until less than 5 per cent of the total quantity required has been injected during the latter half of one hour throughout which the rate of injection has persistently decreased while the pressure has been held continuously at 165 or more pounds per square inch. The temperature of the preservative during the pressure period shall be not less than 130 degrees F., nor more than 190 degrees F., and shall average at least 150 degrees F. After the cylinder is emptied of preserving solution, a vacuum shall be maintained until the material can be removed from the cylinder free of dripping preservative.

At least once each day the railroad's representative shall determine penetration by analysis. The "iodine-potassium ferricyanide-starch" color reaction test to determine the penetration by its visibility will generally be satisfactory.

From ties samples shall be taken at middle and rail sections; from other material samples shall be taken as desired. Any holes that may be bored shall be filled with tight-fitting treated plugs.

The treating plant shall be equipped with the thermometers and gauges necessary to indicate and record accurately the conditions at all stages during the treatment, and all equipment shall be maintained in condition satisfactory to the railroad. The owner of the treating plant shall also provide and keep in condition for use at all times the apparatus and chemicals necessary for making the analyses and tests required in this specification.

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SPECIFICATION

FOR

THE PRESERVATIVE TREATMENT OF WOOD

WITH ZINC CHLORIDE AND CREOSOTE OIL

(See U. S. Patents 815,404 and 1,178,132)

Adopted by the American Railway Engineering Association and consistent with best practice

Except when ordered otherwise by the railroad's representative, the material to be treated shall be air-seasoned until in his judgment any moisture in it will not prevent injection of the specified amount of preservative; shall be restricted in any charge to woods into which approximately equal quantities of preserving fluid can be injected; and shall consist of pieces approximately equal in size and sapwood content, on which all framing, boring, or adzing shall have been done, so separated as to insure contact of steam and preservative with all surfaces.

The zinc chloride used shall be acid-free and shall not contain more than 0.1 per cent iron. Dry zinc chloride shall contain at least 94 per cent soluble zinc chloride, and in any solution purchased the percentage of zinc chloride specified shall be the quantity of zinc choloride required.

The creosote oil shall meet the standard of the American Railway Engineering Association for "Creosote Oil, Grade 3."

The material shall retain an average of 0.5 pound of dry zinc chloride and 3 pounds of creosote oil per cubic foot, which shall permeate all of the sapwood and as much of the heartwood as practicable, and no charge shall retain less than 90 per cent nor more than 110 per cent of these quantities per cubic foot.

The preserving mixture shall be composed of the volumetric proportions of creosote oil and of zinc-chloride solution of the necessary strength which are required to obtain the specified retention of the preservatives with the largest volumetric injection that is practicable, and shall be agitated in the working tank and cylinder so as to insure thorough mixing before and while the cylinder is being filled with preservative and while the preservative in being injected into the material. The strength of the zinc-chloride solution shall not exceed 5 per cent and shall be determined by analysis. Chemical titration, using a silver-nitrate solution with potasium-chromate indicator, before the zinc-choloride solution is mixed with the creosote oil will usually be satisfactory.

For example: With red oak the proportions shall be not less than 77 per cent of 5 per cent zinc-chloride solution and not more than 23 per cent of creosote oil, and the volume injected shall be not less than 20 per cent, while with pine having a large percentage of sapwood they shall be not less than 88 per cent of 2.5 per cent zinc-chloride

solution and not more than 12 per cent of creosote oil, and the volume injected shall be not less than 40 per cent. The quantities of preservatives retained shall be calculated from readings of working-tank gauges or scales and from weights of at least one-tenth of the material on a suitable track scale before and after treatment, checked as may be desired by the railroad's representative.

Air-seasoned material shall be steamed in the cylinder for not less than one hour nor more than two hours, at a pressure of not more than 20 pounds per square inch, the cylinder being provided with vents to relieve it of stagnant air and insure proper circulation of the steam and being drained to prevent condensate from accumulating in sufficient quantity to reach the material. After steaming is completed, a vacuum of at least 22 inches shall be maintained until the wood is as dry and as free from air as practicable. Before the preservative is introduced the cylinder shall be drained of condensate, and if the vacuum is broken a second one as high as the first shall be created. The preserving mixture shall be introduced without breaking the vacuum until the cylinder is filled. The pressure shall be gradually raised, and maintained at a minimum of 125 pounds per square inch until the required amount of preservatives is injected into the material, or until less than 5 per cent of the total quantity required has been injected during the latter half of one hour throughout which the rate of injection has persistently decreased, while the pressure has been held continuously at 165 or more pounds per square inch. The temperature of the preservative during the pressure period shall be not less than 170° F., nor more than 200° F., and shall average at least 180° F. After the cylinder is emptied of preserving mixture, a vacuum shall be maintained until the material can be removed from the cylinder free of dripping preservative.

At least once each day the railroad's representative shall determine penetration by analysis. With woods on which potassium ferrocyanide and uranium acetate will produce color reaction, the penetration may be determined by its visibility. From ties, samples shall be taken at middle and rail sections; from other material samples shall be taken as desired. Any holes that may be bored shall be filled with tight-fitting creosoted plugs.

The treating plant shall be equipped with the thermometers and gauges necessary to indicate and record accurately the conditions at all stages during the treatment, and all equipment shall be maintained in condition satisfactory to the railroad. The owner of the treating plant shall also provide and keep in condition for use at all times the apparatus and chemicals necessary for making the anaylses and tests required in this specification.

When water-gas-tar solution instead of creosote oil is used, the oil shall be a water-gas-tar product, of which at least 60 percent shall be a distillate of water-gas-tar and the remainder refined or filtered water-gas tar. It shall comply with the following requirements:

(1) It shall not contain more than 3 per cent water.

(2) It shall not contain more than 2 per cent of matter insoluble in benzol.

(3) The specific gravity of the oil at 38° compared with water at 15.5° C. shall not be less than 1.03 nor more than 1.07.

(4) The distillate, based on water-free oil, shall be within the following limits:

Up to 210° C., not more than 8 per cent.
Up to 235° C., not more than 20 per cent.
Up to 355° C., not less than 60 per cent.

(5) The specific gravity of the fraction between 235° C. and 315° C. shall not be less than 0.98 nor more than 1.02 at 38°/15.5° C.

(6) The residue above 355° C., if it exceeds 5 per cent, shall have a float test of not more than 50 seconds at 70° C.

(7) The oil shall not yield more than 10 per cent coke residue.

(8) The foregoing tests shall be made in accordance with the standard methods of the American Railway Engineering Association.

When a distillate of water-gas tar instead of creosote oil is used, it shall meet with the following requirements:

(1) It shall not contain more than 3 per cent water.

(2) It shall not contain more than 0.5 per cent of matter insoluble in benzol.

(3) The specific gravity of the oil at 38° compared with water at 15.5° C. shall not be less than 1.02.

(4) The distillate, based on water-free oil, shall be within the following limits:

Up to 210° C., not more than 5 per cent.
Up to 235° C., not more than 25 per cent.
Up to 355° C., not less than 80 per cent.

(5) The specific gravity of the fraction between 235° C. and 315° C. shall not be less than 0.98 nor more than 1.02 at 38°/15.5° C.

(6) The residue above 355° C., if it exceeds 5 per cent, shall have a float test of not more than 50 seconds at 70° C.

(7) The oil shall not yield more than 2 per cent coke residue.

(8) The foregoing tests shall be made in accordance with the standard methods of the American Railway Engineering Association.

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STANDARD SPECIFICATION*

FOR

CREOSOTE OIL (GRADE I)

FOR TIES AND STRUCTURAL TIMBER

The oil shall be a distillate of coal-gas tar or coke-oven tar. It shall comply with the following requirements:

1. It shall not contain more than 3% of water.

2. It shall not contain more than 0.5% of matter insoluble in benzol.

3. The specific gravity of the oil at 38°/15.5° C. shall not be less than 1.03.

4. The distillate, based on water-free oil, shall be within the following limits:

Up to 210° C. not more than 5%.
Up to 235° C. not more than 25%.

5. The specific gravity of the fraction between 235° C. and 315° C. shall be not less than 1.03 at 38°/15.5° C.

The specific gravity of the fraction between 315° C. and 355° C. shall be not less than 1.10 at 38°/15.5° C.

6. The residue above 355°, if it exceeds 5%, shall have a float-test of not more than 50 seconds at 70° C.

7. The oil shall yield not more than 2% coke residue.

8. The foregoing tests shall be made in accordance with the standard methods of the American Wood Preservers' Association.

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*This is the standard specification for a commercial high-grade coal-tar creosote adopted by the American Wood-Preservers' Association, the American Railway Engineering Association, and others.

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SPECIFICATION

FOR

GRADE II CREOSOTE OIL

FOR TIES AND STRUCTURAL TIMBER

The oil shall be a distillate of coal-gas tar or coke-oven tar. It shall comply with the following requirements:

1. It shall not contain more than 3% of water.

2. It shall not contain more than 0.5% of matter insoluble in benzol.

3. The specific gravity of the oil at 38°/15.5° C. shall not be less than 1.03.

4. The distillate, based on water-free oil, shall be within the following limits:

Up to 210° C. not more than 8%.
Up to 235° C. not more than 35%.

5. The specific gravity of the fraction between 235° C. and 315° C. shall be not less than 1.03 at 38°/15.5° C.

The specific gravity of the fraction between 315° C. and 355° C. shall be not less than 1.10 at 38°/15.5° C.

6. The residue above 355°, if it exceeds 5%, shall have a float-test of not more than 50 seconds at 70° C.

7. The oil shall yield not more than 2% coke residue.

8. The foregoing tests shall be made in accordance with the standard methods of the American Wood Preservers' Association.

SPECIFICATION

FOR

CREOSOTE-COAL-TAR SOLUTION

FOR TIES AND STRUCTURAL TIMBER

The oil shall be a coal-tar product, of which at least 80% shall be a distillate of coal-gas tar or coke-oven tar, and the remainder shall be refined or filtered coal-gas tar or coke-oven tar. It shall comply with the following requirements:

1. It shall not contain more than 3% of water.

2. It shall not contain more than 2% of matter insoluble in benzol.

3. The specific gravity of the oil at 38°/15.5° C. shall be not less than 1.05 or more than 1.12.

4. The distillate, based on water-free oil, shall be within the following limits:

Up to 210° C. not more than 5%.
Up to 235° C. not more than 25%.

5. The specific gravity of the fraction between 235° and 315° C. shall be not less than 1.03 at 38°/15.5° C.

The specific gravity of the fraction between 315° C. and 355° C. shall be not less than 1.10 at 38°/15.5° C.

6. The residue above 355° C., if it exceeds 26%, shall have a float-test of not more than 50 seconds at 70° C.

7. The oil shall yield not more than 6% coke residue.

8. The foregoing tests shall be made in accordance with the standard methods of the American Wood Preservers' Association.

SPECIFICATION

FOR

GRADE III CREOSOTE OIL

FOR TIES AND STRUCTURAL TIMBER

The oil shall be a distillate of coal-gas tar or coke-oven tar. It shall comply with the following requirements:

1. It shall not contain more than 3% of water.

2. It shall not contain more than 0.5% of matter insoluble in benzol.

3. The specific gravity of the oil at 38°/15.5° C. shall not be less than 1.03.

4. The distillate, based on water-free oil, shall be within the following limits:

Up to 210° C. not more than 10%.
Up to 235° C. not more than 40%.

5. The specific gravity of the fraction between 235° C. and 315° C. shall be not less than 1.03 at 38°/15.5° C.

The specific gravity of the fraction between 315° C. and 355° C. shall be not less than 1.10 at 38°/15.5° C.

6. The residue above 355°, if it exceeds 5%, shall have a float-test of not more than 50 seconds at 70° C.

7. The oil shall yield not more than 2% coke residue.

8. The foregoing tests shall be made in accordance with the standard methods of the American Wood Preservers' Association.

Why *the* Creosoted Tie?

Treatment for Timber to Increase Its Life Recognized as Necessary to the Economy of Railways

By P. R. HICKS
SERVICE BUREAU, AMERICAN WOOD PRESERVERS' ASSOCIATION, CHICAGO

TIMBER was the first material employed by man for construction purposes and is today the most important and widely used of all construction materials.

The preservative treatment of wood is in general practice throughout Europe but in America it has until quite recently been greatly neglected. It has long since passed the experimental stage. There is no guesswork in the results to be obtained by wood preservation. Standard practices have been developed that may be relied on to produce excellent results. Well-treated wood is regarded as a permanent material of construction.

New Value Added

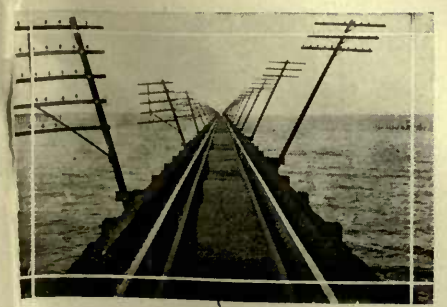
Wood preservation has added a new quality to lumber which enhances its value and makes it a real competitor at a reasonable price of other materials.

Decay, which is the greatest wood destroyer, may be prevented by the proper preservative treatment. The simplest and best way to prevent fungus or the decay of wood is to poison its food supply. On this principle is based the successful use of wood preservatives.

Preservation Ancient Practice

The preservation of wood has been practiced for centuries but it was not until the early part of the 18th century that the preservation of wood by the injection of chemicals became scientific in principle. Many materials have been used and many methods tried to make wood resist decay, insects, and marine borers. Of the wealth of experience only two preservatives have come to be considered as standard—coal-tar creosote and zinc chloride.

To establish trade standards and to prevent adulteration standard specifications for preservatives have been adopted. The specifications of the American Wood-Preservers' association, which are similar to those adopted by the American Railway Engineering association and others, are considered as standard.



Creosoted timber bridge across Lake Pontchartrain in good condition after 40 years' service

The Bridge Over the Lake

Modern timber preservation may be considered as beginning in 1875 when a creosote plant was erected at West Pascagoula, Miss., for the treatment of timbers used by the L. and N. railway. About the same time a plant was built at Slidell, La., by the New Orleans and Northeastern railroad company. All the timber used in the construction of the bridge which spans Lake Pontchartrain was creosoted at this plant and is still in sound condition after about 40 years' service.

It is interesting to note that the first real attempts as to timber preservation were made not because of the scarcity of timber but because of the high cost of replacing it. If the timbers in the Lake Pontchartrain bridge had not been well preserved it would have been necessary to have removed and replaced them every few years. The expense would have been prohibitive. Treated timber was the most economical material for a permanent structure.

Treated Timber Advances

The demand for durable timbers increased gradually. In 1904, thirty-three pressure treating plants were in operation; their annual capacity was about one-fourth billion board feet of timber. In 1921, 122 plants were in operation which treated more than 2,400,000,000 board feet. Others are being built to meet increased demand. The railroads have been responsible to a considerable extent for the present development of timber preservation; today 85 per cent. of the timber treated is for railroad uses.

Pressure Essential Principle

The commercial treatment of wood is accomplished by the use of pressure which is the most satisfactory means of injecting preservatives into wood. The various standard pressure processes differ only in details. By means of pressure the penetration of the preservative is subject to control so that the amount of the preservative and the penetration may be varied to suit the different requirements and thus result in an economical use of preservatives.

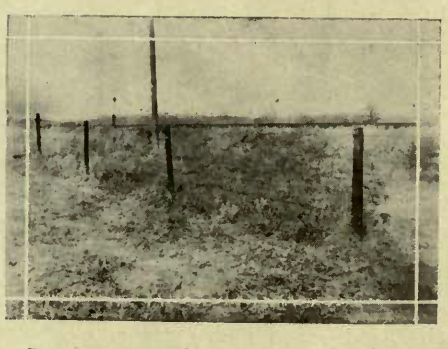
How Much Creosote?

The amount of coal-tar creosote injected ranges from probably five or six to 22 or 24 pounds per cubic foot depending on the kind of timber, the process employed and the proposed use of the timber. In treating with zinc chloride it is standard practice to inject about one-half pound of dry zinc chloride per cubic foot of timber. If a mixture of zinc chloride and creosote is used the required absorption is one-half pound of zinc chloride and about three pounds of creosote per cubic foot.

Plant Equipment

A wood preserving plant consists principally of one or more treating cylinders or retorts six or seven feet in diameter about 120 to 150 feet long capable of withstanding a working pressure of 125 to 200 pounds per square inch. Inside the cylinders is a track for the tram cars which carry the wood to be treated. These cars, loaded with timber to be treated, are handled in trains and are shoved into the retort by small locomotives. The cylinder door is then closed. After treatment the cars are removed and the material loaded for shipment. The treating cylinders are provided with heating coils to heat the preservative, thus facilitating penetration.

There are also storage and measuring tanks for the preservative, pressure and vacuum pumps and facilities for steaming the timber when necessary.



Pressure creosoted posts along right of way

Pressure Treatments

Pressure treatments are grouped in two classes: (1) full-cell process, the object of which is to fill the intercellular spaces of the wood as completely as possible with the preservative and (2) empty-cell process, the object of which is to obtain as thorough and deep a penetration as possible with the use of a minimum quantity of preservative.

When the preservative used is creosote the full-cell treatment is known as the Bethell process; when zinc chloride, the Burnett process, and a mixture of zinc chloride and creosote, the Card process. In all of these processes the methods used are somewhat similar.

The Rueping and Lowry are the standard empty-cell processes. In these processes the creosote is injected under pressure to refusal or at least until a deep and uniform penetration is obtained. Then a portion of the free oil in the wood cells is removed leaving a final retention of five to nine or 10 pounds of oil per cubic foot.

Usually seasoned wood is treated by these pressure processes. While it is possible to treat green timber it seems to be the consensus that a more effective distribution of the preservative is obtained by the treatment of air-seasoned material. Railroad companies and others in many instances often can not anticipate their needs for air-seasoned stock and it is then necessary to treat green material which is usually prepared for treatment by steaming followed by an initial vacuum.

Railroad Uses for Treated Wood

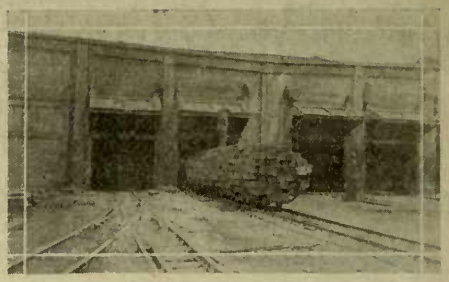
Railroad companies are large users of wood. It has often been estimated that approximately 14 per cent. of the annual cut of timber in the United States or about seven billion board feet is for railway purposes. Practically this entire amount of timber is weakened or destroyed by decay, which may be prevented by proper preservative treatment.

Treated Ties Gain in Number

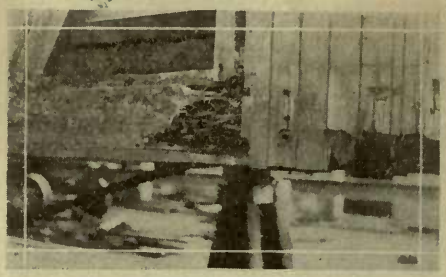
The largest item of expense for wood is in the form of cross and switch ties. While at the present time barely half of the ties used is treated the number has increased considerably during the last few years and will continue to increase, for no material has been developed for track maintenance that is more economical than treated wood. Ties well treated by any one of the standard processes have a life in track of two to several times that of untreated ties which means an annual saving of 10 or more cents per tie per year. This yearly economy increases as more treated ties are put in service since their use decreases the cost of maintenance and lessens the necessity for frequent track disturbance. Standard specifications for the treatment of ties and timber by the full-cell, Burnett, Card, Lowry, and Rueping processes have been adopted by the American Railway Engineering association and are in general use.

As to Car Lumber

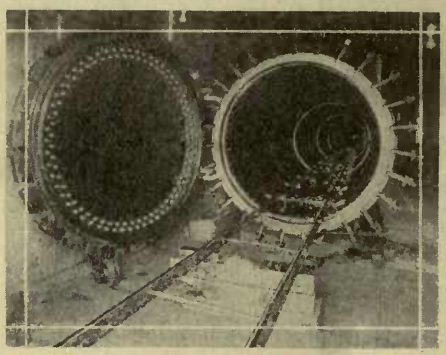
Approximately two billion board feet of lumber and timber are required annually for the maintenance of freight equipment and the construction of new cars. A detailed investigation of the causes of failure of wood in 399 wooden and composite types of cars at one railroad shop showed that 82.3 per cent. of the repairs were necessary because of decay and 17.3 per cent. because of mechanical failure. These percentages may not apply to all shops throughout the country but are nevertheless indicative of the losses suffered by the railroads due to neglect of this small detail.



Ties ready for run in cylinder



Decay in untreated boxcar sill



Cylinder for pressure treatments

Untreated pole destroyed by decay

How Treatment Saves Money

Car lumber well treated with creosote, with zinc chloride or with mixtures of these recognized preservatives by any of the standard processes will last several times as long as untreated material and is necessary as a matter of economy. Treated timber retains its original strength, enables the saving of considerable amounts now spent for labor and material for car maintenance and renders negligible the loss occasioned by unserviceable cars.

Bridge and Wharf Timbers

Well-creosoted bridge and wharf timbers have given efficient service in the United States since 1875. The creosoted railway trestle across Lake Pontchartrain has been in use since 1883. The condition of many creosoted bridges after 20 or more years' service demonstrates the practicability of this economical form of construction.

As to Wood Block Floors

Treated wood block flooring for warehouses, roundhouses, machine shops, loading platforms and other places is making an enviable record for service and economy.

How Poles Are Treated

Treated poles and crossarms are necessary for the economical maintenance of telephone, telegraph, signal and power transmission lines. The two species commonly used for poles are cedar and creosoted southern yellow pine. The cedar poles are usually butt treated with creosote by the open-tank process to a point 1½ or two feet above the ground line; the southern pine poles are creosoted their entire length by the full-cell or by an empty-cell process.

Miscellaneous Uses

There are many railroad structures built of wood; treated timber is the best material for them. Treated posts along the right of way, treated crossing planks, creosoted wood blocks for city intersections, creosoted timber barges or lighters, treated wood for stock pens, treated timber bulkheads, creosoted water tanks, culverts, coal docks, piles for bridges, piers and other foundation purposes and in fact all kinds of railway structures are economical uses for treated wood.

The use of well-treated timber for construction purposes insures long service, excellent satisfaction, and permanence at low cost.

Reprinted from Railway Trade Digest, Railway Exchange, Chicago, of June 17, 1922